

SECTION 00 01 01

PROJECT MANUAL
FOR
RFB #CPPM 2026-015
BARROWS HALL
CHILLER REPLACEMENT

UNIVERSITY OF MAINE

February 28, 2026

Prepared by:
University of Maine System

END OF SECTION 00 01 01

SECTION 00 01 10
TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS GROUP			<u># of Pages</u>
DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS			
Introductory Information			
00 01 01	Project Title Page		1
00 01 10	Table of Contents		2
00 01 15	List of Drawing Sheets		1
Procurement Requirements			
00 11 13	Advertisement for Bids		1
00 21 13	Instructions to Bidders		2
00 41 13	Bid Form		1
00 43 13	Bid Security Form		2
Contracting Requirements			
00 51 00	Notice of Award		1
00 52 13	Construction Contract Agreement Form		2
00 61 13.13	Performance Bond Form		1
00 61 13.16	Payment Bond Form		1
00 62 16	G715 Supplemental Attachment for ACORD Certificate of Insurance		2
00 62 16.10	Certificate of Liability Insurance (ACORD)		2
00 62 16.11	Commercial General Liability Coverage Form (ISO CG 00 01 12 04)		15
00 62 16.12	Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization (ISO CG 20 10 07 04)		1
00 62 16.13	Additional Insured – Owners, Lessees or Contractors – Completed Operations (ISO CG 20 37 07 04)		1
00 62 16.14	Designated Location(s) General Aggregate Limit (ISO CG 25 04 03 97)		2
00 62 73	G703 Schedule of Values Form (Continuation Sheet)		1
00 62 76	G702 Application for Payment Form		1
00 62 76.13	Sales Tax Form		1
00 62 76.16	G707A Consent of Surety to Reduction in or Partial Release of Retainage Form		1
00 62 79	Stored Material Form		2
00 63 14	G716 Request for Information Form		1
00 63 33	G710 Architect’s Supplemental Instructions Form		1
00 63 46	G714 Construction Change Directive Form		1
00 63 57	G709 Proposal Request Form		1
00 63 63	G701 Change Order Form		1
00 65 16	G704 Certificate of Substantial Completion Form		1
00 65 19	Certificate of Completion Form		1
00 65 19.13	G706 Contractor’s Affidavit of Payment of Debts and Claims Form		1
00 65 19.16	G706A Contractor’s Affidavit of Release of Liens Form		1
00 65 19.17	Waiver of Lien		1
00 65 19.18	Subcontractor/Supplier Conditional Release and Waiver of Lien		2
00 65 19.19	G707 Consent of Surety to Final Payment Form		1
00 72 00	A201 General Conditions of the Contract for Construction		43
00 73 00.11	Schedule of Liquidated Damages		1
00 73 16	Insurance Requirements – A101 Exhibit A Insurance and Bonds		8
00 73 46	Wage Determination Schedule		1
SPECIFICATIONS GROUP			
GENERAL REQUIREMENTS SUBGROUP			
DIVISION 01 – GENERAL REQUIREMENTS			
01 11 00	Summary of Work		1
01 14 00	Work Restrictions		1
01 23 00	Alternates		2
01 29 00	Payment Procedures		4
01 33 00	Submittal Procedures		2
01 77 00	Closeout Procedures		2

FACILITY CONSTRUCTION SUBGROUP
DIVISION 02 – EXISTING CONDITIONS
02 41 19 SELECTIVE DEMOLITION

5

DIVISION 03 – CONCRETE

DIVISION 04 – MASONRY

DIVISION 05 – METALS

DIVISION 06 – WOOD, PLASTIC AND COMPOSITES

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 – OPENINGS

DIVISION 09 – FINISHES

DIVISION 10 – SPECIALTIES

DIVISION 11 – EQUIPMENT

DIVISION 12 – FURNISHINGS

DIVISION 13 – SPECIAL CONSTRUCTION

DIVISION 14 – CONVEYING EQUIPMENT

FACILITY SERVICES SUBGROUP

DIVISION 22- PLUMBING

DIVISION 23- HEATING, VENTILATION AND AIR CONDITIONING

23 05 00	COMMON WORK RESULTS FOR MECHANICAL	32
23 05 33	HEAT TRACING FOR HVAC PIPING	4
23 05 93	TESTING, ADJUSTING, AND BALANCING FOR HVAC	5
23 07 00	MECHANICAL INSULATION	10
23 09 00	DIRECT DIGITAL CONTROL (DDC) SYSTEM	29
23 09 93	SEQUENCE OF OPERATIONS	9
23 21 13	HYDRONIC HVAC PIPING	16
23 21 23	HYDRONIC PUMPS	7
23 64 16	CENTRIFUGAL WATER CHILLERS	25
23 65 14	OPEN-CIRCUIT, INDUCED-DRAFT, COUNTERFLOW COOLING TOWERS	11

DIVISION 26- ELECTRICAL

26 10 00	BASIC ELECTRICAL REQUIREMENTS	15
----------	-------------------------------	----

DIVISION 27- COMMUNICATIONS

DIVISION 28- ELECTRONIC SAFETY AND SECURITY

SITE AND INFRASTRUCTURE SUBGROUP

DIVISION 31- EARTHWORK

DIVISION 32- EXTERIOR IMPROVEMENTS

DIVISION 33- UTILITIES

END OF SECTION 00 01 10

SECTION 00 01 15
LIST OF DRAWING SHEETS

DRAWINGS	
Sht No.	SHEET TITLE
-	COVER SHEET
S-1	GENERAL NOTES, ABBREVIATIONS AND DRAWING LIST
S-2	STRUCTURAL PLANS AND DETAILS
MP-0	PLUMBING AND H VAC NOTES, LEGEND AND ABBREVIATIONS
MP-1	MECHANICAL AND MECHANICAL DEMOLITION PLANS
MP-5	MECHANICAL DETAILS AND SCHEDULES
E-0	ELECTRICAL LEGEND AND GENERAL NOTES
E-1	ELECTRICAL SCHEDULES
EP-1	POWER AND POWER DEMOLITION PLANS

END OF SECTION 00 01 15

SECTION 00 11 13
ADVERTISEMENT FOR BIDS

Bids for: **RFB #CPPM 2026-015 UM BARROWS HALL CHILLER REPLACEMENT**

Shall be submitted electronically to cppmquestions@maine.edu
With the following Email Subject Line: **UM BARROWS HALL CHILLER REPLACEMENT**

Bids will be received until **2:00 PM** on **Thursday, March 26, 2026** at which time Bids will be opened and read aloud via Zoom.

Bid opening attendance is available via PC, Mac, Linux, iOS or Android:
[Zoom](https://maine.zoom.us/j/87110097395?pwd=UDt6CDpoWNd6q4JfJBzKXHz5J7Ck1p.1&jst=2) <https://maine.zoom.us/j/87110097395?pwd=UDt6CDpoWNd6q4JfJBzKXHz5J7Ck1p.1&jst=2>
Password: 77842
Or via telephone US: (US) +1 646-931-3860
Meeting ID: 87110097395

Bids received after the stated time will not be considered and will be returned unopened.

Electronic bid submission must be accompanied by a copy of a satisfactory Bid Bond for 5% of the Bid (checks will not be accepted) which shall be in conformity with the form of Bond contained in Section 00 43 13 of the Specifications. Upon determination of the apparent low bidder, the University will contact the low bidder and request an original hard copy of the bid bond be delivered within 72 hours. The University reserves the right to waive all formalities and reject any or all bids or to accept any bids. Scholarships, donations or gifts to the University will not be considered in the evaluation of responses.

Electronic Bid Submission Requirements:

A **SIGNED** virus-free electronic bid form must be submitted as follows:

- The bid and bid bond must be submitted electronically as a single PDF file to the email address shown above.
- Electronic submission must be received by the required **Date/Time** reflected above.

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

Bidders may attend a non-mandatory pre-bid meeting on Tuesday, March 10, 2026, at 9:00 AM. Attendees are to meet in the Barrows ESRB parking lot. Copies of plans and specifications will not be available at the pre-bid meeting. Acquiring or reviewing plans and specifications prior to the meeting is advised.

Project Summary: The University of Maine is seeking to replace the existing steam absorption chiller with a conventional electric water chiller of similar capacity at Barrows Hall. This equipment is located in the top floor mechanical penthouse and on the roof of the building.

Any questions related to the plans and specifications must be submitted prior to **2:00 PM** on Tuesday, March 17, 2026, via email to Adam McNaughton, P.E., Project Manager, University of Maine; cppmquestions@maine.edu

The University of Maine System is an EEO/AA institution and does not discriminate on the grounds of race, color, religion, sex, sexual orientation, transgender status, gender, gender identity or expression, ethnicity, national origin, citizenship status, familial status, ancestry, age, disability physical or mental, genetic information, veteran or military status in employment, education, and all other programs and activities. The following person has been designated to handle inquiries regarding non-discrimination policies: Director of Equal Opportunity, 5713 Chadbourne Hall, Room 412, University of Maine, Orono, ME 04469-5754, 207.581.1226, TTY 711 (Maine Relay System). The University provides reasonable accommodation to qualified individuals with disabilities upon request. General contractors, subcontractors, and product suppliers bidding on this project must subscribe and adhere to the same.

UNIVERSITY OF MAINE SYSTEM
by and through
UNIVERSITY OF MAINE
Jenny Boyden, Vice President of Finance and Chief Business Officer, for
University of Maine System Board of Trustees

END OF SECTION 00 11 13

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

1. At the time of the opening of bids, each bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the plans and contract documents, including all addenda. The failure or omission of any bidder to receive or examine any form, instrument, or document shall not relieve any bidder from any obligation in respect to the bid. The Owner reserves the right to accept or reject any or all bids as may best serve the interests of the University of Maine System.
2. Subject to the University System's right, reserved herein, to accept or reject any or all bids, the General Contractor will be selected on the basis of the sum of the lowest base bid, plus such of the alternates as the University System desires to use.
3. The University System is exempt from the payment of Federal Excise Taxes on articles not for resale and the Federal Transportation Tax on all shipments. The Contractor shall quote less these taxes. Upon application, exemption certificates will be furnished when required.
4. No proposal may be withdrawn during a period of thirty (30) calendar days immediately following the opening thereof.
5. No contract may be assigned, sublet or transferred without the written consent of the University of Maine System.
6. All individuals not residents of this State must comply with the provisions of 14 MRSA §704-A.
7. The successful bidder, or bidders, will be required to furnish 100% Contract Bonds to cover the execution of the contract, in accordance with the AIA Document A101 - 2017 Exhibit A and Article 11 of the AIA Document A201 – 2017 General Conditions of the Contract for Construction.
8. Contractors may be required to furnish a statement of their business experience, record of accomplishments, and financial responsibility, at the discretion of the University System.
9. The base bid shall be based on the materials, methods, equipment and products, as specified.
10. Bidders shall submit the bid on the Bid Form provided in the Specifications, Section 00 41 13.
11. Any materials, methods, equipment and products not herein specified, but worthy of consideration by any General or Subcontractor, may be introduced by a separate letter attached to the regular bid. The Bidder shall state the cost comparison with the specified materials, methods, equipment and products, and the reason for the suggested substitution. It shall be understood by all bidders that the attached letter proposing substitutions shall not be used to determine the low bidder and that all bids are based on specified products.
12. Telegraphic or facsimile proposals will not be considered, but modification of proposals already submitted will be considered if received prior to the hour set for receipt of proposals. If the telegram or facsimile discloses the amount of the proposal, the proposal will be declared invalid. The bidder bears full responsibility to assure that the correction is delivered to the proper location and within the time required.
13. Where a bidder wishes a product to be considered an "approved equal" for bidding purposes, the product, along with all supporting documentation, shall be submitted to the architect for review a minimum of 10 calendar days prior to the bid opening date or the file bid due date, if file bids are required on the project. Products which are determined to be an "approved equal" for bidding purposes shall be listed in an addendum issued so as to be received by bidders no less than 72 hours prior to the bid date or the file bid due date if file bids are required.
14. Where the Bid Form requires the tabulation of subcontractors other than "File Bidders," the Bidder shall list the name of the firm the bidder intends to use in the event the bidder receives the contract award.
15. Bidders may appeal the award decision by submitting a written protest to the University of Maine System

Chief Facilities and General Services Officer within five (5) business days of the date of the award notice (Notice of Award) with a copy of the protest to the successful bidder. The protest must contain a statement of the basis for the challenge.

END OF SECTION 00 21 13

SECTION 00 41 13
BID FORM – SHORT FORM

BIDDER: _____
Physical/Street Address _____
City, State ZIP _____

University of Maine
Office of Facilities Management
5765 Service Building
Orono ME 04469-5765

Having carefully examined the form of contract, general conditions and plans and specifications contained therein for UM BARROWS HALL CHILLER REPLACEMENT, as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment, and materials necessary for and reasonably incidental to the construction and completion of this contract for the base bid of _____ Dollars (\$ _____).

Alternate prices as follows:

Alternate 1. Replace the existing chilled water pumps CHWP-1 and CHWP-2. \$ _____

Alternate 2. Replace Cooling Tower CT-1 and Condenser Water Pumps CWP-1 and CWP-2. \$ _____

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

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

ADDENDUM # _____ DATED _____ ADDENDUM # _____ DATED _____

ADDENDUM # _____ DATED _____ ADDENDUM # _____ DATED _____

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

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

The undersigned agrees, if awarded the Contract, to substantially complete the work on or before August 21, 2026. The undersigned also agrees, if awarded the Contract, that no more than 80% of the contract amount will be sublet to other contractors.

Signed (by individual authorized to sign contract) _____

By (printed name & title) _____ Phone _____

PO Box (if applicable) _____ Email _____

NOTE: If bidder is a corporation, write State of Incorporation, and if a partnership, give full names of all partners.
END OF SECTION 00 41 13

SECTION 00 43 13

BID SECURITY FORM

KNOW ALL BY THESE PRESENTS, THAT WE, the undersigned, as PRINCIPAL _____, and _____ as SURETY, are hereby held and firmly bound unto the Treasurer of the UNIVERSITY OF MAINE SYSTEM in the penal sum of _____ for the payment of which, well and truly to be made, we hereby jointly and severally bind ourselves, our heirs, executors, administrators, successors and assigns, signed this _____ day of _____, 20 _____.

The condition of the above obligation is such that whereas the Principal has submitted to UNIVERSITY OF MAINE SYSTEM, BY AND THROUGH THE UNIVERSITY OF MAINE, a certain proposal, attached hereto and hereby made a part hereof, to enter into a contract in writing for the UM BARROWS HALL CHILLER REPLACEMENT.

NOW THEREFORE,

- (a) If said proposal shall be rejected, or, in the alternate
(b) If said proposal shall be accepted and the Principal shall execute and deliver a contract in the form of contract attached hereto (properly completed in accordance with said proposal) and shall furnish a bond for faithful performance of said contract, and for the payment of all persons performing labor or furnishing materials in connection therewith, and shall in all other respects perform the agreement created by the acceptance of said proposal, then this obligation shall be void, otherwise the same shall remain in force and effect: It being expressly understood and agreed that the liability of the surety for any and all claims hereunder shall, in no event, exceed the penal amount of this obligation as herein stated.

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

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

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

PRINCIPAL: _____

By: _____ L.S.

SURETY: _____

SURETY ADDRESS: _____

By: _____ L.S.

DO NOT ALTER LANGUAGE

END OF SECTION 00 43 13

SECTION 00 51 00

NOTICE OF AWARD

DATE

Vendor Name
Vendor Address.
Vendor Address

RE: ***NOTICE OF AWARD – PROJECT NAME***
UNIVERSITY OF MAINE

Dear (vendor name),

You are hereby notified that the University of Maine System, by and through the University of Maine, accepts your Bid of **\$00.00** for the above named project, subject to final resolution of any bid protests and the parties' ability to establish and confirm final terms, as well as the execution of a written contract and your furnishing satisfactory bonds within twelve (12) calendar days as provided in the bidding documents.

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

Enclosed is your contract agreement for signature. Further, please have your surety provide one original each of the Performance Bond and the Payment Bond, as prescribed in Sections 00 61 13.13 and 00 61 13.16 of the bid document, and a properly executed "Power of Attorney." Please advise your surety agent that the bonds should carry the same date as this Notice of Award and the Contract Agreement. **All originals of the signed contract, bonds and insurance certificates should be forwarded directly to Sandra Binette, Capital Contracts Administrator, 5765 Service Building, Orono, ME 04469.** Once it is completely signed, a copy of the contract will be returned for your use.

Prior to the start of any work on the construction site, Capital Planning and Project Management must receive Certificates of Liability Insurance as specified in Article A.3 of the AIA Document A101 – 2017 Exhibit A, Insurance and Bonds. Please advise your surety that the certificate holder should be as follows: University of Maine System; Office of Risk Management; Robinson Hall, 46 University Drive, Augusta, ME 04330.

The day-to-day administrative and technical details of this project will be handled by the Architect/Engineer, insert name here. All correspondence relative to the day-to-day administration of the project should be directed to insert name, insert title, insert email; 207-000-0000.

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

Sincerely,

Jenny Boyden
Vice President of Finance
& Chief Business Officer

Enclosures

END OF SECTION 00 51 00

**UNIVERSITY OF MAINE SYSTEM
Construction Contract Agreement**

THIS AGREEMENT is made and entered into the _____ day of _____, 20____, by and between the Contractor, _____, and the University of Maine System acting by and through the University of Maine, 5765 Service Building, Orono, ME 04469, hereinafter called the Owner.

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

ARTICLE 1. SCOPE OF THE WORK

The Contractor shall furnish all of the materials and perform all of the work described in the Contract Documents entitled [INSERT PROJECT NAME HERE], prepared by [Insert name of Architect/Engineer here], acting as and in these Contract Documents entitled the Architect and/or Engineer.

ARTICLE 2: START AND TIME OF COMPLETION

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

The Contractor and the Contractor’s surety, if any, shall be liable for and shall pay the Owner the following stipulated liquidated damages for each calendar day of delay after the date established for Substantial Completion until the Work is substantially complete: _____ Dollars (\$ _____) per calendar day.

ARTICLE 3: THE CONTRACT SUM

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

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

Alternate (1) _____	Alternate (2) _____	Alternate (3) _____
Unit Prices		
Item _____	Price _____	
Item _____	Price _____	

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

ARTICLE 4: THE CONTRACT DOCUMENTS

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

- .1 This agreement.
- .2 AIA Document A201-2017, General Conditions of the Contract for Construction, as modified by the Owner.
- .3 AIA A101 – 2017, Exhibit A, Insurance and Bonds, as modified by the Owner.

- .4 The Specifications as outlined in the Project Manual: [Insert Name of Project Here], dated _____.
- .5 The Drawings as listed in the Project Manual.
- .6 The Addenda: Addendum 01 dated _____.
- .7 Exhibit B, Contractor's Proposal dated _____.

ARTICLE 5: OWNER'S REPRESENTATIVES

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

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

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

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

UNIVERSITY OF MAINE SYSTEM
by and through
University of Maine

Company

Company

By: _____
[Insert Signatory Name]
[Insert Signatory Title]
University of Maine

By: _____

END OF SECTION 00 52 13

SECTION 00 61 13.13

PERFORMANCE BOND FORM

Bond No. _____

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

The condition of this obligation is such that if the Principal shall promptly and faithfully perform the Contract entered into on the (4) _____ day of _____, A.D., 20____ for the construction of (5) _____

then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

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

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

WITNESSES:

SIGNATURES:

_____ LS
_____ LS
_____ LS

Bonding Company Agent:

Company: _____

Street: _____

City, State, Zip: _____

Telephone: _____

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

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

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

END OF SECTION 00 61 13.13

SECTION 00 61 13.16
PAYMENT BOND FORM

Bond No. _____

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

The condition of this obligation is such that if the Principal shall promptly satisfy all claims and demands
incurred for all labor and materials used or required by the Principal in connection with the work contemplated
in the Contract entered into on the (4) _____ day of _____, A.D., 20 _____ for the
construction of (5) _____,
_____,
and shall fully reimburse the obligee for all outlay and expense which said obligee may incur in making good
any default of said principal, then this obligation shall be null and void; otherwise, it shall remain in full force
and effect.

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

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

WITNESSES:

SIGNATURES:

_____ LS
_____ LS
_____ LS

Bonding Company Agent:

Company: _____

Street: _____

City, State, Zip: _____

Telephone: _____

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

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

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

END OF SECTION 00 61 13.16



AIA® Document G715™ – 2017

Supplemental Attachment for ACORD Certificate of Insurance 25

PROJECT: <i>(name and address)</i> Samples	CONTRACT INFORMATION: Contract For: Date:	CERTIFICATE INFORMATION: Producer: Insured: Date:
OWNER: <i>(name and address)</i> University of Maine System by and through University of Maine 5765 Service Building Orono, ME 04469	ARCHITECT: <i>(name and address)</i>	CONTRACTOR: <i>(name and address)</i>

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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b Personal injury and advertising injury?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Damages because of physical damage to or destruction of tangible property, including the loss of use of such property?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Bodily injury or property damage arising out of completed operations?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e The Contractor's indemnity obligations included in the Contract Documents?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c Claims for bodily injury other than to employees of the insured?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d Claims for the Contractor's indemnity obligations included in the Contract Documents arising out of injury to employees of the insured?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e Claims for loss excluded under a prior work endorsement or other similar exclusionary language?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g Claims related to residential, multi-family, or other habitational projects?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h Claims related to roofing?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
i Claims related to exterior insulation finish systems, synthetic stucco, or similar exterior coatings or surfaces?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
j Claims related to earth subsistence or movement?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
k Claims related to explosion, collapse, and underground hazards?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
B. Other Insurance Coverage	Yes	No	N/A
1. Indicate whether the Contractor has the following insurance coverages and, if so, indicate the coverage limits for each.			
a Professional liability insurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Coverage limits:			
b Pollution liability insurance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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- 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)

ACORD™ CERTIFICATE OF LIABILITY INSURANCE

DATE (MM/DD/YY)

PRODUCER 	<p>THIS CERTIFICATE IS ISSUED AS A MATTER OF INFORMATION ONLY AND CONFERS NO RIGHTS UPON THE CERTIFICATE HOLDER. THIS CERTIFICATE DOES NOT AMEND, EXTEND OR ALTER THE COVERAGE AFFORDED BY THE POLICIES BELOW.</p> <p style="text-align: center;">INSURERS AFFORDING COVERAGE</p>
INSURED 	INSURER A: INSURER B: INSURER C: INSURER D: INSURER E:

COVERAGES

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

INSR LTR	TYPE OF INSURANCE	POLICY NUMBER	POLICY EFFECTIVE DATE (MM/DD/YY)	POLICY EXPIRATION DATE (MM/DD/YY)	LIMITS								
	GENERAL LIABILITY <input type="checkbox"/> COMMERCIAL GENERAL LIABILITY <input type="checkbox"/> CLAIMS MADE <input type="checkbox"/> OCCUR <hr/> GEN'L AGGREGATE LIMIT APPLIES PER: <input type="checkbox"/> POLICY <input type="checkbox"/> PRO-JECT <input type="checkbox"/> LOC				EACH OCCURRENCE \$ FIRE DAMAGE (Any one fire) \$ MED EXP (Any one person) \$ PERSONAL & ADV INJURY \$ GENERAL AGGREGATE \$ PRODUCTS - COMP/OP AGG \$								
	AUTOMOBILE LIABILITY <input type="checkbox"/> ANY AUTO <input type="checkbox"/> ALL OWNED AUTOS <input type="checkbox"/> SCHEDULED AUTOS <input type="checkbox"/> HIRED AUTOS <input type="checkbox"/> NON-OWNED AUTOS				COMBINED SINGLE LIMIT (Ea accident) \$ BODILY INJURY (Per person) \$ BODILY INJURY (Per accident) \$ PROPERTY DAMAGE (Per accident) \$								
	GARAGE LIABILITY <input type="checkbox"/> ANY AUTO				AUTO ONLY - EA ACCIDENT \$ OTHER THAN EA ACC \$ AUTO ONLY: AGG \$								
	EXCESS LIABILITY <input type="checkbox"/> OCCUR <input type="checkbox"/> CLAIMS MADE <hr/> DEDUCTIBLE RETENTION \$				EACH OCCURRENCE \$ AGGREGATE \$ \$ \$ \$								
	WORKERS COMPENSATION AND EMPLOYERS' LIABILITY				<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:50%; text-align: center;">WC STATU-TORY LIMITS</td> <td style="width:50%; text-align: center;">OTH-ER</td> </tr> <tr> <td colspan="2">E.L. EACH ACCIDENT \$</td> </tr> <tr> <td colspan="2">E.L. DISEASE - EA EMPLOYEE \$</td> </tr> <tr> <td colspan="2">E.L. DISEASE - POLICY LIMIT \$</td> </tr> </table>	WC STATU-TORY LIMITS	OTH-ER	E.L. EACH ACCIDENT \$		E.L. DISEASE - EA EMPLOYEE \$		E.L. DISEASE - POLICY LIMIT \$	
WC STATU-TORY LIMITS	OTH-ER												
E.L. EACH ACCIDENT \$													
E.L. DISEASE - EA EMPLOYEE \$													
E.L. DISEASE - POLICY LIMIT \$													
	OTHER												

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

University of Maine System is named an additional insured under General Liability.

Project:

CERTIFICATE HOLDER University of Maine System Office of Risk Management Robinson Hall 46 University Drive Augusta, ME 04330	ADDITIONAL INSURED; INSURER LETTER: _____ CANCELLATION SHOULD ANY OF THE ABOVE DESCRIBED POLICIES BE CANCELLED BEFORE THE EXPIRATION DATE THEREOF, THE ISSUING INSURER WILL ENDEAVOR TO MAIL _____ DAYS WRITTEN NOTICE TO THE CERTIFICATE HOLDER NAMED TO THE LEFT, BUT FAILURE TO DO SO SHALL IMPOSE NO OBLIGATION OR LIABILITY OF ANY KIND UPON THE INSURER, ITS AGENTS OR REPRESENTATIVES. AUTHORIZED REPRESENTATIVE
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IMPORTANT

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

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

DISCLAIMER

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

Sample

COMMERCIAL GENERAL LIABILITY COVERAGE FORM

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

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

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

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

SECTION I – COVERAGES

COVERAGE A BODILY INJURY AND PROPERTY DAMAGE LIABILITY

1. Insuring Agreement

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

- (1) The amount we will pay for damages is limited as described in Section III – Limits Of Insurance; and
- (2) Our right and duty to defend ends when we have used up the applicable limit of insurance in the payment of judgments or settlements under Coverages A or B or medical expenses under Coverage C.

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

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

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

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

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

- (1) Reports all, or any part, of the "bodily injury" or "property damage" to us or any other insurer;
- (2) Receives a written or verbal demand or claim for damages because of the "bodily injury" or "property damage"; or
- (3) Becomes aware by any other means that "bodily injury" or "property damage" has occurred or has begun to occur.

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

2. Exclusions

This insurance does not apply to:

a. Expected Or Intended Injury

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

b. Contractual Liability

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

- (1) That the insured would have in the absence of the contract or agreement; or
- (2) Assumed in a contract or agreement that is an "insured contract", provided the "bodily injury" or "property damage" occurs subsequent to the execution of the contract or agreement. Solely for the purposes of liability assumed in an "insured contract", reasonable attorney fees and necessary litigation expenses incurred by or for a party other than an insured are deemed to be damages because of "bodily injury" or "property damage", provided:
 - (a) Liability to such party for, or for the cost of, that party's defense has also been assumed in the same "insured contract"; and
 - (b) Such attorney fees and litigation expenses are for defense of that party against a civil or alternative dispute resolution proceeding in which damages to which this insurance applies are alleged.

c. Liquor Liability

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

- (1) Causing or contributing to the intoxication of any person;
- (2) The furnishing of alcoholic beverages to a person under the legal drinking age or under the influence of alcohol; or
- (3) Any statute, ordinance or regulation relating to the sale, gift, distribution or use of alcoholic beverages.

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

d. Workers' Compensation And Similar Laws

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

e. Employer's Liability

"Bodily injury" to:

- (1) An "employee" of the insured arising out of and in the course of:
 - (a) Employment by the insured; or
 - (b) Performing duties related to the conduct of the insured's business; or
- (2) The spouse, child, parent, brother or sister of that "employee" as a consequence of Paragraph (1) above.

This exclusion applies:

- (1) Whether the insured may be liable as an employer or in any other capacity; and
- (2) To any obligation to share damages with or repay someone else who must pay damages because of the injury.

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

f. Pollution

- (1) "Bodily injury" or "property damage" arising out of the actual, alleged or threatened discharge, dispersal, seepage, migration, release or escape of "pollutants":
- (a) At or from any premises, site or location which is or was at any time owned or occupied by, or rented or loaned to, any insured. However, this subparagraph does not apply to:
 - (i) "Bodily injury" if sustained within a building and caused by smoke, fumes, vapor or soot produced by or originating from equipment that is used to heat, cool or dehumidify the building, or equipment that is used to heat water for personal use, by the building's occupants or their guests;
 - (ii) "Bodily injury" or "property damage" for which you may be held liable, if you are a contractor and the owner or lessee of such premises, site or location has been added to your policy as an additional insured with respect to your ongoing operations performed for that additional insured at that premises, site or location and such premises, site or location is not and never was owned or occupied by, or rented or loaned to, any insured, other than that additional insured; or
 - (iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire";
 - (b) At or from any premises, site or location which is or was at any time used by or for any insured or others for the handling, storage, disposal, processing or treatment of waste;
 - (c) Which are or were at any time transported, handled, stored, treated, disposed of, or processed as waste by or for:
 - (i) Any insured; or
 - (ii) Any person or organization for whom you may be legally responsible; or
 - (d) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the "pollutants" are brought on or to the premises, site or location in connection with such operations by such insured, contractor or subcontractor. However, this subparagraph does not apply to:
 - (i) "Bodily injury" or "property damage" arising out of the escape of fuels, lubricants or other operating fluids which are needed to perform the normal electrical, hydraulic or mechanical functions necessary for the operation of "mobile equipment" or its parts, if such fuels, lubricants or other operating fluids escape from a vehicle part designed to hold, store or receive them. This exception does not apply if the "bodily injury" or "property damage" arises out of the intentional discharge, dispersal or release of the fuels, lubricants or other operating fluids, or if such fuels, lubricants or other operating fluids are brought on or to the premises, site or location with the intent that they be discharged, dispersed or released as part of the operations being performed by such insured, contractor or subcontractor;
 - (ii) "Bodily injury" or "property damage" sustained within a building and caused by the release of gases, fumes or vapors from materials brought into that building in connection with operations being performed by you or on your behalf by a contractor or subcontractor; or
 - (iii) "Bodily injury" or "property damage" arising out of heat, smoke or fumes from a "hostile fire".
 - (e) At or from any premises, site or location on which any insured or any contractors or subcontractors working directly or indirectly on any insured's behalf are performing operations if the operations are to test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants".

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

- (a) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or
- (b) Claim or "suit" by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

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

g. Aircraft, Auto Or Watercraft

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

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

This exclusion does not apply to:

- (1) A watercraft while ashore on premises you own or rent;
- (2) A watercraft you do not own that is:
 - (a) Less than 26 feet long; and
 - (b) Not being used to carry persons or property for a charge;
- (3) Parking an "auto" on, or on the ways next to, premises you own or rent, provided the "auto" is not owned by or rented or loaned to you or the insured;
- (4) Liability assumed under any "insured contract" for the ownership, maintenance or use of aircraft or watercraft; or

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

- (a) The operation of machinery or equipment that is attached to, or part of, a land vehicle that would qualify under the definition of "mobile equipment" if it were not subject to a compulsory or financial responsibility law or other motor vehicle insurance law in the state where it is licensed or principally garaged; or
- (b) the operation of any of the machinery or equipment listed in Paragraph **f.(2)** or **f.(3)** of the definition of "mobile equipment".

h. Mobile Equipment

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

- (1) The transportation of "mobile equipment" by an "auto" owned or operated by or rented or loaned to any insured; or
- (2) The use of "mobile equipment" in, or while in practice for, or while being prepared for, any prearranged racing, speed, demolition, or stunting activity.

i. War

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

- (1) War, including undeclared or civil war;
- (2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or
- (3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

j. Damage To Property

"Property damage" to:

- (1) Property you own, rent, or occupy, including any costs or expenses incurred by you, or any other person, organization or entity, for repair, replacement, enhancement, restoration or maintenance of such property for any reason, including prevention of injury to a person or damage to another's property;
- (2) Premises you sell, give away or abandon, if the "property damage" arises out of any part of those premises;
- (3) Property loaned to you;
- (4) Personal property in the care, custody or control of the insured;

- (5) That particular part of real property on which you or any contractors or subcontractors working directly or indirectly on your behalf are performing operations, if the "property damage" arises out of those operations; or
- (6) That particular part of any property that must be restored, repaired or replaced because "your work" was incorrectly performed on it.

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

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

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

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

k. Damage To Your Product

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

l. Damage To Your Work

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

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

m. Damage To Impaired Property Or Property Not Physically Injured

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

- (1) A defect, deficiency, inadequacy or dangerous condition in "your product" or "your work"; or
- (2) A delay or failure by you or anyone acting on your behalf to perform a contract or agreement in accordance with its terms.

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

n. Recall Of Products, Work Or Impaired Property

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

- (1) "Your product";
- (2) "Your work"; or
- (3) "Impaired property";

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

o. Personal And Advertising Injury

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

p. Electronic Data

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

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

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

COVERAGE B PERSONAL AND ADVERTISING INJURY LIABILITY

1. Insuring Agreement

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

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

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

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

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

2. Exclusions

This insurance does not apply to:

a. Knowing Violation Of Rights Of Another

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

b. Material Published With Knowledge Of Falsity

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

c. Material Published Prior To Policy Period

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

d. Criminal Acts

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

e. Contractual Liability

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

f. Breach Of Contract

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

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

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

h. Wrong Description Of Prices

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

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

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

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

j. Insureds In Media And Internet Type Businesses

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

- (1) Advertising, broadcasting, publishing or telecasting;
- (2) Designing or determining content of websites for others; or
- (3) An Internet search, access, content or service provider.

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

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

k. Electronic Chatrooms Or Bulletin Boards

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

l. Unauthorized Use Of Another's Name Or Product

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

m. Pollution

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

n. Pollution-Related

Any loss, cost or expense arising out of any:

- (1) Request, demand, order or statutory or regulatory requirement that any insured or others test for, monitor, clean up, remove, contain, treat, detoxify or neutralize, or in any way respond to, or assess the effects of, "pollutants"; or
- (2) Claim or suit by or on behalf of a governmental authority for damages because of testing for, monitoring, cleaning up, removing, containing, treating, detoxifying or neutralizing, or in any way responding to, or assessing the effects of, "pollutants".

o. War

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

- (1) War, including undeclared or civil war;
- (2) Warlike action by a military force, including action in hindering or defending against an actual or expected attack, by any government, sovereign or other authority using military personnel or other agents; or
- (3) Insurrection, rebellion, revolution, usurped power, or action taken by governmental authority in hindering or defending against any of these.

COVERAGE C MEDICAL PAYMENTS

1. Insuring Agreement

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

- (1) On premises you own or rent;
- (2) On ways next to premises you own or rent; or
- (3) Because of your operations; provided that:
 - (1) The accident takes place in the "coverage territory" and during the policy period;
 - (2) The expenses are incurred and reported to us within one year of the date of the accident; and
 - (3) The injured person submits to examination, at our expense, by physicians of our choice as often as we reasonably require.

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

- (1) First aid administered at the time of an accident;
- (2) Necessary medical, surgical, x-ray and dental services, including prosthetic devices; and
- (3) Necessary ambulance, hospital, professional nursing and funeral services.

2. Exclusions

We will not pay expenses for "bodily injury":

a. Any Insured

To any insured, except "volunteer workers".

b. Hired Person

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

c. Injury On Normally Occupied Premises

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

d. Workers Compensation And Similar Laws

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

e. Athletics Activities

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

f. Products-Completed Operations Hazard

Included within the "products-completed operations hazard".

g. Coverage A Exclusions

Excluded under Coverage A.

SUPPLEMENTARY PAYMENTS – COVERAGES A AND B

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

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

- c. The cost of bonds to release attachments, but only for bond amounts within the applicable limit of insurance. We do not have to furnish these bonds.
- d. All reasonable expenses incurred by the insured at our request to assist us in the investigation or defense of the claim or "suit", including actual loss of earnings up to \$250 a day because of time off from work.
- e. All costs taxed against the insured in the "suit".
- f. Prejudgment interest awarded against the insured on that part of the judgment we pay. If we make an offer to pay the applicable limit of insurance, we will not pay any prejudgment interest based on that period of time after the offer.
- g. All interest on the full amount of any judgment that accrues after entry of the judgment and before we have paid, offered to pay, or deposited in court the part of the judgment that is within the applicable limit of insurance.

These payments will not reduce the limits of insurance.

- 2. If we defend an insured against a "suit" and an indemnitee of the insured is also named as a party to the "suit", we will defend that indemnitee if all of the following conditions are met:
 - a. The "suit" against the indemnitee seeks damages for which the insured has assumed the liability of the indemnitee in a contract or agreement that is an "insured contract";
 - b. This insurance applies to such liability assumed by the insured;
 - c. The obligation to defend, or the cost of the defense of, that indemnitee, has also been assumed by the insured in the same "insured contract";
 - d. The allegations in the "suit" and the information we know about the "occurrence" are such that no conflict appears to exist between the interests of the insured and the interests of the indemnitee;
 - e. The indemnitee and the insured ask us to conduct and control the defense of that indemnitee against such "suit" and agree that we can assign the same counsel to defend the insured and the indemnitee; and
 - f. The indemnitee:
 - (1) Agrees in writing to:
 - (a) Cooperate with us in the investigation, settlement or defense of the "suit";

- (b) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the "suit";
 - (c) Notify any other insurer whose coverage is available to the indemnitee; and
 - (d) Cooperate with us with respect to coordinating other applicable insurance available to the indemnitee; and
- (2) Provides us with written authorization to:
 - (a) Obtain records and other information related to the "suit"; and
 - (b) Conduct and control the defense of the indemnitee in such "suit".

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

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

- a. We have used up the applicable limit of insurance in the payment of judgments or settlements; or
- b. The conditions set forth above, or the terms of the agreement described in Paragraph f. above, are no longer met.

SECTION II – WHO IS AN INSURED

- 1. If you are designated in the Declarations as:
 - a. An individual, you and your spouse are insureds, but only with respect to the conduct of a business of which you are the sole owner.
 - b. A partnership or joint venture, you are an insured. Your members, your partners, and their spouses are also insureds, but only with respect to the conduct of your business.
 - c. A limited liability company, you are an insured. Your members are also insureds, but only with respect to the conduct of your business. Your managers are insureds, but only with respect to their duties as your managers.

- d. An organization other than a partnership, joint venture or limited liability company, you are an insured. Your "executive officers" and directors are insureds, but only with respect to their duties as your officers or directors. Your stockholders are also insureds, but only with respect to their liability as stockholders.
 - e. A trust, you are an insured. Your trustees are also insureds, but only with respect to their duties as trustees.
2. Each of the following is also an insured:
- a. Your "volunteer workers" only while performing duties related to the conduct of your business, or your "employees", other than either your "executive officers" (if you are an organization other than a partnership, joint venture or limited liability company) or your managers (if you are a limited liability company), but only for acts within the scope of their employment by you or while performing duties related to the conduct of your business. However, none of these "employees" or "volunteer workers" are insureds for:
 - (1) "Bodily injury" or "personal and advertising injury":
 - (a) To you, to your partners or members (if you are a partnership or joint venture), to your members (if you are a limited liability company), to a co-"employee" while in the course of his or her employment or performing duties related to the conduct of your business, or to your other "volunteer workers" while performing duties related to the conduct of your business;
 - (b) To the spouse, child, parent, brother or sister of that co-"employee" or "volunteer worker" as a consequence of Paragraph (1)(a) above;
 - (c) For which there is any obligation to share damages with or repay someone else who must pay damages because of the injury described in Paragraphs (1)(a) or (b) above; or
 - (d) Arising out of his or her providing or failing to provide professional health care services.
 - (2) "Property damage" to property:
 - (a) Owned, occupied or used by,
 - (b) Rented to, in the care, custody or control of, or over which physical control is being exercised for any purpose by you, any of your "employees", "volunteer workers", any partner or member (if you are a partnership or joint venture), or any member (if you are a limited liability company).
 - b. Any person (other than your "employee" or "volunteer worker"), or any organization while acting as your real estate manager.
 - c. Any person or organization having proper temporary custody of your property if you die, but only:
 - (1) With respect to liability arising out of the maintenance or use of that property; and
 - (2) Until your legal representative has been appointed.
 - d. Your legal representative if you die, but only with respect to duties as such. That representative will have all your rights and duties under this Coverage Part.
3. Any organization you newly acquire or form, other than a partnership, joint venture or limited liability company, and over which you maintain ownership or majority interest, will qualify as a Named Insured if there is no other similar insurance available to that organization. However:
- a. Coverage under this provision is afforded only until the 90th day after you acquire or form the organization or the end of the policy period, whichever is earlier;
 - b. Coverage **A** does not apply to "bodily injury" or "property damage" that occurred before you acquired or formed the organization; and
 - c. Coverage **B** does not apply to "personal and advertising injury" arising out of an offense committed before you acquired or formed the organization.
- No person or organization is an insured with respect to the conduct of any current or past partnership, joint venture or limited liability company that is not shown as a Named Insured in the Declarations.

SECTION III – LIMITS OF INSURANCE

- 1. The Limits of Insurance shown in the Declarations and the rules below fix the most we will pay regardless of the number of:
 - a. Insureds;
 - b. Claims made or "suits" brought; or
 - c. Persons or organizations making claims or bringing "suits".

2. The General Aggregate Limit is the most we will pay for the sum of:
 - a. Medical expenses under Coverage **C**;
 - b. Damages under Coverage **A**, except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard"; and
 - c. Damages under Coverage **B**.
3. The Products-Completed Operations Aggregate Limit is the most we will pay under Coverage **A** for damages because of "bodily injury" and "property damage" included in the "products-completed operations hazard".
4. Subject to 2. above, the Personal and Advertising Injury Limit is the most we will pay under Coverage **B** for the sum of all damages because of all "personal and advertising injury" sustained by any one person or organization.
5. Subject to 2. or 3. above, whichever applies, the Each Occurrence Limit is the most we will pay for the sum of:
 - a. Damages under Coverage **A**; and
 - b. Medical expenses under Coverage **C** because of all "bodily injury" and "property damage" arising out of any one "occurrence".
6. Subject to 5. above, the Damage To Premises Rented To You Limit is the most we will pay under Coverage **A** for damages because of "property damage" to any one premises, while rented to you, or in the case of damage by fire, while rented to you or temporarily occupied by you with permission of the owner.
7. Subject to 5. above, the Medical Expense Limit is the most we will pay under Coverage **C** for all medical expenses because of "bodily injury" sustained by any one person.

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

SECTION IV – COMMERCIAL GENERAL LIABILITY CONDITIONS

1. Bankruptcy

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

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

- a. You must see to it that we are notified as soon as practicable of an "occurrence" or an offense which may result in a claim. To the extent possible, notice should include:
 - (1) How, when and where the "occurrence" or offense took place;
 - (2) The names and addresses of any injured persons and witnesses; and
 - (3) The nature and location of any injury or damage arising out of the "occurrence" or offense.
- b. If a claim is made or "suit" is brought against any insured, you must:
 - (1) Immediately record the specifics of the claim or "suit" and the date received; and
 - (2) Notify us as soon as practicable.

You must see to it that we receive written notice of the claim or "suit" as soon as practicable.
- c. You and any other involved insured must:
 - (1) Immediately send us copies of any demands, notices, summonses or legal papers received in connection with the claim or "suit";
 - (2) Authorize us to obtain records and other information;
 - (3) Cooperate with us in the investigation or settlement of the claim or defense against the "suit"; and
 - (4) Assist us, upon our request, in the enforcement of any right against any person or organization which may be liable to the insured because of injury or damage to which this insurance may also apply.
- d. No insured will, except at that insured's own cost, voluntarily make a payment, assume any obligation, or incur any expense, other than for first aid, without our consent.

3. Legal Action Against Us

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

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

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

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

4. Other Insurance

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

a. Primary Insurance

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

b. Excess Insurance

This insurance is excess over:

- (1) Any of the other insurance, whether primary, excess, contingent or on any other basis:
 - (a) That is Fire, Extended Coverage, Builder's Risk, Installation Risk or similar coverage for "your work";
 - (b) That is Fire insurance for premises rented to you or temporarily occupied by you with permission of the owner;
 - (c) That is insurance purchased by you to cover your liability as a tenant for "property damage" to premises rented to you or temporarily occupied by you with permission of the owner; or
 - (d) If the loss arises out of the maintenance or use of aircraft, "autos" or watercraft to the extent not subject to Exclusion **g.** of Section **I** – Coverage **A** – Bodily Injury And Property Damage Liability.
- (2) Any other primary insurance available to you covering liability for damages arising out of the premises or operations, or the products and completed operations, for which you have been added as an additional insured by attachment of an endorsement.

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

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

- (1) The total amount that all such other insurance would pay for the loss in the absence of this insurance; and
- (2) The total of all deductible and self-insured amounts under all that other insurance.

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

c. Method Of Sharing

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

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

5. Premium Audit

- a. We will compute all premiums for this Coverage Part in accordance with our rules and rates.
- b. Premium shown in this Coverage Part as advance premium is a deposit premium only. At the close of each audit period we will compute the earned premium for that period and send notice to the first Named Insured. The due date for audit and retrospective premiums is the date shown as the due date on the bill. If the sum of the advance and audit premiums paid for the policy period is greater than the earned premium, we will return the excess to the first Named Insured.
- c. The first Named Insured must keep records of the information we need for premium computation, and send us copies at such times as we may request.

6. Representations

By accepting this policy, you agree:

- a. The statements in the Declarations are accurate and complete;
- b. Those statements are based upon representations you made to us; and
- c. We have issued this policy in reliance upon your representations.

7. Separation Of Insureds

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

- a. As if each Named Insured were the only Named Insured; and
- b. Separately to each insured against whom claim is made or "suit" is brought.

8. Transfer Of Rights Of Recovery Against Others To Us

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

9. When We Do Not Renew

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

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

SECTION V – DEFINITIONS

1. "Advertisement" means a notice that is broadcast or published to the general public or specific market segments about your goods, products or services for the purpose of attracting customers or supporters. For the purposes of this definition:
 - a. Notices that are published include material placed on the Internet or on similar electronic means of communication; and
 - b. Regarding web-sites, only that part of a web-site that is about your goods, products or services for the purposes of attracting customers or supporters is considered an advertisement.
2. "Auto" means:
 - a. A land motor vehicle, trailer or semitrailer designed for travel on public roads, including any attached machinery or equipment; or

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

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

3. "Bodily injury" means bodily injury, sickness or disease sustained by a person, including death resulting from any of these at any time.
4. "Coverage territory" means:
 - a. The United States of America (including its territories and possessions), Puerto Rico and Canada;
 - b. International waters or airspace, but only if the injury or damage occurs in the course of travel or transportation between any places included in a. above; or
 - c. All other parts of the world if the injury or damage arises out of:
 - (1) Goods or products made or sold by you in the territory described in a. above;
 - (2) The activities of a person whose home is in the territory described in a. above, but is away for a short time on your business; or
 - (3) "Personal and advertising injury" offenses that take place through the Internet or similar electronic means of communicationprovided the insured's responsibility to pay damages is determined in a "suit" on the merits, in the territory described in a. above or in a settlement we agree to.
5. "Employee" includes a "leased worker". "Employee" does not include a "temporary worker".
6. "Executive officer" means a person holding any of the officer positions created by your charter, constitution, by-laws or any other similar governing document.
7. "Hostile fire" means one which becomes uncontrollable or breaks out from where it was intended to be.
8. "Impaired property" means tangible property, other than "your product" or "your work", that cannot be used or is less useful because:
 - a. It incorporates "your product" or "your work" that is known or thought to be defective, deficient, inadequate or dangerous; or
 - b. You have failed to fulfill the terms of a contract or agreement;if such property can be restored to use by:
 - a. The repair, replacement, adjustment or removal of "your product" or "your work"; or

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

9. "Insured contract" means:

- a. A contract for a lease of premises. However, that portion of the contract for a lease of premises that indemnifies any person or organization for damage by fire to premises while rented to you or temporarily occupied by you with permission of the owner is not an "insured contract";
- b. A sidetrack agreement;
- c. Any easement or license agreement, except in connection with construction or demolition operations on or within 50 feet of a railroad;
- d. An obligation, as required by ordinance, to indemnify a municipality, except in connection with work for a municipality;
- e. An elevator maintenance agreement;
- f. That part of any other contract or agreement pertaining to your business (including an indemnification of a municipality in connection with work performed for a municipality) under which you assume the tort liability of another party to pay for "bodily injury" or "property damage" to a third person or organization. Tort liability means a liability that would be imposed by law in the absence of any contract or agreement.

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

- (1) That indemnifies a railroad for "bodily injury" or "property damage" arising out of construction or demolition operations, within 50 feet of any railroad property and affecting any railroad bridge or trestle, tracks, roadbeds, tunnel, underpass or crossing;
- (2) That indemnifies an architect, engineer or surveyor for injury or damage arising out of:
 - (a) Preparing, approving, or failing to prepare or approve, maps, shop drawings, opinions, reports, surveys, field orders, change orders or drawings and specifications; or
 - (b) Giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage; or
- (3) Under which the insured, if an architect, engineer or surveyor, assumes liability for an injury or damage arising out of the insured's rendering or failure to render professional services, including those listed in (2) above and supervisory, inspection, architectural or engineering activities.

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

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

- a. After it is moved from the place where it is accepted for movement into or onto an aircraft, watercraft or "auto";
- b. While it is in or on an aircraft, watercraft or "auto"; or
- c. While it is being moved from an aircraft, watercraft or "auto" to the place where it is finally delivered;

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

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

- a. Bulldozers, farm machinery, forklifts and other vehicles designed for use principally off public roads;
- b. Vehicles maintained for use solely on or next to premises you own or rent;
- c. Vehicles that travel on crawler treads;
- d. Vehicles, whether self-propelled or not, maintained primarily to provide mobility to permanently mounted:
 - (1) Power cranes, shovels, loaders, diggers or drills; or
 - (2) Road construction or resurfacing equipment such as graders, scrapers or rollers;
- e. Vehicles not described in a., b., c. or d. above that are not self-propelled and are maintained primarily to provide mobility to permanently attached equipment of the following types:
 - (1) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment; or
 - (2) Cherry pickers and similar devices used to raise or lower workers;
- f. Vehicles not described in a., b., c. or d. above maintained primarily for purposes other than the transportation of persons or cargo.

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

- (1) Equipment designed primarily for:
 - (a) Snow removal;
 - (b) Road maintenance, but not construction or resurfacing; or
 - (c) Street cleaning;
- (2) Cherry pickers and similar devices mounted on automobile or truck chassis and used to raise or lower workers; and
- (3) Air compressors, pumps and generators, including spraying, welding, building cleaning, geophysical exploration, lighting and well servicing equipment.

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

13. "Occurrence" means an accident, including continuous or repeated exposure to substantially the same general harmful conditions.
14. "Personal and advertising injury" means injury, including consequential "bodily injury", arising out of one or more of the following offenses:
 - a. False arrest, detention or imprisonment;
 - b. Malicious prosecution;
 - c. The wrongful eviction from, wrongful entry into, or invasion of the right of private occupancy of a room, dwelling or premises that a person occupies, committed by or on behalf of its owner, landlord or lessor;
 - d. Oral or written publication, in any manner, of material that slanders or libels a person or organization or disparages a person's or organization's goods, products or services;
 - e. Oral or written publication, in any manner, of material that violates a person's right of privacy;
 - f. The use of another's advertising idea in your "advertisement"; or
 - g. Infringing upon another's copyright, trade dress or slogan in your "advertisement".
15. "Pollutants" mean any solid, liquid, gaseous or thermal irritant or contaminant, including smoke, vapor, soot, fumes, acids, alkalis, chemicals and waste. Waste includes materials to be recycled, reconditioned or reclaimed.

16. "Products-completed operations hazard":

- a. Includes all "bodily injury" and "property damage" occurring away from premises you own or rent and arising out of "your product" or "your work" except:
 - (1) Products that are still in your physical possession; or
 - (2) Work that has not yet been completed or abandoned. However, "your work" will be deemed completed at the earliest of the following times:
 - (a) When all of the work called for in your contract has been completed.
 - (b) When all of the work to be done at the job site has been completed if your contract calls for work at more than one job site.
 - (c) When that part of the work done at a job site has been put to its intended use by any person or organization other than another contractor or subcontractor working on the same project.

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

- b. Does not include "bodily injury" or "property damage" arising out of:
 - (1) The transportation of property, unless the injury or damage arises out of a condition in or on a vehicle not owned or operated by you, and that condition was created by the "loading or unloading" of that vehicle by any insured;
 - (2) The existence of tools, uninstalled equipment or abandoned or unused materials; or
 - (3) Products or operations for which the classification, listed in the Declarations or in a policy schedule, states that products-completed operations are subject to the General Aggregate Limit.

17. "Property damage" means:

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

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

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

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

- 18.** "Suit" means a civil proceeding in which damages because of "bodily injury", "property damage" or "personal and advertising injury" to which this insurance applies are alleged. "Suit" includes:
 - a.** An arbitration proceeding in which such damages are claimed and to which the insured must submit or does submit with our consent; or
 - b.** Any other alternative dispute resolution proceeding in which such damages are claimed and to which the insured submits with our consent.
- 19.** "Temporary worker" means a person who is furnished to you to substitute for a permanent "employee" on leave or to meet seasonal or short-term workload conditions.
- 20.** "Volunteer worker" means a person who is not your "employee", and who donates his or her work and acts at the direction of and within the scope of duties determined by you, and is not paid a fee, salary or other compensation by you or anyone else for their work performed for you.

21. "Your product":

a. Means:

- (1)** Any goods or products, other than real property, manufactured, sold, handled, distributed or disposed of by:
 - (a)** You;
 - (b)** Others trading under your name; or
 - (c)** A person or organization whose business or assets you have acquired; and
- (2)** Containers (other than vehicles), materials, parts or equipment furnished in connection with such goods or products.

b. Includes

- (1)** Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your product"; and
 - (2)** The providing of or failure to provide warnings or instructions.
- c.** Does not include vending machines or other property rented to or located for the use of others but not sold.

22. "Your work":

a. Means:

- (1)** Work or operations performed by you or on your behalf; and
- (2)** Materials, parts or equipment furnished in connection with such work or operations.

b. Includes

- (1)** Warranties or representations made at any time with respect to the fitness, quality, durability, performance or use of "your work", and
- (2)** The providing of or failure to provide warnings or instructions.

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 10 07 04

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

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

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

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

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

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

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

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

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

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

END OF SECTION 00 62 16.12

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 20 37 07 04

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

**ADDITIONAL INSURED – OWNERS, LESSEES OR
CONTRACTORS – COMPLETED OPERATIONS**

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

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

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

END OF SECTION 00 62 16.13

POLICY NUMBER:

COMMERCIAL GENERAL LIABILITY
CG 25 04 03 97

THIS ENDORSEMENT CHANGES THE POLICY. PLEASE READ IT CAREFULLY.

DESIGNATED LOCATION(S) GENERAL AGGREGATE LIMIT

This endorsement modifies insurance provided under the following:

COMMERCIAL GENERAL LIABILITY COVERAGE PART

SCHEDULE

Designated Location(s):

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

- A.** For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under **COVERAGE A (SECTION I)**, and for all medical expenses caused by accidents under **COVERAGE C (SECTION I)**, which can be attributed only to operations at a single designated "location" shown in the Schedule above:
1. A separate Designated Location General Aggregate Limit applies to each designated "location", and that limit is equal to the amount of the General Aggregate Limit shown in the Declarations.
 2. The Designated Location General Aggregate Limit is the most we will pay for the sum of all damages under **COVERAGE A**, except damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard", and for medical expenses under **COVERAGE C** regardless of the number of:
 - a. Insureds;
 - b. Claims made or "suits" brought; or
 - c. Persons or organizations making claims or bringing "suits".
 3. Any payments made under **COVERAGE A** for damages or under **COVERAGE C** for medical expenses shall reduce the Designated Location General Aggregate Limit for that designated "location". Such payments shall not reduce the General Aggregate Limit shown in the Declarations nor shall they reduce any other Designated Location General Aggregate Limit for any other designated "location" shown in the Schedule above.
 4. The limits shown in the Declarations for Each Occurrence, Fire Damage and Medical Expense continue to apply. However, instead of being subject to the General Aggregate Limit shown in the Declarations, such limits will be subject to the applicable Designated Location General Aggregate Limit.

- B.** For all sums which the insured becomes legally obligated to pay as damages caused by "occurrences" under **COVERAGE A (SECTION I)**, and for all medical expenses caused by accidents under **COVERAGE C (SECTION I)**, which cannot be attributed only to operations at a single designated "location" shown in the Schedule above:
1. Any payments made under **COVERAGE A** for damages or under **COVERAGE C** for medical expenses shall reduce the amount available under the General Aggregate Limit or the Products-Completed Operations Aggregate Limit, whichever is applicable; and
 2. Such payments shall not reduce any Designated Location General Aggregate Limit.
- C.** When coverage for liability arising out of the "products-completed operations hazard" is provided, any payments for damages because of "bodily injury" or "property damage" included in the "products-completed operations hazard" will reduce the Products-Completed Operations Aggregate Limit, and not reduce the General Aggregate Limit nor the Designated Location General Aggregate Limit.
- D.** For the purposes of this endorsement, the **Definitions** Section is amended by the addition of the following definition:
- "Location" means premises involving the same or connecting lots, or premises whose connection is interrupted only by a street, roadway, waterway or right-of-way of a railroad.
- E.** The provisions of Limits Of Insurance (**SECTION III**) not otherwise modified by this endorsement shall continue to apply as stipulated.

Sample

END OF SECTION 00 62 16.14



AIA Document G702® - 1992

Application and Certificate for Payment

TO OWNER: University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

PROJECT: _____

FROM CONTRACTOR: VIA ARCHITECT: _____

APPLICATION NO. PERIOD TO: _____

CONTRACT FOR: _____

CONTRACT DATE: _____

PROJECT NOS: _____ / _____ / _____

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

CONTRACTOR'S APPLICATION FOR PAYMENT

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

1. ORIGINAL CONTRACT SUM 0.00
2. NET CHANGE BY CHANGE ORDERS 0.00
3. CONTRACT SUM TO DATE (Line 1 ± 2) 0.00
4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) 0.00
5. RETAINAGE:
 - a. 0 _____ % of Completed Work
(Column D + E on G703) 0.00
 - b. 0 _____ % of Stored Material
(Column F on G703) 0.00

Total Retainage (Lines 5a + 5b or Total in Column I of G703) 0.00
6. TOTAL EARNED LESS RETAINAGE 0.00
(Line 4 Less Line 5 Total)
7. LESS PREVIOUS CERTIFICATES FOR PAYMENT 0.00
(Line 6 from prior Certificate)
8. CURRENT PAYMENT DUE 0.00
9. BALANCE TO FINISH, INCLUDING RETAINAGE 0.00
(Line 3 less Line 6)

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

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

CONTRACTOR: _____ Date: _____

By: _____ State of: _____

County of: _____

Subscribed and sworn to before me this _____ day of _____

Notary Public: _____

My Commission expires: _____

ARCHITECT'S CERTIFICATE FOR PAYMENT

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

AMOUNT CERTIFIED 0.00
(Attach explanation if amount certified differs from the amount applied. Initial all figures on this Application and on the Continuation Sheet that are changed to conform with the amount certified.)

ARCHITECT:

By: _____ Date: _____

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

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User Notes: (3B9ADA4C)

SECTION 00 62 76.13
SAMPLE

SALES TAX FORM

DATE: _____

VENDOR: _____

Vendor Name

Vendor Address

Vendor City, State Zip

I hereby certify under penalties of perjury, that:

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

This project is titled: INSERT PROJECT NAME HERE
Project Title

The project is located at: UNIVERSITY OF MAINE
Campus Name or Town

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

Signed: _____
Authorized Signature

Name & Title: _____

Firm Name: _____

Firm Address: _____

Firm City, State Zip _____

END OF SECTION 00 62 76.13



AIA[®] Document G707A™ – 1994

Consent of Surety to Reduction in or Partial Release of Retainage

PROJECT: <i>(Name and address)</i> Samples	ARCHITECT'S PROJECT NUMBER:	OWNER: <input type="checkbox"/>
	CONTRACT FOR:	ARCHITECT: <input type="checkbox"/>
TO OWNER: <i>(Name and address)</i> University of Maine System by and through University of Maine 5765 Service Building Orono, ME 04469	CONTRACT DATED:	CONTRACTOR: <input type="checkbox"/>
		SURETY: <input type="checkbox"/>
		OTHER: <input type="checkbox"/>

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

on bond of
(Insert name and address of Contractor)

, SURETY,

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

, CONTRACTOR,

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

, OWNER,

as set forth in said Surety's bond.

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

(Surety)

(Signature of authorized representative)

(Printed name and title)

Attest:
(Seal):

00 62 79
SAMPLE
STORED MATERIALS

University of Maine System
by and through
University of Maine
5765 Service Building
Orono ME 04469

Project Title: _____

Location: University of Maine

Contractor: _____

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

SCHEDULE

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

Surety _____
Power of Attorney Must be Attached

By: _____
Attorney-in-Fact

Date: _____

BILL OF SALE

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

1. Contractor has good title to the Materials, free and clear of all liens and encumbrances, and title is granted to the Owner;
2. The Materials will be used only in the construction of the above referenced project, under the provisions of the Contract, and will not be diverted elsewhere without the prior written consent of the Owner;
3. The Materials have been delivered to and are at the places approved for storage, and they are clearly marked and identified as the property of the Owner and are stored in a safe and secure manner to protect from damage or loss;

 **AIA**® Document G716™ – 2004

Request for Information (“RFI”)

TO:

FROM:

PROJECT:
Samples

ISSUE DATE:

RFI No.

PROJECT NUMBERS: /

REQUESTED REPLY DATE:
COPIES TO:

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

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

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

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

BY

DATE

COPIES TO

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



AIA[®] Document G710[™] – 2017

Architect's Supplemental Instructions

PROJECT: *(name and address)*

Samples

CONTRACT INFORMATION:

Contract For:

Date:

ASI INFORMATION:

ASI Number:

Date:

OWNER: *(name and address)*

University of Maine System

by and through

University of Maine

5765 Service Building

Orono, ME 04469

ARCHITECT: *(name and address)***CONTRACTOR:** *(name and address)*

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

(Insert a detailed description of the Architect's supplemental instructions and, if applicable, attach or reference specific exhibits.)

ISSUED BY THE ARCHITECT:

ARCHITECT *(Firm name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

 **AIA**® Document G714™ – 2017

Construction Change Directive

PROJECT: *(name and address)*
Samples

CONTRACT INFORMATION:
Contract For:
Date:

CCD INFORMATION:
Directive Number:
Date:

OWNER: *(name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Contractor is hereby directed to make the following change(s) in this Contract:
(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits.)

PROPOSED ADJUSTMENTS

- The proposed basis of adjustment to the Contract Sum or Guaranteed Maximum Price is:
 - Lump Sum decrease of \$0.00
 - Unit Price of \$ per
 - Cost, as defined below, plus the following fee:
(Insert a definition of, or method for determining, cost)
 - As follows:

- The Contract Time is proposed to . The proposed adjustment, if any, is .

NOTE: The Owner, Architect and Contractor should execute a Change Order to supersede this Construction Change Directive to the extent they agree upon adjustments to the Contract Sum, Contract Time, or Guaranteed Maximum price for the change(s) described herein.

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

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

ARCHITECT *(Firm name)*

OWNER *(Firm name)*

CONTRACTOR *(Firm name)*

SIGNATURE

SIGNATURE

SIGNATURE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

DATE

DATE

DATE



AIA[®] Document G709[™] – 2018

Proposal Request

PROJECT: *(name and address)*

Samples

CONTRACT INFORMATION:

Contract For:

Date:

Architect's Project Number:

Proposal Request Number:

Proposal Request Date:

OWNER: *(name and address)*

University of Maine System

by and through

University of Maine

5765 Service Building

Orono, ME 04469

ARCHITECT: *(name and address)***CONTRACTOR:** *(name and address)*

The Owner requests an itemized proposal for changes to the Contract Sum and Contract Time for proposed modifications to the Contract Documents described herein. The Contractor shall submit this proposal within Zero (0) days or notify the Architect in writing of the anticipated date of submission.

(Insert a detailed description of the proposed modifications to the Contract Documents and, if applicable, attach or reference specific exhibits.)

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

REQUESTED BY THE ARCHITECT:

PRINTED NAME AND TITLE



AIA® Document G701™ – 2017

Change Order

PROJECT: *(Name and address)*
Samples

CONTRACT INFORMATION:
Contract For:
Date:

CHANGE ORDER INFORMATION:
Change Order Number:
Date:

OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(Name and address)*

CONTRACTOR: *(Name and address)*

THE CONTRACT IS CHANGED AS FOLLOWS:

(Insert a detailed description of the change and, if applicable, attach or reference specific exhibits. Also include agreed upon adjustments attributable to executed Construction Change Directives.)

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

The Contract Time will be increased by Zero (0) days.
The new date of Substantial Completion will be

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

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

ARCHITECT *(Firm name)*

CONTRACTOR *(Firm name)*

OWNER *(Firm name)*

SIGNATURE

SIGNATURE

SIGNATURE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

PRINTED NAME AND TITLE

DATE

DATE

DATE



AIA® Document G704™ – 2017

Certificate of Substantial Completion

PROJECT: *(name and address)*
Samples

CONTRACT INFORMATION:
Contract For:
Date:

CERTIFICATE INFORMATION:
Certificate Number:
Date:

OWNER: *(name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

ARCHITECT: *(name and address)*

CONTRACTOR: *(name and address)*

The Work identified below has been reviewed and found, to the Architect’s best knowledge, information, and belief, to be substantially complete. Substantial Completion is the stage in the progress of the Work when the Work or designated portion is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The date of Substantial Completion of the Project or portion designated below is the date established by this Certificate.

(Identify the Work, or portion thereof, that is substantially complete.)

ARCHITECT *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE OF SUBSTANTIAL COMPLETION

WARRANTIES

The date of Substantial Completion of the Project or portion designated above is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

(Identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement.)

WORK TO BE COMPLETED OR CORRECTED

A list of items to be completed or corrected is attached hereto, or transmitted as agreed upon by the parties, and identified as follows:
(Identify the list of Work to be completed or corrected.)

The failure to include any items on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Unless otherwise agreed to in writing, the date of commencement of warranties for items on the attached list will be the date of issuance of the final Certificate of Payment or the date of final payment, whichever occurs first. The Contractor will complete or correct the Work on the list of items attached hereto within () days from the above date of Substantial Completion.

Cost estimate of Work to be completed or corrected: \$

The responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work, insurance, and other items identified below shall be as follows:

(Note: Owner’s and Contractor’s legal and insurance counsel should review insurance requirements and coverage.)

The Owner and Contractor hereby accept the responsibilities assigned to them in this Certificate of Substantial Completion:

CONTRACTOR *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

OWNER *(Firm Name)*

SIGNATURE

PRINTED NAME AND TITLE

DATE

SECTION 00 65 19
CERTIFICATE OF COMPLETION FORM
(Final)

DATE:

PROJECT NAME: UM BARROWS HALL CHILLER REPLACEMENT

SUBSTANTIAL COMPLETION DATE:

FINAL COMPLETION is defined, in accordance with Article 9 of the A201 General Conditions of the Contract for Construction, as the date certified by the Architect when all the Work of the Project is fully complete, the Close-Out requirements of Paragraph 9.10 of the General Conditions have been completed, including the Close-Out Meeting and approval of Close-Out by the Architect, in accordance with Subparagraph 9.10.2, and the Contract fully performed in accordance with the Contract Documents, and the Contractor entitled to final payment.

The CONTRACTOR certifies that the Work is fully completed and was completed on or before _____, 202_, and submits herewith:

Application for Final Payment (AIA G702)
Affidavit of Payments (AIA G706)
Consent of Surety (AIA G707)
Releases of Liens (AIA G706A)
Waiver of Lien

CONTRACTOR:

By: _____ Date: _____
Name:

The ARCHITECT has inspected the Work and has determined that the Date of Final Completion was _____, 202_.

ARCHITECT:

By: _____ Date: _____
Name:

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

OWNER:

By: _____ Date: _____
Ryan Ward
University of Maine System

END OF SECTION 00 65 19



AIA[®] Document G706™ – 1994

Contractor's Affidavit of Payment of Debts and Claims

PROJECT: *(Name and address)*
Samples

ARCHITECT'S PROJECT NUMBER:

OWNER:

ARCHITECT:

CONTRACTOR:

SURETY:

OTHER:

TO OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

CONTRACT FOR:
CONTRACT DATED:

STATE OF: *(State of Signature)*

COUNTY OF: *(County of Signature)*

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

CONTRACTOR: *(Name and address)*

BY: _____

(Signature of authorized representative)

(Printed name and title)

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).

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:



AIA[®] Document G706A[™] – 1994

Contractor's Affidavit of Release of Liens

PROJECT: *(Name and address)*

Samples

ARCHITECT'S PROJECT NUMBER:

OWNER:

TO OWNER: *(Name and address)*

University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

CONTRACT FOR:

CONTRACT DATED:

ARCHITECT:

CONTRACTOR:

SURETY:

OTHER:

STATE OF: *(State of Signature)*

COUNTY OF: *(County of Signature)*

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

EXCEPTIONS:

SUPPORTING DOCUMENTS ATTACHED HERETO:

1. Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
2. Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.

CONTRACTOR: *(Name and address)*

BY:

(Signature of authorized representative)

(Printed name and title)

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

SAMPLE

SECTION 00 65 19.17
WAIVER OF LIEN

DATE: _____

State of: _____

State of Signature

County of: _____

County of Signature

TO: University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

SUBJECT:

Project Name: UM BARROWS HALL CHILLER REPLACEMENT

Project Location: UNIVERSITY OF MAINE

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

Signed: _____

Title: _____

Firm Name: _____

NOTARY

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

Signature Notary Public

END OF SECTION 00 65 19.17

SUBCONTRACTOR/SUPPLIER CONDITIONAL
RELEASE AND WAIVER OF LIEN

DATE: _____

State of: _____
State of Signature

County of: _____
County of Signature

SUBJECT:

Project Name: _____

Project Location: _____

_____ (hereinafter called the Subcontractor) in consideration of the sum of \$ _____ to be paid to Subcontractor by _____ upon receipt of said payment does hereby release and forever discharge _____ and the **University of Maine System** from any and all workman's, materialman's, mechanic's, building or other liens, claims, causes of action, liabilities and other obligations with respect to the value of any and all work, services and materials furnished, performed, or supplied by the subcontractor to or in connection with the construction project known as the Insert Project Name Here located in Insert Location Here (hereinafter called the "Premises") through the date of _____. Subcontractor shall take all reasonable action to discharge any lien currently filed or pending against _____ and the **University of Maine System**, including without limitation the recording of instruments discharging said lien with the appropriate Registry of Deeds.

Subcontractor acknowledges that its receipt of said payment will constitute full and final payment for all work performed by Subcontractor through the date set forth above except for retainage if applicable, in the amount of (\$) _____.

Subcontractor further covenants and represents that all of the subcontract suppliers, mechanics, materialmen, and laborers listed below engaged by Subcontractor have been paid in full (less proper retainage if any) or shall be immediately paid in full from the proceeds of this current payment for all work done and or materials furnished to the Premises through the date set forth in the first paragraph above. The Subcontractor hereby agrees to indemnify, defend, and hold _____ and The **University of Maine System** harmless from any and all claims, including but not limited to attorney fees, claims for payment, and liens of any kind or nature filed or made by any person or entity based upon work done or materials furnished in connection with the Premises by the Subcontractor or any sub-subcontractor, suppliers, mechanics, materialmen, and laborers employed by Subcontractor through the date set forth in the first paragraph above. Subcontractor shall request any sub-subcontractor, suppliers, mechanics, materialmen, and laborers employed by Subcontractor through the date set forth in the first paragraph above to, and shall itself, take all reasonable action to discharge any lien in connection with payments owed by Subcontractor currently filed or pending against _____ and the **University of Maine System**, including without limitation the recording of instruments discharging said lien with the appropriate Registry of Deeds.

Major sub-subcontractors and suppliers whose contract or purchase order meets or exceeds \$5,000 working for said Subcontractor for the period stated above:

SECTION 00 65 19.18

The undersigned represents that he is authorized by all corporate or other action necessary to execute and deliver this release.

Signed: _____

Title: _____

Firm Name: _____

NOTARY

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

Signature Notary Public

END OF SECTION 00 65 19.18



AIA® Document G707™ – 1994

Consent Of Surety to Final Payment

PROJECT: *(Name and address)*
Samples

ARCHITECT'S PROJECT NUMBER:

OWNER:

CONTRACT FOR:

ARCHITECT:

TO OWNER: *(Name and address)*
University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

CONTRACT DATED:

CONTRACTOR:

SURETY:

OTHER:

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

on bond of
(Insert name and address of Contractor)

, SURETY,

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

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

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

(Surety)

(Signature of authorized representative)

Attest:
(Seal):

(Printed name and title)



AIA® Document A201® – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

University of Maine System
by and through

THE ARCHITECT:
(Name, legal status and address)

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

For guidance in modifying this document to include supplementary conditions, see AIA Document A503™, Guide for Supplementary Conditions.

TABLE OF ARTICLES

- 1 GENERAL PROVISIONS
- 2 OWNER
- 3 CONTRACTOR
- 4 ARCHITECT
- 5 SUBCONTRACTORS
- 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS
- 7 CHANGES IN THE WORK
- 8 TIME
- 9 PAYMENTS AND COMPLETION
- 10 PROTECTION OF PERSONS AND PROPERTY
- 11 INSURANCE AND BONDS
- 12 UNCOVERING AND CORRECTION OF WORK
- 13 MISCELLANEOUS PROVISIONS

Init.

14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES



Init.

/

INDEX

(Topics and numbers in bold are Section headings.)

Acceptance of Nonconforming Work

9.6.6, 9.9.3, **12.3**

Acceptance of Work

9.6.6, 9.8.2, 9.9.3, 9.10.1, 9.10.3, 12.3

Access to Work

3.16, 6.2.1, 12.1

Accident Prevention

10

Acts and Omissions

3.2, 3.3.2, 3.12.8, 3.18, 4.2.3, 8.3.1, 9.5.1, 10.2.5,

10.2.8, 13.3.2, 14.1, 15.1.2, 15.2

Addenda

1.1.1

Additional Costs, Claims for

3.7.4, 3.7.5, 10.3.2, 15.1.5

Additional Inspections and Testing

9.4.2, 9.8.3, 12.2.1, **13.4**

Additional Time, Claims for

3.2.4, 3.7.4, 3.7.5, 3.10.2, 8.3.2, **15.1.6**

Administration of the Contract

3.1.3, **4.2**, 9.4, 9.5

Advertisement or Invitation to Bid

1.1.1

Aesthetic Effect

4.2.13

Allowances

3.8

Applications for Payment

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5.1, 9.5.4, 9.6.3, 9.7, 9.10

Approvals

2.1.1, 2.3.1, 2.5, 3.1.3, 3.10.2, 3.12.8, 3.12.9,

3.12.10.1, 4.2.7, 9.3.2, 13.4.1

Arbitration

8.3.1, 15.3.2, **15.4**

ARCHITECT

4

Architect, Definition of

4.1.1

Architect, Extent of Authority

2.5, 3.12.7, 4.1.2, 4.2, 5.2, 6.3, 7.1.2, 7.3.4, 7.4, 9.2,
9.3.1, 9.4, 9.5, 9.6.3, 9.8, 9.10.1, 9.10.3, 12.1, 12.2.1,
13.4.1, 13.4.2, 14.2.2, 14.2.4, 15.1.4, 15.2.1

Architect, Limitations of Authority and Responsibility

2.1.1, 3.12.4, 3.12.8, 3.12.10, 4.1.2, 4.2.1, 4.2.2, 4.2.3,
4.2.6, 4.2.7, 4.2.10, 4.2.12, 4.2.13, 5.2.1, 7.4, 9.4.2,
9.5.4, 9.6.4, 15.1.4, 15.2

Architect's Additional Services and Expenses

2.5, 12.2.1, 13.4.2, 13.4.3, 14.2.4

Architect's Administration of the Contract

3.1.3, 3.7.4, 15.2, 9.4.1, 9.5

Architect's Approvals

2.5, 3.1.3, 3.5, 3.10.2, 4.2.7

Architect's Authority to Reject Work

3.5, 4.2.6, 12.1.2, 12.2.1

Architect's Copyright

1.1.7, 1.5

Architect's Decisions

3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 4.2.14, 6.3,
7.3.4, 7.3.9, 8.1.3, 8.3.1, 9.2, 9.4.1, 9.5, 9.8.4, 9.9.1,
13.4.2, 15.2

Architect's Inspections

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.8.3, 9.9.2, 9.10.1, 13.4

Architect's Instructions

3.2.4, 3.3.1, 4.2.6, 4.2.7, 13.4.2

Architect's Interpretations

4.2.11, 4.2.12

Architect's Project Representative

4.2.10

Architect's Relationship with Contractor

1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5, 3.7.4, 3.7.5, 3.9.2, 3.9.3, 3.10, 3.11, 3.12, 3.16,
3.18, 4.1.2, 4.2, 5.2, 6.2.2, 7, 8.3.1, 9.2, 9.3, 9.4, 9.5,
9.7, 9.8, 9.9, 10.2.6, 10.3, 11.3, 12, 13.3.2, 13.4, 15.2

Architect's Relationship with Subcontractors

1.1.2, 4.2.3, 4.2.4, 4.2.6, 9.6.3, 9.6.4, 11.3

Architect's Representations

9.4.2, 9.5.1, 9.10.1

Architect's Site Visits

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Asbestos

10.3.1

Attorneys' Fees

3.18.1, 9.6.8, 9.10.2, 10.3.3

Award of Separate Contracts

6.1.1, 6.1.2

Award of Subcontracts and Other Contracts for Portions of the Work

5.2

Basic Definitions

1.1

Bidding Requirements

1.1.1

Binding Dispute Resolution

8.3.1, 9.7, 11.5, 13.1, 15.1.2, 15.1.3, 15.2.1, 15.2.5,
15.2.6.1, 15.3.1, 15.3.2, 15.3.3, 15.4.1

Bonds, Lien

7.3.4.4, 9.6.8, 9.10.2, 9.10.3

Bonds, Performance, and Payment

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**, 11.1.3, **11.5**

Building Information Models Use and Reliance

1.8

Building Permit

3.7.1

Capitalization

1.3

Certificate of Substantial Completion

9.8.3, 9.8.4, 9.8.5

Init.

/

Certificates for Payment

4.2.1, 4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4, 15.1.4

Certificates of Inspection, Testing or Approval
13.4.4

Certificates of Insurance
9.10.2

Change Orders

1.1.1, 3.4.2, 3.7.4, 3.8.2.3, 3.11, 3.12.8, 4.2.8, 5.2.3, 7.1.2, 7.1.3, **7.2**, 7.3.2, 7.3.7, 7.3.9, 7.3.10, 8.3.1, 9.3.1.1, 9.10.3, 10.3.2, 11.2, 11.5, 12.1.2

Change Orders, Definition of

7.2.1

CHANGES IN THE WORK

2.2.2, 3.11, 4.2.8, **7**, 7.2.1, 7.3.1, 7.4, 8.3.1, 9.3.1.1, 11.5

Claims, Definition of

15.1.1

Claims, Notice of
1.6.2, 15.1.3

CLAIMS AND DISPUTES

3.2.4, 6.1.1, 6.3, 7.3.9, 9.3.3, 9.10.4, 10.3.3, **15**, 15.4
Claims and Timely Assertion of Claims
15.4.1

Claims for Additional Cost

3.2.4, 3.3.1, 3.7.4, 7.3.9, 9.5.2, 10.2.5, 10.3.2, **15.1.5**

Claims for Additional Time

3.2.4, 3.3.1, 3.7.4, 6.1.1, 8.3.2, 9.5.2, 10.3.2, **15.1.6**

Concealed or Unknown Conditions, Claims for
3.7.4

Claims for Damages
3.2.4, 3.18, 8.3.3, 9.5.1, 9.6.7, 10.2.5, 10.3.3, 11.3, 11.3.2, 14.2.4, 15.1.7

Claims Subject to Arbitration
15.4.1

Cleaning Up

3.15, 6.3

Commencement of the Work, Conditions Relating to
2.2.1, 3.2.2, 3.4.1, 3.7.1, 3.10.1, 3.12.6, 5.2.1, 5.2.3, 6.2.2, 8.1.2, 8.2.2, 8.3.1, 11.1, 11.2, **15.1.5**

Commencement of the Work, Definition of
8.1.2

Communications

3.9.1, **4.2.4**

Completion, Conditions Relating to
3.4.1, 3.11, 3.15, 4.2.2, 4.2.9, 8.2, 9.4.2, 9.8, 9.9.1, 9.10, 12.2, 14.1.2, 15.1.2

COMPLETION, PAYMENTS AND
9

Completion, Substantial
3.10.1, 4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, 9.8, 9.9.1, 9.10.3, 12.2, 15.1.2
Compliance with Laws
2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14.1.1, 14.2.1.3, 15.2.8, 15.4.2, 15.4.3

Concealed or Unknown Conditions

3.7.4, 4.2.8, 8.3.1, 10.3

Conditions of the Contract

1.1.1, 6.1.1, 6.1.4

Consent, Written

3.4.2, 3.14.2, 4.1.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3, 13.2, 15.4.4.2

Consolidation or Joinder

15.4.4

CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

1.1.4, **6**

Construction Change Directive, Definition of
7.3.1

Construction Change Directives

1.1.1, 3.4.2, 3.11, 3.12.8, 4.2.8, 7.1.1, 7.1.2, 7.1.3, **7.3**, 9.3.1.1

Construction Schedules, Contractor's

3.10, 3.11, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Contingent Assignment of Subcontracts

5.4, 14.2.2.2

Continuing Contract Performance

15.1.4

Contract, Definition of

1.1.2

CONTRACT, TERMINATION OR SUSPENSION OF THE

5.4.1.1, 5.4.2, 11.5, **14**

Contract Administration

3.1.3, 4, 9.4, 9.5

Contract Award and Execution, Conditions Relating to
3.7.1, 3.10, 5.2, 6.1

Contract Documents, Copies Furnished and Use of
1.5.2, 2.3.6, 5.3

Contract Documents, Definition of

1.1.1

Contract Sum

2.2.2, 2.2.4, 3.7.4, 3.7.5, 3.8, 3.10.2, 5.2.3, 7.3, 7.4, **9.1**, 9.2, 9.4.2, 9.5.1.4, 9.6.7, 9.7, 10.3.2, 11.5, 12.1.2, 12.3, 14.2.4, 14.3.2, 15.1.4.2, **15.1.5**, **15.2.5**

Contract Sum, Definition of

9.1

Contract Time

1.1.4, 2.2.1, 2.2.2, 3.7.4, 3.7.5, 3.10.2, 5.2.3, 6.1.5, 7.2.1.3, 7.3.1, 7.3.5, 7.3.6, 7, 7, 7.3.10, 7.4, 8.1.1, 8.2.1, 8.2.3, 8.3.1, 9.5.1, 9.7, 10.3.2, 12.1.1, 12.1.2, 14.3.2, 15.1.4.2, 15.1.6.1, 15.2.5

Contract Time, Definition of

8.1.1

CONTRACTOR

3

Contractor, Definition of

3.1, **6.1.2**

Contractor's Construction and Submittal Schedules

3.10, 3.12.1, 3.12.2, 4.2.3, 6.1.3, 15.1.6.2

Init.

/

Contractor's Employees
2.2.4, 3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3, 11.3, 14.1, 14.2.1.1

Contractor's Liability Insurance

11.1

Contractor's Relationship with Separate Contractors
and Owner's Forces
3.12.5, 3.14.2, 4.2.4, 6, 11.3, 12.2.4

Contractor's Relationship with Subcontractors
1.2.2, 2.2.4, 3.3.2, 3.18.1, 3.18.2, 4.2.4, 5, 9.6.2, 9.6.7,
9.10.2, 11.2, 11.3, 11.4

Contractor's Relationship with the Architect
1.1.2, 1.5, 2.3.3, 3.1.3, 3.2.2, 3.2.3, 3.2.4, 3.3.1, 3.4.2,
3.5.1, 3.7.4, 3.10, 3.11, 3.12, 3.16, 3.18, 4.2, 5.2, 6.2.2,
7, 8.3.1, 9.2, 9.3, 9.4, 9.5, 9.7, 9.8, 9.9, 10.2.6, 10.3,
11.3, 12, 13.4, 15.1.3, 15.2.1

Contractor's Representations
3.2.1, 3.2.2, 3.5, 3.12.6, 6.2.2, 8.2.1, 9.3.3, 9.8.2

Contractor's Responsibility for Those Performing the
Work
3.3.2, 3.18, 5.3, 6.1.3, 6.2, 9.5.1, 10.2.8

Contractor's Review of Contract Documents
3.2

Contractor's Right to Stop the Work
2.2.2, 9.7

Contractor's Right to Terminate the Contract
14.1

Contractor's Submittals
3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 9.2, 9.3, 9.8.2,
9.8.3, 9.9.1, 9.10.2, 9.10.3

Contractor's Superintendent
3.9, 10.2.6

Contractor's Supervision and Construction
Procedures
1.2.2, 3.3, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 7.3.6, 8.2, 10, 12, 14, 15.1.4

Coordination and Correlation
1.2, 3.2.1, 3.3.1, 3.10, 3.12.6, 6.1.3, 6.2.1

Copies Furnished of Drawings and Specifications
1.5, 2.3.6, 3.11

Copyrights
1.5, **3.17**

Correction of Work
2.5, 3.7.3, 9.4.2, 9.8.2, 9.8.3, 9.9.1, 12.1.2, **12.2**, 12.3,
15.1.3.1, 15.1.3.2, 15.2.1

Correlation and Intent of the Contract Documents
1.2

Cost, Definition of
7.3.4

Costs
2.5, 3.2.4, 3.7.3, 3.8.2, 3.15.2, 5.4.2, 6.1.1, 6.2.3,
7.3.3.3, 7.3.4, 7.3.8, 7.3.9, 9.10.2, 10.3.2, 10.3.6, 11.2,
12.1.2, 12.2.1, 12.2.4, 13.4, 14

Cutting and Patching
3.14, 6.2.5

Damage to Construction of Owner or Separate
Contractors
3.14.2, 6.2.4, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damage to the Work
3.14.2, 9.9.1, 10.2.1.2, 10.2.5, 10.4, 12.2.4

Damages, Claims for
3.2.4, 3.18, 6.1.1, 8.3.3, 9.5.1, 9.6.7, 10.3.3, 11.3.2,
11.3, 14.2.4, 15.1.7

Damages for Delay
6.2.3, 8.3.3, 9.5.1.6, 9.7, 10.3.2, 14.3.2

Date of Commencement of the Work, Definition of
8.1.2

Date of Substantial Completion, Definition of
8.1.3

Day, Definition of
8.1.4

Decisions of the Architect
3.7.4, 4.2.6, 4.2.7, 4.2.11, 4.2.12, 4.2.13, 6.3, 7.3.4,
7.3.9, 8.1.3, 8.3.1, 9.2, 9.4, 9.5.1, 9.8.4, 9.9.1, 13.4.2,
14.2.2, 14.2.4, 15.1, 15.2

Decisions to Withhold Certification
9.4.1, **9.5**, 9.7, 14.1.1.3

Defective or Nonconforming Work, Acceptance,
Rejection and Correction of
2.5, 3.5, 4.2.6, 6.2.3, 9.5.1, 9.5.3, 9.6.6, 9.8.2, 9.9.3,
9.10.4, 12.2.1

Definitions
1.1, 2.1.1, 3.1.1, 3.5, 3.12.1, 3.12.2, 3.12.3, 4.1.1, 5.1,
6.1.2, 7.2.1, 7.3.1, 8.1, 9.1, 9.8.1, 15.1.1

Delays and Extensions of Time
3.2, **3.7.4**, 5.2.3, 7.2.1, 7.3.1, **7.4**, **8.3**, 9.5.1, **9.7**,
10.3.2, **10.4**, 14.3.2, **15.1.6**, 15.2.5

Digital Data Use and Transmission
1.7

Disputes
6.3, 7.3.9, 15.1, 15.2

Documents and Samples at the Site
3.11

Drawings, Definition of
1.1.5

Drawings and Specifications, Use and Ownership of
3.11

Effective Date of Insurance
8.2.2

Emergencies
10.4, 14.1.1.2, **15.1.5**

Employees, Contractor's
3.3.2, 3.4.3, 3.8.1, 3.9, 3.18.2, 4.2.3, 4.2.6, 10.2,
10.3.3, 11.3, 14.1, 14.2.1.1

Equipment, Labor, or Materials
1.1.3, 1.1.6, 3.4, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,
4.2.6, 4.2.7, 5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3,
9.10.2, 10.2.1, 10.2.4, 14.2.1.1, 14.2.1.2

Execution and Progress of the Work
1.1.3, 1.2.1, 1.2.2, 2.3.4, 2.3.6, 3.1, 3.3.1, 3.4.1, 3.7.1,
3.10.1, 3.12, 3.14, 4.2, 6.2.2, 7.1.3, 7.3.6, 8.2, 9.5.1,
9.9.1, 10.2, 10.3, 12.1, 12.2, 14.2, 14.3.1, 15.1.4

Extensions of Time
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3, 7.4, 9.5.1, 9.7, 10.3.2,
10.4, 14.3, 15.1.6, **15.2.5**

Failure of Payment

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2
Faulty Work

(See Defective or Nonconforming Work)

Final Completion and Final Payment

4.2.1, 4.2.9, 9.8.2, **9.10**, 12.3, 14.2.4, 14.4.3

Financial Arrangements, Owner's

2.2.1, 13.2.2, 14.1.1.4

GENERAL PROVISIONS

1

Governing Law

13.1

Guarantees (See Warranty)

Hazardous Materials and Substances

10.2.4, **10.3**

Identification of Subcontractors and Suppliers

5.2.1

Indemnification

3.17, **3.18**, 9.6.8, 9.10.2, 10.3.3, 11.3

Information and Services Required of the Owner

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10.1, 6.1.3, 6.1.4, 6.2.5,

9.6.1, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2,

14.1.1.4, 14.1.4, 15.1.4

Initial Decision

15.2

Initial Decision Maker, Definition of

1.1.8

Initial Decision Maker, Decisions

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Initial Decision Maker, Extent of Authority

14.2.4, 15.1.4.2, 15.2.1, 15.2.2, 15.2.3, 15.2.4, 15.2.5

Injury or Damage to Person or Property

10.2.8, 10.4

Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,

9.9.2, 9.10.1, 12.2.1, 13.4

Instructions to Bidders

1.1.1

Instructions to the Contractor

3.2.4, 3.3.1, 3.8.1, 5.2.1, 7, 8.2.2, 12, 13.4.2

Instruments of Service, Definition of

1.1.7

Insurance

6.1.1, 7.3.4, 8.2.2, 9.3.2, 9.8.4, 9.9.1, 9.10.2, 10.2.5, **11**

Insurance, Notice of Cancellation or Expiration

11.1.4, 11.2.3

Insurance, Contractor's Liability

11.1

Insurance, Effective Date of

8.2.2, 14.4.2

Insurance, Owner's Liability

11.2

Insurance, Property

10.2.5, 11.2, 11.4, 11.5

Insurance, Stored Materials

9.3.2

INSURANCE AND BONDS

11

Insurance Companies, Consent to Partial Occupancy

9.9.1

Insured loss, Adjustment and Settlement of

11.5

Intent of the Contract Documents

1.2.1, 4.2.7, 4.2.12, 4.2.13

Interest

13.5

Interpretation

1.1.8, 1.2.3, **1.4**, 4.1.1, 5.1, 6.1.2, 15.1.1

Interpretations, Written

4.2.11, 4.2.12

Judgment on Final Award

15.4.2

Labor and Materials, Equipment

1.1.3, 1.1.6, **3.4**, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2, 10.2.1,

10.2.4, 14.2.1.1, 14.2.1.2

Labor Disputes

8.3.1

Laws and Regulations

1.5, 2.3.2, 3.2.3, 3.2.4, 3.6, 3.7, 3.12.10, 3.13, 9.6.4,

9.9.1, 10.2.2, 13.1, 13.3.1, 13.4.2, 13.5, 14, 15.2.8,

15.4

Liens

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Limitations, Statutes of

12.2.5, 15.1.2, 15.4.1.1

Limitations of Liability

3.2.2, 3.5, 3.12.10, 3.12.10.1, 3.17, 3.18.1, 4.2.6,

4.2.7, 6.2.2, 9.4.2, 9.6.4, 9.6.7, 9.6.8, 10.2.5, 10.3.3,

11.3, 12.2.5, 13.3.1

Limitations of Time

2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2.7,

5.2, 5.3, 5.4.1, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3,

9.4.1, 9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15,

15.1.2, 15.1.3, 15.1.5

Materials, Hazardous

10.2.4, 10.3

Materials, Labor, Equipment and

1.1.3, 1.1.6, 3.4.1, 3.5, 3.8.2, 3.8.3, 3.12, 3.13, 3.15.1,

5.2.1, 6.2.1, 7.3.4, 9.3.2, 9.3.3, 9.5.1.3, 9.10.2,

10.2.1.2, 10.2.4, 14.2.1.1, 14.2.1.2

Means, Methods, Techniques, Sequences and

Procedures of Construction

3.3.1, 3.12.10, 4.2.2, 4.2.7, 9.4.2

Mechanic's Lien

2.1.2, 9.3.1, 9.3.3, 9.6.8, 9.10.2, 9.10.4, 15.2.8

Mediation

8.3.1, 15.1.3.2, 15.2.1, 15.2.5, 15.2.6, **15.3**, 15.4.1,

15.4.1.1

Minor Changes in the Work

1.1.1, 3.4.2, 3.12.8, 4.2.8, 7.1, **7.4**

Init.

/

MISCELLANEOUS PROVISIONS

13

Modifications, Definition of

1.1.1

Modifications to the Contract

1.1.1, 1.1.2, 2.5, 3.11, 4.1.2, 4.2.1, 5.2.3, 7, 8.3.1, 9.7, 10.3.2

Mutual Responsibility

6.2

Nonconforming Work, Acceptance of

9.6.6, 9.9.3, **12.3**

Nonconforming Work, Rejection and Correction of
2.4, 2.5, 3.5, 4.2.6, 6.2.4, 9.5.1, 9.8.2, 9.9.3, 9.10.4, 12.2

Notice

1.6, 1.6.1, 1.6.2, 2.1.2, 2.2.2., 2.2.3, 2.2.4, 2.5, 3.2.4, 3.3.1, 3.7.4, 3.7.5, 3.9.2, 3.12.9, 3.12.10, 5.2.1, 7.4, 8.2.2, 9.6.8, 9.7, 9.10.1, 10.2.8, 10.3.2, 11.5, 12.2.2.1, 13.4.1, 13.4.2, 14.1, 14.2.2, 14.4.2, 15.1.3, 15.1.5, 15.1.6, 15.4.1

Notice of Cancellation or Expiration of Insurance

11.1.4, 11.2.3

Notice of Claims

1.6.2, 2.1.2, 3.7.4, 9.6.8, 10.2.8, **15.1.3**, 15.1.5, 15.1.6, 15.2.8, 15.3.2, 15.4.1

Notice of Testing and Inspections

13.4.1, 13.4.2

Observations, Contractor's

3.2, 3.7.4

Occupancy

2.3.1, 9.6.6, 9.8

Orders, Written

1.1.1, 2.4, 3.9.2, 7, 8.2.2, 11.5, 12.1, 12.2.2.1, 13.4.2, 14.3.1

OWNER

2

Owner, Definition of

2.1.1

Owner, Evidence of Financial Arrangements

2.2, 13.2.2, 14.1.1.4

Owner, Information and Services Required of the

2.1.2, **2.2**, 2.3, 3.2.2, 3.12.10, 6.1.3, 6.1.4, 6.2.5, 9.3.2, 9.6.1, 9.6.4, 9.9.2, 9.10.3, 10.3.3, 11.2, 13.4.1, 13.4.2, 14.1.1.4, 14.1.4, 15.1.4

Owner's Authority

1.5, 2.1.1, 2.3.32.4, 2.5, 3.4.2, 3.8.1, 3.12.10, 3.14.2, 4.1.2, 4.2.4, 4.2.9, 5.2.1, 5.2.4, 5.4.1, 6.1, 6.3, 7.2.1, 7.3.1, 8.2.2, 8.3.1, 9.3.2, 9.5.1, 9.6.4, 9.9.1, 9.10.2, 10.3.2, 11.4, 11.5, 12.2.2, 12.3, 13.2.2, 14.3, 14.4, 15.2.7

Owner's Insurance

11.2

Owner's Relationship with Subcontractors

1.1.2, 5.2, 5.3, 5.4, 9.6.4, 9.10.2, 14.2.2

Owner's Right to Carry Out the Work

2.5, 14.2.2

Owner's Right to Clean Up

6.3

Owner's Right to Perform Construction and to Award Separate Contracts

6.1

Owner's Right to Stop the Work

2.4

Owner's Right to Suspend the Work

14.3

Owner's Right to Terminate the Contract

14.2, 14.4

Ownership and Use of Drawings, Specifications and Other Instruments of Service

1.1.1, 1.1.6, 1.1.7, **1.5**, 2.3.6, 3.2.2, 3.11, 3.17, 4.2.12, 5.3

Partial Occupancy or Use

9.6.6, **9.9**

Patching, Cutting and

3.14, 6.2.5

Patents

3.17

Payment, Applications for

4.2.5, 7.3.9, 9.2, **9.3**, 9.4, 9.5, 9.6.3, 9.7, 9.8.5, 9.10.1, 14.2.3, 14.2.4, 14.4.3

Payment, Certificates for

4.2.5, 4.2.9, 9.3.3, **9.4**, 9.5, 9.6.1, 9.6.6, 9.7, 9.10.1, 9.10.3, 14.1.1.3, 14.2.4

Payment, Failure of

9.5.1.3, **9.7**, 9.10.2, 13.5, 14.1.1.3, 14.2.1.2

Payment, Final

4.2.1, 4.2.9, **9.10**, 12.3, 14.2.4, 14.4.3

Payment Bond, Performance Bond and

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Payments, Progress

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

PAYMENTS AND COMPLETION

9

Payments to Subcontractors

5.4.2, 9.5.1.3, 9.6.2, 9.6.3, 9.6.4, 9.6.7, 14.2.1.2

PCB

10.3.1

Performance Bond and Payment Bond

7.3.4.4, 9.6.7, 9.10.3, **11.1.2**

Permits, Fees, Notices and Compliance with Laws

2.3.1, **3.7**, 3.13, 7.3.4.4, 10.2.2

PERSONS AND PROPERTY, PROTECTION OF

10

Polychlorinated Biphenyl

10.3.1

Product Data, Definition of

3.12.2

Product Data and Samples, Shop Drawings

3.11, **3.12**, 4.2.7

Progress and Completion

4.2.2, **8.2**, 9.8, 9.9.1, 14.1.4, 15.1.4

Progress Payments

9.3, **9.6**, 9.8.5, 9.10.3, 14.2.3, 15.1.4

Init.

/

Project, Definition of
1.1.4

Project Representatives
4.2.10

Property Insurance
10.2.5, **11.2**

Proposal Requirements
1.1.1

PROTECTION OF PERSONS AND PROPERTY
10

Regulations and Laws

1.5, 2.3.2, 3.2.3, 3.6, 3.7, 3.12.10, 3.13, 9.6.4, 9.9.1,
10.2.2, 13.1, 13.3, 13.4.1, 13.4.2, 13.5, 14, 15.2.8, 15.4

Rejection of Work
4.2.6, 12.2.1

Releases and Waivers of Liens
9.3.1, 9.10.2

Representations

3.2.1, 3.5, 3.12.6, 8.2.1, 9.3.3, 9.4.2, 9.5.1, 9.10.1

Representatives

2.1.1, 3.1.1, 3.9, 4.1.1, 4.2.10, 13.2.1

Responsibility for Those Performing the Work

3.3.2, 3.18, 4.2.2, 4.2.3, 5.3, 6.1.3, 6.2, 6.3, 9.5.1, 10
Retainage

9.3.1, 9.6.2, 9.8.5, 9.9.1, 9.10.2, 9.10.3

Review of Contract Documents and Field
Conditions by Contractor

3.2, 3.12.7, 6.1.3

Review of Contractor's Submittals by Owner and
Architect

3.10.1, 3.10.2, 3.11, 3.12, 4.2, 5.2, 6.1.3, 9.2, 9.8.2

Review of Shop Drawings, Product Data and Samples
by Contractor

3.12

Rights and Remedies

1.1.2, 2.4, 2.5, 3.5, 3.7.4, 3.15.2, 4.2.6, 5.3, 5.4, 6.1,
6.3, 7.3.1, 8.3, 9.5.1, 9.7, 10.2.5, 10.3, 12.2.1, 12.2.2,
12.2.4, **13.3**, 14, 15.4

Royalties, Patents and Copyrights
3.17

Rules and Notices for Arbitration
15.4.1

Safety of Persons and Property
10.2, 10.4

Safety Precautions and Programs

3.3.1, 4.2.2, 4.2.7, 5.3, **10.1**, 10.2, 10.4

Samples, Definition of
3.12.3

Samples, Shop Drawings, Product Data and
3.11, **3.12**, 4.2.7

Samples at the Site, Documents and
3.11

Schedule of Values

9.2, 9.3.1

Schedules, Construction

3.10, 3.12.1, 3.12.2, 6.1.3, 15.1.6.2

Separate Contracts and Contractors

1.1.4, 3.12.5, 3.14.2, 4.2.4, 4.2.7, 6, 8.3.1, 12.1.2

Separate Contractors, Definition of
6.1.1

Shop Drawings, Definition of
3.12.1

Shop Drawings, Product Data and Samples

3.11, **3.12**, 4.2.7

Site, Use of

3.13, 6.1.1, 6.2.1

Site Inspections

3.2.2, 3.3.3, 3.7.1, 3.7.4, 4.2, 9.9.2, 9.4.2, 9.10.1, 13.4

Site Visits, Architect's

3.7.4, 4.2.2, 4.2.9, 9.4.2, 9.5.1, 9.9.2, 9.10.1, 13.4

Special Inspections and Testing

4.2.6, 12.2.1, 13.4

Specifications, Definition of
1.1.6

Specifications

1.1.1, **1.1.6**, 1.2.2, 1.5, 3.12.10, 3.17, 4.2.14

Statute of Limitations

15.1.2, 15.4.1.1

Stopping the Work

2.2.2, 2.4, 9.7, 10.3, 14.1

Stored Materials

6.2.1, 9.3.2, 10.2.1.2, 10.2.4

Subcontractor, Definition of
5.1.1

SUBCONTRACTORS

5

Subcontractors, Work by

1.2.2, 3.3.2, 3.12.1, 3.18, 4.2.3, 5.2.3, 5.3, 5.4, 9.3.1.2,
9.6.7

Subcontractual Relations

5.3, 5.4, 9.3.1.2, 9.6, 9.10, 10.2.1, 14.1, 14.2.1

Submittals

3.10, 3.11, 3.12, 4.2.7, 5.2.1, 5.2.3, 7.3.4, 9.2, 9.3, 9.8,
9.9.1, 9.10.2, 9.10.3

Submittal Schedule

3.10.2, 3.12.5, 4.2.7

Subrogation, Waivers of

6.1.1, **11.3**

Substances, Hazardous
10.3

Substantial Completion

4.2.9, 8.1.1, 8.1.3, 8.2.3, 9.4.2, **9.8**, 9.9.1, 9.10.3, 12.2,
15.1.2

Substantial Completion, Definition of
9.8.1

Substitution of Subcontractors

5.2.3, 5.2.4

Substitution of Architect

2.3.3

Substitutions of Materials

3.4.2, 3.5, 7.3.8

Sub-subcontractor, Definition of
5.1.2

Init.

/

Subsurface Conditions
3.7.4

Successors and Assigns
13.2

Superintendent
3.9, 10.2.6

Supervision and Construction Procedures
1.2.2, **3.3**, 3.4, 3.12.10, 4.2.2, 4.2.7, 6.1.3, 6.2.4, 7.1.3,
7.3.4, 8.2, 8.3.1, 9.4.2, 10, 12, 14, 15.1.4

Suppliers
1.5, 3.12.1, 4.2.4, 4.2.6, 5.2.1, 9.3, 9.4.2, 9.5.4, 9.6,
9.10.5, 14.2.1

Surety
5.4.1.2, 9.6.8, 9.8.5, 9.10.2, 9.10.3, 11.1.2, 14.2.2,
15.2.7

Surety, Consent of
9.8.5, 9.10.2, 9.10.3

Surveys
1.1.7, 2.3.4

Suspension by the Owner for Convenience
14.3

Suspension of the Work
3.7.5, 5.4.2, 14.3
Suspension or Termination of the Contract
5.4.1.1, 14

Taxes
3.6, 3.8.2.1, 7.3.4.4

Termination by the Contractor
14.1, 15.1.7

Termination by the Owner for Cause
5.4.1.1, **14.2**, 15.1.7

Termination by the Owner for Convenience
14.4

Termination of the Architect
2.3.3
Termination of the Contractor Employment
14.2.2

**TERMINATION OR SUSPENSION OF THE
CONTRACT**

14
Tests and Inspections

3.1.3, 3.3.3, 3.7.1, 4.2.2, 4.2.6, 4.2.9, 9.4.2, 9.8.3,
9.9.2, 9.10.1, 10.3.2, 12.2.1, **13.4**

TIME
8

Time, Delays and Extensions of
3.2.4, 3.7.4, 5.2.3, 7.2.1, 7.3.1, 7.4, **8.3**, 9.5.1, 9.7,
10.3.2, 10.4, 14.3.2, 15.1.6, 15.2.5

Time Limits
2.1.2, 2.2, 2.5, 3.2.2, 3.10, 3.11, 3.12.5, 3.15.1, 4.2,
5.2, 5.3, 5.4, 6.2.4, 7.3, 7.4, 8.2, 9.2, 9.3.1, 9.3.3, 9.4.1,
9.5, 9.6, 9.7, 9.8, 9.9, 9.10, 12.2, 13.4, 14, 15.1.2,
15.1.3, 15.4

Time Limits on Claims
3.7.4, 10.2.8, 15.1.2, 15.1.3

Title to Work
9.3.2, 9.3.3

UNCOVERING AND CORRECTION OF WORK
12

Uncovering of Work
12.1
Unforeseen Conditions, Concealed or Unknown
3.7.4, 8.3.1, 10.3

Unit Prices
7.3.3.2, 9.1.2

Use of Documents
1.1.1, 1.5, 2.3.6, 3.12.6, 5.3

Use of Site
3.13, 6.1.1, 6.2.1

Values, Schedule of
9.2, 9.3.1

Waiver of Claims by the Architect
13.3.2

Waiver of Claims by the Contractor
9.10.5, 13.3.2, **15.1.7**

Waiver of Claims by the Owner
9.9.3, 9.10.3, 9.10.4, 12.2.2.1, 13.3.2, 14.2.4, **15.1.7**

Waiver of Consequential Damages
14.2.4, 15.1.7

Waiver of Liens
9.3, 9.10.2, 9.10.4

Waivers of Subrogation
6.1.1, **11.3**

Warranty
3.5, 4.2.9, 9.3.3, 9.8.4, 9.9.1, 9.10.2, 9.10.4, 12.2.2,
15.1.2

Weather Delays
8.3, 15.1.6.2

Work, Definition of
1.1.3

Written Consent
1.5.2, 3.4.2, 3.7.4, 3.12.8, 3.14.2, 4.1.2, 9.3.2, 9.10.3,
13.2, 13.3.2, 15.4.4.2

Written Interpretations
4.2.11, 4.2.12

Written Orders
1.1.1, 2.4, 3.9, 7, 8.2.2, 12.1, 12.2, 13.4.2, 14.3.1

ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

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

§ 1.1.2 The Contract

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

§ 1.1.3 The Work

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

§ 1.1.4 The Project

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

§ 1.1.5 The Drawings

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

§ 1.1.6 The Specifications

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

§ 1.1.7 Instruments of Service

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

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith. The Architect is the Initial Decision Maker for this Agreement.

§ 1.2 Correlation and Intent of the Contract Documents

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

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 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. Where the Procurement Requirements include provisions that portions of the Work be File Bid in accordance with the requirements of the Maine Bid Depository System, the subcontracts for these portions of the work will cover the same scope of work as defined by the Procurement Requirements and the File Bid and shall have the same contract amount as listed in the successful bid.

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

§ 1.3 Capitalization

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

§ 1.4 Interpretation

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

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and 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 the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights. The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102-2017 and B201-2017.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, 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 suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants. The provisions of this section shall not be deemed to modify the contract between the University of Maine System (the Owner) and the Architect under B102-2017 and B201-2017.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give 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 served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties ~~will use AIA Document~~ may use AIA Document G201-2013 Project Digital Data Protocol Form and E203™-2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™-2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™-2013, Project Building Information Modeling Protocol Form, shall be at the using or relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

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

.1 For the purpose of this Contract, the Owner is defined as: University of Maine System, acting through its duly authorized agent.

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

§ 2.2 Evidence of the Owner's Financial Arrangements

~~§ 2.2.1 Prior to Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~

~~§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.~~

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After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

~~§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor. Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.~~

~~§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.~~

§ 2.3 Information and Services Required of the Owner

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

§ 2.3.2 ~~The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. Architect is a person or entity lawfully licensed to practice in the State of Maine. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number. Whenever the prime professional designer for the Work is an Engineer, the term Architect, wherever used in these documents shall have the term Engineer substituted for the term Architect. The Engineer shall be lawfully licensed to practice engineering in the State of Maine or an entity lawfully practicing engineering identified as such in the Agreement.~~

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

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall ~~exercise proper precautions relating to the safe performance of the Work~~ at all times conduct safe performance of the Work, including but not limited to appropriate precautions.

§ 2.3.5 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.

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

§ 2.4 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

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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.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of 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 default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

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

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

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

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

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

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

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

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors,

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inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best industry standard or better 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. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be 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 notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

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

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

§ 3.4 Labor and Materials

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

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

§ 3.4.2.1 After the Contract has been executed, the Owner and Architect may consider a formal request for substitution of products in place of those specified. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect to evaluate the Contractor's proposed substitutions and to make agreed-upon changes in the Drawings and Specifications made necessary by the Owner's acceptance of the substitutions.

By making requests for substitutions, the Contractor

- .1 Represents that the Contractor has personally investigated the proposed substitute product and determined it is equal or superior in all respects to that specified;
- .2 Represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
- .3 Certifies that the cost data presented is complete and includes all related costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and,
- .4 Will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.

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

§ 3.4.4 If a wage scale prepared by the State of Maine Department of Labor, Bureau of Labor Standards, is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor employed on the project.

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The provisions of Title 26 MRSA Chapter 15 Preference to Maine Workers and Contractors, apply to this project, including but not limited to:

§ 1310. Wage and benefits rates to be kept posted

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

§ 1311. Wage and benefit record of contractor

The contractor and each subcontractor in charge of the construction of a public work shall keep an accurate record showing the names and occupation of all laborers, workers and mechanics employed by them and all independent contractors working under contract with them in connection with the construction on the public works. The record must also show for all laborers, workers, mechanics and independent contractors the hours worked, the title of the job, the hourly rate or other method of remuneration and the actual wages or other compensation paid to each of the laborers, workers, mechanics and independent contractors. A copy of such a record must be kept at the job site and must be open at all reasonable hours to the inspection of the Bureau of Labor Standards and the public authority that let the contract and its officers and agents. It is not necessary to preserve those records for a period longer than 3 years after the termination of the contract. A copy of each such record must also be filed monthly with the public authority that let the contract. The filed record is a public record pursuant to Title 1, chapter 13, except that the public authority letting a contract shall adopt rules to protect the privacy of personal information contained in the records filed with the public authority under this section, such as Social Security numbers and taxpayer identification numbers. The rules may not prevent the disclosure of information regarding the classification of workers or independent contractors and the remuneration they receive. Such rules are routine technical rules as defined by Title 5, chapter 375, subchapter 2-A.

§ 3.4.5 If a wage scale prepared by the U.S. Department of Labor pursuant to the provision of the Davis-Bacon Act is included in the Contract Documents, such wage scale represents the minimum wages that must be paid in each category of labor on the project. The requirements and responsibilities within the Davis-Bacon Act apply to this project if a Davis-Bacon wage scale is included.

§ 3.4.6 EQUAL EMPLOYMENT OPPORTUNITY

During the performance of this contract, the contractor agrees as follows:

- .1** The contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, including transgender status, gender, gender identity or gender expression, ethnicity, national origin or citizenship status, familial status, ancestry, age, disability physical or mental, genetic information, veteran or military status status. Such action shall include, but not be limited to, the following: employment, upgrading, demotions, transfers, recruitment or recruitment advertising; layoffs or terminations; rates of pay or other forms of compensation; and selection for training, including apprenticeship.
- .2** The contractor will, in all solicitations or advertisements for employees placed by or on behalf of the contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, sexual orientation, including transgender status, gender, gender identity or gender expression, ethnicity, national origin or citizenship status, familial status, ancestry, age, disability physical or mental, genetic information, veteran or military status.
- .3** The contractor will send to each labor union or representative of the workers with which there is a collective or bargaining agreement in place, or other contract or understanding, whereby labor is being furnished for the performances of his contract, a notice, as set forth by the Maine Human Rights Commission, found on their website (https://www1.maine.gov/mhrc/guidance/mhra_guarantees.htm), to be provided by the contracting department or agency, advising the said labor union or workers' representative of the contractor's commitment under the provisions of the contract, and shall post copies of the notice in conspicuous places available to employees and to applicants for employment.
- .4** The contractor will cause the foregoing provisions to be inserted in all contracts for any work covered by this agreement so that such provisions will be binding upon each subcontractor.

.5 Contractors and subcontractors with contracts in excess of \$50,000 will also pursue in good faith affirmative action programs.

§ 3.5 Warranty

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

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

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

§ 3.6.1 The University of Maine System is exempt from payment of taxes under the Maine Sales and Use Tax Law Title 36 Section 1760 for taxes on materials that are permanently incorporated into the real property belonging to the University of Maine System. The University of Maine System is also exempt from the payment of Federal Excise Taxes on articles not for resale and from the Federal Transportation Tax on all shipments; exemption certificates for these taxes will be furnished when required. All quotations shall be less these taxes. The contractor shall pay all other taxes that have been or are legally enacted.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

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

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

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

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are ~~disturbed and in no event later than 14 days after first observance of the conditions~~ disturbed. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may ~~submit a Claim~~ 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

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

§ 3.8 Allowances

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

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- .1 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- .2 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- .3 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

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

§ 3.9 Superintendent

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

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

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

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

- .1 The Contractor shall provide an updated Construction Schedule with each Application for Payment reflecting actual construction progress and activities.

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

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

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

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

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

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

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

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

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

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

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

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

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and 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.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.12.11 The Architect's review of the Contractor's submittals will be limited to examination of an initial submission and two (2) resubmittals. The Architects review of additional submittals will be made only with the consent of the Owner after notification by the Architect. The Owner shall deduct from the next payment made from the Contract Sum amounts paid to the Architect for evaluation of such additional submittals.

§ 3.13 Use of Site

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

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or 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 construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its 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 and 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 the Owner shall be entitled to reimbursement from the Contractor.

§ 3.15.3 Waste Management. The University is committed to a resource management strategy which reduces to a minimum the production of waste material while reusing, recycling or composting as much as possible of the remaining materials. Contractor will submit a construction waste management plan for the project that identifies opportunities to reduce, reuse, or recycle waste from renovations or new construction.

§ 3.16 Access to Work

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

§ 3.17 Royalties, Patents and Copyrights

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

§ 3.18 Indemnification

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

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

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

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

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the final payment is due, and from time to time during the period for correction of Work described in § 12.2, and until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, endeavor to guard the Owner against defects and deficiencies in the Work, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the

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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.

- .1 The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect as determined solely by the Owner, or request of the Contractor. The reimbursement shall be deducted from the next payment made from the Contract Sum following the Owner's payment to the Architect.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner ~~reasonably~~ informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

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

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

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

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

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

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

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

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

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the 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, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

- .1 The Contractor shall provide Owner a list of all subcontractors and independent contractors on the job site and a record of the entity to whom that subcontractor or independent contractor is directly contracted and by whom that subcontractor or independent contractor is insured for workers' compensation purposes. The list shall be presented at the preconstruction meeting and, when changes occur, at each requisition meeting as necessary.
- .2 Where the use of the Maine Bid Depository is required by the Procurement Requirements, Subcontractors included in the Contractor's Proposal shall be the Subcontractors for the defined Work unless a change has been approved by the Owner.

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

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

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

§ 5.4 Contingent Assignment of Subcontracts

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

- .1 assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- .2 assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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

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

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract 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 Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction

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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 or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has 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 notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work 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. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 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 that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

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

§ 6.3 Owner's Right to Clean Up

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

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

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

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

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

§ 7.1.4 The combined overhead and profit included in the total cost to the Owner of a Change in the Work shall be based on a previously agreed upon unit pricing or on the following schedule allowing for appropriate allowances for contract duration:

.1 For the Contractor, for Work performed by the Contractor's own forces, 20% of the cost.

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- .2 For the Contractor, for Work performed by the Contractor's Subcontractors, 10% of the amount due the Subcontractors.
- .3 For each Subcontractor involved, for Work performed by the Subcontractor's own forces, 20% of the cost.
- .4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 10% of the amount due the Sub-subcontractor.
- .5 Costs to which overhead and profit is to be applied shall be limited to the following:
 - .1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' compensation insurance;
 - .2 Costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
 - .3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others; and,
 - .4 Costs of premiums for all bonds, insurance, permit fees, and sales, use or similar taxes related to the Work.

§ 7.1.5 When there is only an extension of Contract Time, any Claim for delay made pursuant to Article 15 is limited to additional costs related to supervision and field office personnel, which may be included in the overhead and profit calculation.

§ 7.1.6 In order to facilitate checking of quotations, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they are to be itemized also. In no case will a change be approved without such itemization.

§ 7.2 Change Orders

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

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

§ 7.3 Construction Change Directives

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

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

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

- .1 Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 Unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may

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

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

§ 8.2 Progress and Completion

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

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 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 (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

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

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

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 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.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

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

§ 9.3 Applications for Payment

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

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

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

§ 9.3.1.3 The provisions of Title 5 M.R.S.A § 1746, as amended, pertain to this project. The Owner shall retain five percent (5%) of each payment due the Contractor as part of the security for the fulfillment of the Contract Agreement by the Contractor; the Contractor shall not withhold a greater percentage from subcontractors. The Owner may, if deemed expedient by the Owner, cause the Contractor to be paid temporarily or permanently from time to time during the progress of the work, such portion of the amount retained as the Owner deems prudent or desirable.

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

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

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

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

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect ~~may~~ shall withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to

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make such representations to the Owner. The Architect ~~may shall~~ also withhold a Certificate for Payment or, because of subsequently discovered evidence, ~~may shall~~ nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- .1 defective Work, i.e. Work that does not conform to the requirements of the Contract, shall include, but not be limited to, non-conforming Work, disputed Work, incomplete Work, and unacceptable Work, which is not remedied;
 - .1 The Architect shall deduct and withhold from any certification for payment an amount equal to one hundred and fifty percent (150%) the value of any defective Work.
- .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 suppliers for labor, materials or equipment;
- .4 reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- .5 damage to the Owner or a Separate Contractor;
- .6 reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or
- .7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

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

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

§ 9.6 Progress Payments

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

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

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

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

§ 9.6.5 The Contractor's payments to 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 or provided by 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, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

§ 9.6.9 All Progress Payments and Final Payment are subject to the requirements of the "Maine Prompt Pay Act" Title 10 M.R.S.A. ch. 201-A, as amended. Payments shall be made on a timely basis in accord with the requirements of this Statute; however, the Contractor waives interest on any late payment.

§ 9.7 Failure of Payment

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

§ 9.8 Substantial Completion

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

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

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

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

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

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

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

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

§ 9.10 Final Completion and Final Payment

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

- .1** Except with the consent of the Owner, the Architect will perform no more than three (3) site reviews to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for any additional site reviews.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no 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) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance 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 the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, 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 the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to

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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 audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a 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, if any, shall be liable for and shall pay the Owner the sums stipulated as liquidated damages in the Contract Documents for each calendar day of delay after the date established for Substantial Completion in the Contract Documents until the Work is substantially complete.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

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

§ 10.2 Safety of Persons and Property

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

- .1 employees on the Work and other persons who may be affected thereby;
- .2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; 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.
- .4 If this Contract involves renovation, repair, or preparation of surfaces for painting in pre-1978 apartments, houses, or spaces used by child care facilities, Contractor shall use certified workers who follow the lead-safe work practices as required by the US Environmental Protection Agency's Renovation, Repair and Remodeling rule described in 40 CFR § 745.85. Notification of the tenants or users under this rule will be the responsibility of the Owner.

§ 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 implement, 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 the owners and users of adjacent sites and utilities of the safeguards.

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

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to

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the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

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

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

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. 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 notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. ~~Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection.~~ When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. ~~By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.~~

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, ~~including but not limited to exclusive of 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. This indemnification obligation shall not apply to any claim for which Owner would not be liable under the Maine Tort Claims Act (14 M.R.S.A. '8101, et seq.) if such claim were made directly against Owner and Owner shall continue to enjoy all rights, claims, immunities and defenses available to it under law.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous 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 hazardous 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 reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the

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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 reimburse the Contractor for all cost and expense thereby ~~incurred~~incurred, exclusive of attorneys' fees.

§ 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 Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 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.

§ 11.1.4 **Notice of Cancellation or Expiration of Contractor's Required Insurance.** Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

~~§ 11.2.2 **Failure to Purchase Required Property Insurance.** If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.~~

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§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, 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 those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 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, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused, with the exception of intentional acts or grossly negligent consultants, contractors or sub-contractors.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have ~~14~~30 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising

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out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any 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 notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, 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.

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§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 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.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

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§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

~~§ 13.5 Interest~~

~~Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.~~

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- .1 Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- .2 An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- .3 Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- ~~.4 The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.~~

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- .1 repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- .2 fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- .3 repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

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- .1 Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 Accept assignment of subcontracts pursuant to Section 5.4; and
- .3 Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- .1 that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- .2 that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of 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 Owner shall pay the Contractor for Work properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the ~~Agreement~~ Agreement; but not including overhead and profit on Work not executed.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, 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. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law,

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but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 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.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 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.

§ 15.1.6.2 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.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

- .1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and
- .2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision

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shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of

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60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 ~~If the~~ The parties have selected arbitration as the method for binding dispute resolution in the Agreement, any ~~Claim~~ this Agreement, any claim, dispute or other matter in question arising out of or related to this Agreement subject to, but not resolved by, mediation shall be subject to ~~arbitration which,~~ arbitration, which unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association conducted in the place where the Project is located, unless another place is mutually agreed upon, and in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. ~~The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon.~~ this Agreement, except that the parties shall select only one Arbitrator, and there shall be no discovery. A demand for arbitration shall be made in writing, delivered to the other party to ~~the Contract,~~ this Agreement, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be ~~demanded,~~ defended.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

SECTION 00 73 00.11
SAMPLE

SCHEDULE OF LIQUIDATED DAMAGES

Liquidated damages (a fixed amount set forth in the Contract) agreed to by the Owner and the Contractor are intended to compensate the Owner for unexcused delay in the performance of the Contract. The parties agree that the purpose of the liquidated damages schedule below is to establish, in advance, a reasonable estimate of the damages that would be incurred by the Owner if there is an unexcused delay, or a breach of Contract, which causes the work to be extended beyond the contractual substantial completion date. This agreement of liquidated damages by the parties is made to establish the reasonableness of them to the actual damages an Owner may have incurred due to unexcused delays by the Contractor, even though the actual damages may be an uncertain amount and unprovable.

The specific per diem rates of Liquidated Damages are (_____/[enter amt if can reasonably determine-provide method of determination; otherwise] set forth below). By executing the Contract, the Contractor acknowledges that such an amount is not a penalty and that the daily amount set forth in the Contract is a reasonable per diem forecast of damages incurred by the Owner due to the Contractor's failure to complete the Work within the Contract Time.

Original Contract Amount		Per Diem Amount of Liquidated Damages
From	To	
More Than	and Including	
0	\$100,000	\$500
\$100,000	\$300,000	\$675
\$300,000	\$500,000	\$750
\$500,000	\$1,000,000	\$825
\$1,000,000	\$2,000,000	\$1,000
\$2,000,000	\$4,000,000	\$1,250
\$4,000,000	and more	\$1,500

END OF SECTION 00 73 00.11



AIA® Document A101® – 2017 Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the N/A day of _____ in the year Sample
(In words, indicate day, month and year.)

for the following **PROJECT**:
(Name and location or address)

THE OWNER:
(Name, legal status and address)

University of Maine System
by and through
University of Maine
5765 Service Building
Orono, ME 04469

THE CONTRACTOR:
(Name, legal status and address)

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

This document is intended to be used in conjunction with AIA Document A201®–2017, General Conditions of the Contract for Construction. Article 11 of A201®–2017 contains additional insurance provisions.

TABLE OF ARTICLES

- A.1 GENERAL**
- A.2 OWNER'S INSURANCE**
- A.3 CONTRACTOR'S INSURANCE AND BONDS**
- A.4 SPECIAL TERMS AND CONDITIONS**

ARTICLE A.1 GENERAL

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 **Causes of Loss.** The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, or materials. Sub-limits, if any, are as follows:

(Indicate below the cause of loss and any applicable sub-limit.)

§ A.2.3.1 For this project, Property Insurance coverage, up to the total amount of the Project, will be provided by the University by either adding the Project to the University's existing master property insurance or purchasing a stand-alone builder's risk policy. Coverage shall be included for the Contractor and all Subcontractors, as their interests may appear, while involved in the Project and until the work is completed or the contractor is otherwise advised in writing. This insurance is limited to the "all risk" type coverage provided under the University's master property insurance for direct physical loss or damage to the building or building materials related to the project, subject to standard policy limitations and exclusions. The contractor is responsible for a \$10,000 per claim deductible. Any other insurance desired by the Contractor beyond that covered by the University's insurance, or to cover the \$10,000 deductible, is the responsibility of the Contractor. This contract stands as verification of the University's property insurance coverage on the project and no further verification will be provided.

Causes of Loss

Sub-Limit

§ A.2.3.1.2 **Specific Required Coverages.** The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:

(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage

Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 **Deductibles and Self-Insured Retentions.** If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 **Occupancy or Use Prior to Substantial Completion.** The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of

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coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures

If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.

The Owner shall purchase and maintain the insurance selected and described below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

- § A.2.4.1 **Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.
- § A.2.4.2 **Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.
- § A.2.4.3 **Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.
- § A.2.4.4 **Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.
- § A.2.4.5 **Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.
- § A.2.4.6 **Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.
- § A.2.4.7 **Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects,

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engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

§ A.2.5.1 Cyber Security Insurance for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

§ A.2.5.2 Other Insurance
(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.1.1 Certificates of Insurance filed with the University of Maine System shall indicate the Certificate Holder as:

University of Maine System
Office of Risk Management
Robinson Hall
46 University Drive
Augusta, ME 04330

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04. All required insurance shall be provided by companies that have a current A.M. Best insurance rating of A- or better and that are licensed or approved to do business in the State of Maine.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than two million dollars (\$ 2,000,000) each occurrence, two million dollars (\$ 2,000,000) general aggregate, and two million dollars (\$ 2,000,000) aggregate for products-completed operations hazard, providing coverage for claims including

- .1 damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- .2 personal injury and advertising injury;
- .3 damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- .4 bodily injury or property damage arising out of completed operations; and
- .5 the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

- .1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.
- .2 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.
- .3 Claims for bodily injury other than to employees of the insured.
- .4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.
- .5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.
- .6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.
- .7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.
- .8 Claims related to roofing, if the Work involves roofing.
- .9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.
- .10 Claims related to earth subsidence or movement, where the Work involves such hazards.
- .11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than one million dollars (\$ 1,000,000) per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than five hundred thousand dollars (\$ 500,000.) each accident, five hundred thousand dollars (\$ 500,000.) each employee, and five hundred thousand dollars (\$ 500,000.) policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and ~~decks~~ docks. Policy limits for such coverage shall not be less than five hundred thousand dollars (\$500,000) each accident, five hundred thousand dollars (\$500,000) each employee, and five hundred thousand dollars (\$500,000) policy limit. Contractor is required to provide proof of such coverage, if applicable to the Work, by submitting a copy of the endorsement or by submitting the USLH form WC 00 01 06 A (current edition).

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than one million dollars (\$ 1,000,000.) per claim and one million dollars (\$ 1,000,000.) in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than one million dollars (\$ 1,000,000.) per claim and two million dollars (\$ 2,000,000.) in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than one million dollars (\$ 1,000,000.) per claim and two million dollars (\$ 2,000,000.) in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than two million dollars (\$ 2,000,000.) per claim and two million dollars (\$ 2,000,000.) in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than one million dollars (\$ 1,000,000.) per claim and one million dollars (\$ 1,000,000.) in the aggregate. Authorization from Administration of the University of Maine System must be obtained thirty (30) days prior to the utilization of the equipment.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a duration other than the expiration of the period for correction of Work, state the duration.)

N/A

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insurance in accordance with Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. Where policy limits are provided, include the policy limit in the appropriate fill point.)

[] § A.3.3.2.1 Property insurance of the same type and scope satisfying the requirements identified in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner of the responsibility to purchase and maintain such ~~insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3-insurance.~~ The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any

deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

- [] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than (\$) per claim and (\$) in the aggregate, for Work within fifty (50) feet of railroad property.
- [] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than one million dollars (\$ 1,000,000) per claim and two million dollars (\$ 2,000,000) in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.
- [] **§ A.3.3.2.4 Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.**
- [] **§ A.3.3.2.5 Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.**
- [] **§ A.3.3.2.6 Other Insurance**
(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

Coverage	Limits

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows: and the Contractor shall furnish a Performance Bond and a Payment Bond covering the faithful performance of the Contract and payment of obligations arising thereof. Bonds may be obtained through the Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100% of the Contract Sum. Should the Contract Sum change during the contract and warranty periods, the amount of the Bonds will be changed to reflect the Contract Sum.

- .1 The Contractor shall deliver the required bonds to the Owner at the same time as the signed Contract Agreement is delivered to the Owner. Prior to the commencement of the Work, the Contractor shall submit satisfactory evidence that such bonds will be furnished.

(Specify type and penal sum of bonds.)

- .2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

Type	Penal Sum (\$0.00)
------	--------------------

Payment Bond

Performance Bond

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.**3**

The Contract Bonds shall continue in effect for one year after final acceptance of each contract to protect the Owner's interest in connection with the one year guarantee of workmanship and materials

and to assure settlement of claims, for the payment of all bills for labor, materials, and equipment by the Contractor.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

N/A



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

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

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

<u>Occupational Title</u>	<u>Minimum Wage</u>	<u>Minimum Benefit</u>	<u>Total</u>
Brickmasons and Blockmasons	\$43.02	\$7.64	\$50.66
Bulldozer Operator	\$30.62	\$5.38	\$36.00
Carpenter	\$30.01	\$19.69	\$49.70
Cement Masons and Concrete Finisher	\$24.42	\$2.52	\$26.94
Construction and Maintenance Painters	\$23.96	\$1.59	\$25.55
Construction Laborer	\$21.90	\$19.72	\$41.62
Conveyor Operators and Tenders	\$30.17	\$13.77	\$43.94
Crane and Tower Operators	\$40.43	\$8.63	\$49.06
Crushing Grinding and Polishing Machine Operators	\$26.15	\$3.24	\$29.39
Earth Drillers - Except Oil and Gas	\$25.04	\$3.77	\$28.81
Electrical Power - Line Installer and Repairers	\$48.12	\$15.63	\$63.75
Electricians	\$38.74	\$21.14	\$59.88
Elevator Installers and Repairers	\$67.34	\$39.76	\$107.10
Excavator Operator	\$34.12	\$6.49	\$40.61
Fence Erectors	\$30.90	\$2.18	\$33.08
Flaggers	\$21.39	\$0.86	\$22.25
Floor Layers - Except Carpet/Wood/Hard Tiles	\$29.00	\$8.65	\$37.65
Glaziers	\$23.73	\$4.62	\$28.35
Hazardous Materials Removal Workers	\$24.12	\$1.60	\$25.72
Heating and Air Conditioning and Refrigeration Mechanics and Installers	\$32.88	\$4.41	\$37.29
Heavy and Tractor - Trailer Truck Drivers	\$24.44	\$2.50	\$26.94
Highway Maintenance Workers	\$23.30	\$1.14	\$24.44
Industrial Machinery Mechanics	\$29.97	\$6.74	\$36.71
Industrial Truck and Tractor Operators	\$24.61	\$4.21	\$28.82
Insulation Worker - Mechanical	\$27.35	\$6.05	\$33.40
Light Truck or Delivery Services Drivers	\$26.79	\$5.14	\$31.93
Loading Machine and Dragline Operators	\$29.71	\$4.79	\$34.50
Millwrights	\$35.99	\$10.52	\$46.51
Mobile Heavy Equipment Mechanics - Except Engines	\$30.67	\$5.10	\$35.77
Operating Engineers and Other Equipment Operators	\$39.74	\$3.67	\$43.41
Paving Surfacing and Tamping Equipment Operators	\$30.74	\$10.67	\$41.41
Pile-Driver Operators	\$37.15	\$3.12	\$40.27
Pipe/Steam/Sprinkler Fitter	\$43.76	\$25.44	\$69.20
Pipelayers	\$28.75	\$3.64	\$32.39
Plumbers	\$40.00	\$24.71	\$64.71
Radio Cellular and Tower Equipment Installers	\$34.72	\$5.63	\$40.35
Reinforcing Iron and Rebar Workers	\$33.35	\$27.55	\$60.90
Riggers	\$27.16	\$21.25	\$48.41
Roofers	\$24.71	\$4.70	\$29.41
Sheet Metal Workers	\$24.97	\$5.69	\$30.66
Structural Iron and Steel Workers	\$27.16	\$21.25	\$48.41
Tapers	\$29.16	\$5.64	\$34.80
Telecommunications Equipment Installers and Repairers - Except Line Installers	\$37.09	\$10.21	\$47.30
Telecommunications Line Installers and Repairers	\$28.49	\$5.29	\$33.78
Tile and Marble Setters	\$28.91	\$5.46	\$34.37

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

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

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

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

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

A true copy

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

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

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.01 SUMMARY

- A. The University of Maine is seeking to replace the existing steam absorption chiller with a conventional electric water chiller of similar capacity at Barrows Hall. This equipment is located in the top floor mechanical penthouse and on the roof of the building.

Bid Schedule:

Bid advertised: Saturday, February 28, 2026

Non-mandatory pre-bid meeting: Tuesday, March 10, 2026 at 9am

Questions Due: Tuesday, March 17, by 2:00pm

Response to Questions by: Thursday, March 19, 2026 by 2:00pm

Bid Opening-Bids received until: 2:00pm on Thursday, March 26, 2026

Substantial completion date: August 21, 2026

SECTION 01 14 00
WORK RESTRICTIONS

PART 1 GENERAL

1.01 PROJECT CONDITIONS

A. Tobacco Free Campus Policy: On January 1, 2011 the University System adopted a tobacco free campus policy. As of January 1, 2012 compliance with the tobacco free campus policy became mandatory. This paragraph serves as notification to Contractor of the policy and provides the parameters of compliance enforcement. Contractor shall be responsible for notifying its workers and subcontractors regarding the policy and for enforcement of the policy with same. Noncompliance will be managed as follows:

1. First offense – notify Contractor to remind employee and/or subcontractor of policy.
2. Second offense – contractor/subcontractor employee removed from campus for the remainder of the Work.

Additional information regarding the tobacco free campus policy is located at:
<http://umaine.edu/tobaccofree/>

- B. Sexual Harassment will not be tolerated on the campuses of the University of Maine System.
- C. Weapons and Ammunition are not permitted on the campuses of the University of Maine System.
- D. Contractor will be required to provide a site-specific Safety Plan for the project.
- E. Contractor parking will be limited to authorized areas defined by the University of Maine System Representative.

PART 2 to 3 – Not Used

END OF SECTION 01 14 00

SECTION 012300 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if the Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternates into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

- A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include, as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation, whether or not indicated as part of alternate.
- B. Execute accepted alternates under the same conditions as other Work of the Contract.
- C. Schedule: A Part 3 "Schedule of Alternates" Article is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. Alternate No. 1: Replace Chilled Water Pumps CHWP-1 and CHWP-2.

1. Base Bid: The existing chilled water pumps remain to serve the new chiller. Re-balance the chilled water system to achieve as close to the scheduled flow rate for the new chiller as possible.
2. Alternate No. 1: Replace the existing chilled water pumps (CHWP-1 and CHWP-2) as scheduled on the drawings. Replace the existing chilled water bypass valve as noted on the contract drawings and revise the control sequence to control the new bypass valve from chiller evaporator barrel DP. Revise control sequence to modulate chilled water pump speed on chilled water system DP.

B. Alternate No. 2: Replace Cooling Tower CT-1 and Condenser Water Pumps CWP-1 and CWP-2.

1. Base Bid: The existing cooling tower and condenser water pumps remain as currently exist. Re-balance the condenser water pumps to reduce the flow rate through the condenser barrel for the new chiller to that scheduled while maintaining the scheduled flow rate for the existing Clean Room chiller in the basement.
2. Alternate No. 1: Replace the existing Cooling Tower (CT-1R) and replace the existing condenser water pumps (CWP-1 and CWP-2) as scheduled on the drawings. Re-balance the condenser loop as required.

END OF SECTION 012300

SECTION 01 29 00
PAYMENT PROCEDURES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. The forms for application for payment, duly notarized, shall be the current authorized edition of the AIA Document G702, Application for Payment, supported by a current authorized edition of AIA G703, Continuation Sheet. Samples of these, and other required AIA documents, are provided in the Contract Documents under Division 00 for informational purposes only.

1.03 DEFINITIONS

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

1.04 SCHEDULE OF VALUES

- A. Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Architect prior to the pre-construction meeting.
- B. Format and Content: Use the specification table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
 - 1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Contractor's name and address.
 - d. Date of submittal.
 - 2. Submit draft of AIA G702 Application for Payment form and AIA G703 Continuation Sheet (Schedule of Values) form.
 - 3. Arrange the Schedule of Values in tabular form with separate columns to indicate the following for each item listed:
 - a. Related Specification Section or Division.
 - b. Description of the Work.
 - c. Name of subcontractor.
 - d. Name of manufacturer or fabricator.
 - e. Name of supplier.
 - f. Change Orders (numbers).
 - g. Dollar value.
 - 4. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Specification table of contents. Provide several line items for principal subcontract amounts, where appropriate.

- a. For each line item, provide a sublist breakdown as follows:
 - 1) Material.
 - 2) Labor.
5. Documentation: Submit proper documentation for the amounts being requisitioned from subcontractors and material suppliers with each Application for Payment. Three (3) copies of an Application for Payment or a Payment Requisition are required for all subcontracted work. Three (3) copies of the invoice is required for each major supplier.
6. Stored Materials: If Contractor is requesting payment for stored materials as part of the Application for Payment, Contractor must complete Column F in the G703 Continuation Sheet (Schedule of Values) to record the stored materials amounts against line items that pertain to those stored materials. Stored materials are materials or equipment purchased or fabricated and stored, but not yet installed or incorporated into the Work.
 - a. Complete and provide three (3) copies of 00 62 79 Stored Materials form with all required documentation. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
 - b. Only major long lead delivery items may be considered for off-site storage (example: long lead custom mechanical unit). Standard order and production materials and products shall be delivered to the site before including in Application for Payment of such items.
7. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
8. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown as separate line items in the Schedule of Values.
9. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when approved Change Orders or Construction Change Directives result in a change in the Contract Sum.
10. Retainage: The required five percent (5%) retainage held per Application for Payment submission shall be accounted for on the G703 on a per line item basis. Each line item with a value in Column G "Total Completed and Stored To Date" shall have a corresponding five percent retainage value entered in Column I.
 - a. Final Release of Retainage: The final release of retainage shall be entered as a separate line item on the G703 as "Final Release of Retainage" with the full amount of the five percent retainage entered as a negative number in Column I. The final release of retainage request is submitted as a separate application.

1.05 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: G702 Application for Payment shall be submitted to Architect and Owner not less than seven (7) days before monthly progress meeting. The period covered by each Application for Payment is one (1) month, ending on the last day of the month.
- C. Payment Application Forms: The Contractor is required under the Contract Documents to use official original AIA documents. Samples of the required documents are provided in Division 00 of the Specifications.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.

2. Include amounts of approved Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal:
1. Submit signed and notarized original of:
 - a. AIA G702 Application & Certificate for Payment.
 - b. AIA G703 Continuation Sheet.
 - c. AIA G706 Contractor's Affidavit of Payment of Debts & Claims.
 - d. AIA G706A Contractor's Affidavit of Release of Liens.
 - e. 00 65 19.17 Waiver of Lien.
 2. Transmit each Application for Payment with a transmittal form listing attachments and recording appropriate information about submission.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit three (3) copies of waivers of mechanic's lien from subcontractors, sub-subcontractors, major suppliers, and every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 2. When an application shows completion of an item, submit final waivers.
 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 5. Waiver Forms: Submit 00 65 19.17 Waiver of Lien forms, executed in a manner acceptable to Owner.
- G. Certified Payrolls: Wages paid to all workers performing work on the Project shall be in accordance with the Section 00 73 64 Wage Determination Schedule for the Project. Contractor shall submit one (1) copy of each weekly certified payroll for Contractor and all subcontractors, sub-subcontractors, sub-sub-subcontractors, etc. performing work on the Project during the time covered by the Application for Payment. The certified payroll shall be completed in accordance with Section 3.4.4 of the A201 General Conditions and contain the following information:
1. Contractor name.
 2. Contractor address.
 3. Period number.
 4. Week ending date.
 5. Employee(s)'s name.
 6. Employee(s)'s job title.
 7. Employee hourly wage:
 - a. Straight time rate.
 - b. Overtime rate.
 8. Hours worked per day (broken down by straight time and overtime hours).
 9. Hours worked per week (broken down by straight time and overtime hours).
 10. Total earned for the week:
 - a. Straight time.
 - b. Overtime.
 11. Benefits that form a part of the wage rate.
 12. The signature and name of the authorized payroll person.
- H. Initial Application for Payment: Administrative actions and submittals that must precede submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of Values.

3. Contractor's Construction Schedule.
 4. Submittals Schedule.
 5. List of Contractor's staff assignments.
 6. List of Contractor's principal consultants.
 7. Copies of building permits and other required permits.
 8. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 9. Initial progress report.
 10. Report of preconstruction conference.
 11. Insurance verification through submission of insurance certificates, for all Subcontractors.
- I. Progress Applications for Payment: Administrative actions and submittals that must precede or coincide with submittal of progress Applications for Payment include the following:
1. Contractor's Construction Schedule update.
 2. Submittals for Work being requisitioned that are complete and approved.
 3. Submission of list of completed tests, checklists, commissioning, reports, and similar requirements for the work that are submitted and in compliance with the Contract Documents.
 4. Distribution of minutes of previous month's progress meeting.
 5. Current record drawings.
- J. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion, less retainage, for portion of the Work claimed as substantially complete. Application must:
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. Reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- K. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that fees and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA G707 Consent of Surety to Final Payment, three (3) originals.
 5. Evidence that claims have been settled.
 6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 7. Final, liquidated damages settlement statement, if a liquidated damages claim has been processed.
 8. As-built drawings.
 9. Operation and maintenance manuals.
 10. Final lien waivers.
 11. All training and equipment testing is complete.

PART 2 to 3 – Not Used

END OF SECTION 01 29 00

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittal procedures.
- B. Proposed products list.
- C. Shop drawings and product data.
- D. Manufacturers' instructions.
- E. Manufacturers' certificates.

1.02 SUBMITTAL PROCEDURES

- A. Identify Project, Contractor, Subcontractor or Supplier, pertinent Drawing sheet and detail number(s), and Specification Section number, as appropriate.
- B. Apply Contractor's stamp, signed or initialed certifying that review, verification of Products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with the requirements of the Work and Contract Documents.
- C. Schedule submittals to expedite the Project, and deliver to Architect/Engineer at business address. Coordinate submission of related items.
- D. Identify variations from Contract Documents and Product or system limitations which may be detrimental to successful performance of the completed Work.
- E. Revise and resubmit submittals when changes occur; identify all changes made since previous submittal.
- F. Distribute copies of reviewed submittals to concerned parties. Instruct parties to promptly report any inability to comply with provisions.

1.03 PROPOSED PRODUCTS LIST

- A. Submit complete list of major products proposed for use, with name of manufacturer and trade name of each product.

1.04 SHOP DRAWINGS AND PRODUCT DATA

- A. Submit electronic PDFs of all submittals organized with cover sheet and contractor's review of submittal, which will be reviewed by Architect/Engineer.

1.05 MANUFACTURERS' INSTRUCTIONS

- A. Submit manufacturers' printed instructions for delivery, storage, assembly, installation, and finishing. Submit in electronic format (PDF).
- B. Identify conflicts between manufacturers' instructions and Contract Documents.

1.06 MANUFACTURERS' CERTIFICATES

- A. When specified in individual Specification Sections, submit manufacturers' certificates to Architect/Engineer for review, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Architect/Engineer.

1.07 SCHEDULE

- A. Within ten (10) days after signing the Contract, the Contractor shall submit a schedule in either bar chart or CPM format, sufficiently detailed so that actual progress may be easily compared with scheduled progress.

PART 2 to 3 – Not Used

END OF SECTION 01 33 00

SECTION 01 77 00
CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Administrative provisions for Substantial Completion and for final acceptance.

1.02 SUBSTANTIAL COMPLETION

- A. When Contractor considers work, or designated portion of work, is substantially complete, submit written notice with list of items to be completed or corrected.
- B. Should Owner inspection find work is not substantially complete, Owner will promptly notify Contractor in writing, listing observed deficiencies.
- C. Contractor shall remedy deficiencies and send a second written notice of substantial completion.
- D. When Owner finds work is substantially complete, Owner will prepare a Certificate of Substantial Completion in accordance with provisions of the General Conditions.

1.03 FINAL COMPLETION

- A. When Contractor considers work is complete, 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 and deficiencies listed with Certificate of Substantial Completion have been corrected.
 - 4. Equipment and systems have been tested, adjusted and balanced and are fully operational.
 - 5. Operation of systems has been demonstrated to Owner's personnel.
 - 6. Work is complete and ready for final inspection.
- B. Should Owner inspection find work incomplete, Owner will promptly notify Contractor in writing, listing observed deficiencies.
- C. Contractor shall remedy deficiencies and send a second certification of final completion.
- D. When Owner finds work is complete, Owner will consider closeout submittals.

1.04 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.
- B. Warranties and bonds. Submit originals and in PDF format.
- C. Spare parts and maintenance Materials.
- D. Evidence of payment and Releases of Lien.

1.05 APPLICATION FOR FINAL PAYMENT

- A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

1.06 GUARANTEE

- A. Neither the final requisition for payment nor any provision in the Contract Documents nor partial or entire use or occupancy of the building by the Owner shall constitute an acceptance of work done in accordance with the Contract Documents or relieve the Contractor of liability in respect to express warranties or responsibility for faulty materials or workmanship. The Contractor shall remedy any defects in the work and pay for any damage to other work resulting therefrom which shall appear within one year from the date of final acceptance unless a longer period is specified. The Owner will give notice of observed defects with reasonable promptness.
- B. Although subcontractors shall, throughout these Specifications, be required to provide guarantees for their respective work, the Contractor, in the last analysis, shall be responsible for all work and the guarantee thereof. In the case of disputes between subcontractors as to fault of problems, it is up to the Contractor to resolve these disputes or accept the cost of repair or replacement himself.

PART 2 to 3 – Not Used

END OF SECTION 01 77 00

SECTION 024119 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Demolition and removal of selected portions of building.
 - 2. Salvage of existing items to be reused in the new work.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and dispose of them off-site unless indicated to be salvaged or reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage, prepare for reuse, and reinstall where indicated.
- C. Existing to Remain: Leave existing items that are not to be removed and that are not otherwise indicated to be salvaged or reinstalled.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.

1.4 MATERIALS OWNERSHIP

- A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

- A. Predemolition Conference: Conduct conference at Project site.
 - 1. Inspect and discuss condition of construction to be selectively demolished.
 - 2. Review structural load limitations of existing structure.

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BARROWS HALL
UNIVERSITY OF MAINE
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3. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
5. Review areas where existing construction is to remain and requires protection.

1.6 FIELD CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.
- B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
- E. Storage or sale of removed items or materials on-site is not permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
 1. Maintain fire-protection facilities in service during selective demolition operations.

1.7 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding.
- B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

1.8 COORDINATION

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

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.
- B. Standards: Comply with ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

- A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

3.3 PROTECTION

- A. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
- B. Remove temporary barricades and protections where hazards no longer exist.

3.4 SELECTIVE DEMOLITION, GENERAL

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

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1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
 5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
 6. Maintain adequate ventilation when using cutting torches.
 7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
 8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
 9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
 10. Dispose of demolished items and materials promptly.
- B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.
1. Do not allow demolished materials to accumulate on-site.
 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
 3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
- B. Burning: Do not burn demolished materials.

3.6 CLEANING

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

END OF SECTION 024119

SECTION 230500 – COMMON WORK RESULTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.
- B. This section applies HVAC Division 23 sections.

1.2 GENERAL

- A. Section 230500 includes items common to all the division specification sections.
- B. Provide services, skilled and common labor, and all apparatus and materials required for the complete installation as shown and within the intent of the contract documents, field conditions, and code requirements.
- C. The intention of these Contract Documents is to call for finished work, fully tested and ready for operation. Any components or labor not mentioned in the Contract Documents but required for functioning systems shall be provided. Should there appear to be any discrepancies or questions of intent, the Contractor shall refer the matter to the Architect/Engineer for a decision before start of any related work.
- D. Consistency and Completeness: The contract documents are intended to include all components; however, the contract documents may not be perfect. Repetitive, common components (such as volume dampers, thermostats, condensate drains, trap primers, vent pipes, valves, etc.) are shown throughout. If a common component is missing in from the drawings, provide as similar per other areas. There will be no change orders for missing such components, the contractor shall provide consistent, complete, functioning systems.
- E. Should the Drawings or the Specifications disagree in themselves or with each other, the Contractor shall provide the better quality or greater quantity of work and/or materials unless otherwise directed by written addendum to the Contract Documents.
- F. Materials or work described in words, which so applied, have a well-known technical or trade meaning shall be held to refer to such recognized standards. Since the plans and specifications cover the dimensions and features of the work and do not set forth the analysis of the design, it is the duty of the Contractor fulfilling them to ascertain the true intent in any case where it is doubtful.

1.3 MANUFACTURERS INSTRUCTIONS

- A. Provide equipment and components to comply with manufacturer's written installation instructions and published drawings.
- B. Follow manufacturer's instructions for inspection, start-up, calibration, commissioning, and testing.

1.4 EFFICIENCY MAINE

- A. This project intends to pursue Efficient Maine prescriptive and/or custom incentives. The contractor shall participate in the activities associated with Efficiency Maine incentive approval process including but not limited to; preparation and submission of required incentive applications and the tracking and submission of measure specific invoices to Efficiency Maine within 60 days of the completion of the work.
- B. The contractor shall become familiar with the Efficiency Maine Business Program including available incentives and the application and review process. Efficiency Maine is available to assist in the application process and can be reached at <https://www.energymaine.com/at-work/>. Contractor must contact EM prior to submittals to review the project equipment and scope.
 - 1. <https://www.energymaine.com/at-work/ci-incentive-program/>
 - 2. Review plans and specifications for compliance with Efficiency Maine standards for applicable systems and technologies.
 - 3. Review plans and specifications for incentive opportunities.
- C. The project schedule shall reflect and accommodate the time required to achieve application pre-approval from Efficiency Maine (EM). No equipment shall be purchased until pre-approval is received from EM.
- D. Invoices shall be forwarded to EM within 60 days of the completion of the work. This deliverable shall be shown on the project schedule as a milestone date and coordinated with all contractors to assure compliance with this requirement.
- E. As a minimum, obtain rebates for the following:
 - 1. High efficiency chiller.
 - 2. Smart pumps

1.5 DEFINITIONS

- A. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

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- B. "Provide": Furnish and install, complete and ready for the intended use.
- C. "Shall": The word "shall" is used to indicate mandatory requirements strictly to be followed in order to conform to the standard and procedures and from which no deviation is permitted.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspace, and attics.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.
- I. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

1.6 SUBMITTALS

- A. Submit Shop Drawings on all items of equipment and materials to be furnished and installed. Submission of Shop Drawings and samples shall be accompanied by a transmittal letter, stating name of project and contractor, number of drawings, titles, and other pertinent data called for in individual sections. Shop Drawings shall be dated and contain Name of project; name of prime professional; name of prime contractor; description or names of equipment, materials, and items; and complete identification of locations at which materials or equipment are to be installed. Individual piecemeal or incomplete submittals will not be accepted. Similar items, (all types specified) shall be submitted at one time. Number each submittal by trade. Indicate deviations from contract requirements on Letter of Transmittal. Shop Drawings will be given a general review only.

1.7 SUBSTITUTIONS

- A. Engineer will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Engineer will return requests without action, except to record noncompliance with these requirements:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner

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BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.

2. Requested substitution does not require revisions to the Contract Documents.
3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
4. Substitution request is fully documented and properly submitted.
5. Requested substitution will not adversely affect Contractor's Construction Schedule.
6. Requested substitution has received necessary approvals of authorities having jurisdiction.
7. Requested substitution is compatible with other portions of the Work and shall be acceptable to all contractors involved.
8. Equipment electrical characteristics different than scheduled may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified at no additional cost.
9. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.
10. Requested substitution has been coordinated with other portions of the Work.
11. Requested substitution provides specified warranty.

1.8 QUALITY ASSURANCE

- A. Work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- B. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- C. Installer Qualifications: Work shall be done by skilled mechanics shall have successfully completed an apprenticeship program or another craft training program.
- D. The Contractor shall hold a license to perform the work as issued by the local jurisdiction.

1.9 COORDINATION

- A. Coordinate use of project space and sequence of installation of work, which is indicated diagrammatically on drawings. Follow routings shown, as closely as practicable, with due allowance for available physical space; make runs parallel with lines of building. Utilize space efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- B. Coordinate use of project space and sequence of installation of work.
- C. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for installations. Coordinate installation of required supporting devices

and set sleeves in poured-in-place concrete and other structural components as they are constructed.

1.10 TEST ADJUST AND BALANCE READINESS

- A. The Contractor shall provide and coordinate the services of qualified, responsible sub-contractors, suppliers and personnel as required to correct, repair, and/or replace deficient items or conditions found during this project, including the testing, adjusting, and balancing period.
- B. In order that systems may be properly tested, balanced, and adjusted as required herein by these Specifications, the Contractor shall operate the systems at his expense for the length of time necessary to properly verify their completion and readiness for TAB. Project Contract completion schedules shall allow for sufficient time to permit the completion of TAB services prior to Owner occupancy. The Contractor shall allow adequate time for the testing and balancing activities of the Owner provided services, during the construction period, and prior to Substantial Completion as defined in the Uniform General Conditions of this Construction Document.
- C. The Drawings and Specifications indicate adjustment devices for the purpose of adjustment to obtain optimum operating conditions, and it will be the responsibility of the Contractor to provide these devices in a manner that will leave them accessible and readily adjustable. Should any such device not be readily accessible, the Contractor shall provide access as requested by the TAB Firm. Also, any malfunction encountered by TAB personnel and reported to the Contractor shall be corrected by the Contractor immediately so that the balancing work can proceed with the minimum of delays.
- D. Complete operational readiness of the HVAC systems also requires that the following be accomplished:
 - 1. Distribution Systems:
 - a. Verify installation for conformity to design. Ducts shall be terminated and tested as required by the Specification.
 - b. Dampers shall be properly located and functional. Dampers shall have tight closure and open fully with smooth and free operation.
 - c. RGD'S and terminal devices shall be provided and secured in a fully open position.
 - d. Air handling systems and associated apparatus shall be sealed to eliminate uncontrolled bypass or leakage of air. Clean filters shall be in place, coils shall be clean with fins straightened, bearings properly greased, and the system shall be completely operational. The Contractor shall verify that systems are operating within the design pressure limits of the piping and ductwork.
 - e. Under normal operating conditions, check condensate drains for proper connections and functioning. Cooling coil drain pans have a positive slope to drain. Cooling coil condensate drain trap maintains an air seal.
 - f. Fans shall be operating and verified for freedom from vibration, proper fan rotation.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- g.
 - h. Bearings shall be greased.
 - i. Terminal units shall be provided and functional (i.e., controls functioning).
2. Water Circulating Systems:
- a. Verify installation for conformity to design. Hydronic systems are pressure tested, flushed, filled, and properly vented; valves are fully open. Examine HVAC system and equipment installations to verify that indicated balancing devices are properly provided, and that their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation
 - b. Valves shall be set to their fully open position. After the system is flushed and checked for proper operation, strainers shall be removed and cleaned. The Contractor shall repeat the operation until circulating water is clean and then the start-up strainers shall be discarded.
 - c. Record motor amperage on each phase and voltage after reaching rated speed. Readings shall not exceed nameplate rating. Thermal overload protection is in place.
 - d. In preparation of TAB, water circulating systems shall be full and free of air, expansion tanks shall be set for proper water level, and air vents shall be provided at high points of systems and operating freely. Chemicals shall be added to closed systems to treat piping and inhibit corrosion. The system static pressure shall be adequate to completely fill the system without operating the pumps.
 - e. Check and set operating parameters of the heat transfer and control devices to the design requirements.
 - f. Proper balancing devices shall be in place and located correctly. Heat transfer coils shall be checked for correct piping connections.
3. Building Automation System (BAS)
- a. The BAS Contractor shall verify that control components are provided in accordance with project requirements and are functional.
 - b. The BAS Contractor shall verify that controlling instruments are calibrated and set for design operating conditions except for components that require input from the TAB Agency, but a default shall be set. The Control Contractor shall cooperate with the TAB Agency and provide software and interfaces to communicate with the system.
 - c. The BAS Contractor shall thoroughly check controls, sensors, operators, sequences, etc. before notifying the TAB Agency that the BAS is operational. The BAS Contractor shall provide technical support (technicians and necessary computers) to the TAB Agency for a complete check of these systems.
 - d. Prior to occupancy, each ventilation system shall be tested to ensure that OA dampers operate properly in accordance with system design.
 - e. Fire Alarm: Division 26 shall thoroughly check detection devices, sequences, inter-locks, etc. before notifying the TAB Agency that the system is operational. Division 26 shall certify that the systems are totally operational to the Contractor prior to the TAB beginning.

1.11 RENOVATION PROJECT REQUIREMENTS

- A. The Contractor shall cooperate with the Owner to minimize conflicts with the Owner's operations.
- B. The Contractor shall study drawings and specifications, visit the site, and get acquainted with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to be familiarized with the conditions and extent of the proposed work. The Contractor shall execute alterations, additions, removals, relocations, or new work, etc., as indicated, or required to provide a complete installation in accordance with the intent of the drawing and specifications.
- C. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of site beyond areas in which the Work is indicated. Keep driveways and entrances serving premises clear and available to Owner. Schedule deliveries to minimize use of driveways and entrances and minimize space and time requirements for storage of materials and equipment on-site.
- D. Follow the recommended procedures of the SMACNA IAQ Guidelines for Occupied Buildings under Construction.
- E. Continuity of Services: The building will be in use during construction operations. Maintain existing systems in operation within rooms of building. Schedules for various phases of contract work shall be coordinated with other trades and with Owner's Representative. Provide, as part of the contract, temporary plumbing and mechanical and electrical connections and relocations as required to accomplish the above. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services. Notify Owner at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions. Indicate method of providing temporary utilities. Do not proceed with utility interruptions without Owner's written permission.
- F. Cutting And Patching: Provide temporary support of Work to be cut. Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 - 1. Where existing services/systems are required to be removed relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.
 - 2. Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay. Cut in-place construction to provide for installation of other components or performance of other construction and subsequently patch as required to restore surfaces to their original condition.
 - 3. Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original installer; comply with original installer's written recommendations.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

4. Patch construction by filling, repairing, refinishing, closing, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified in other Sections. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing. Clean piping, conduit, and similar features before applying paint or other finishing materials. Restore damaged pipe covering to its original condition.
5. Any structural member weakened or impaired by cutting, notching, or otherwise shall be reinforced, repaired, or replaced to be left in safe structural condition in accordance with the local building code requirements.
6. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.
7. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

PART 2 - PRODUCT

2.1 PRODUCT CRITERIA

- A. Any costs incurred due to deviations from basis of design unit shall be responsibility of the contractor.
- B. Material and equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products for at least 5 years.
- C. Equipment Service: Products shall be supported by a service organization that maintains a complete inventory of repair parts and is located reasonably close to the site.
- D. Multiple Units: When two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
- E. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
- F. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.
- G. Asbestos products or equipment or materials containing asbestos shall not be used.

2.2 PROGRAMMABLE 3-PHASE LINE VOLTAGE MONITORS

- A. Provide for all inverter-driven equipment.
- B. Provide an ICM Controls Model #ICM450A or equal, for motor protection from premature failure and damage caused by common voltage faults such as phase unbalance, over/under voltage, phase loss and phase reversal.
 - 1. Voltage: Universal, 190-600 VAC
 - 2. Simultaneous 3-phase true RMS voltage monitoring
 - 3. Factory calibrated.
 - 4. 3-phase voltages simultaneously displayed on LCD
 - 5. Fault memory
 - 6. Fault monitoring: High / low voltage, voltage unbalance, phase loss, phase reversal
 - 7. Simple configuration
 - 8. Fully adjustable variables
 - 9. Modbus RS485 communications
 - 10. LED indicators
 - 11. Common ¼" quick connect terminations.

2.3 IDENTIFICATION

- A. Equipment:
 - 1. Terminology: Match schedules as closely as possible.
 - 2. Stencils for Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
 - a. Lettering Size: Minimum letter height of 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
 - b. Stencil Material: Fiberboard or metal.
 - c. Paint: Exterior, alkyd enamel. Paint may be in pressurized spray-can form.
- B. In addition to the equipment tag, equipment located above the ceiling that requires servicing shall be labeled on the ceiling grid using a labeling machine.
- C. Piping Identification Devices
 - 1. Manufactured Pipe Markers, General: Seton, Brady, or approved equal; preprinted, color-coded, with lettering indicating service, and showing direction of flow.
 - 2. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length. Size of letters and length of color field per ASME A13.1.
 - 3. Pipes with OD, Including Insulation; Full-band snap-around pipe markers extending 360 degrees around pipe at each location. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to

indicate direction of flow. Length of color field and size of letters shall be proportional to pipe OD.

- Types: Self-adhesive type: Seton Opti-Code; Snap-around type: Seton Setmark; Wrap-around type: Seton Ultra-mark; PVF over-laminated polyester construction seals in and protects graphics; suitable for outdoor or harsh environments.

D. Valve Tags & Schedules

- Valve Tags: Stamped or engraved 1-1/2" round with 1/4-inch letters for piping system legend and 1/2-inch black-filled numbers, with numbering scheme; 3/16" hole for fastener; Material: 19-gauge brass; Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.
- Valve Schedules: For each piping system, on standard-size bond paper. Also save in PDF format. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses. Valve-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws. Frame: aluminum. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

- E. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing. Size: 3 by 5-1/4 inches minimum. Large-size primary caption such as "DANGER". Color: Yellow background with black lettering.

2.4 PIPE JOINING MATERIALS

- A. Provide per local code.

- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

- C. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is indicated. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges. AWWA C110, rubber, flat face, 1/8 inch thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Press Connections

- Basis-of-Design Product: Subject to compliance with requirements, provide Viega LLC; ProPress, Apollo, or approved equal.
- Press ends shall have Viega Smart Connect, Apollo Leak Before Press, or similar technology designed into the fitting itself, allowing identification of an un-pressed fitting during pressure testing. The function of this feature is to provide the installer quick and

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

easy identification of connections which have not been pressed prior to putting the system into operation.

3. Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of ASME B16.51 and IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed, or an alternative supplied by the fitting manufacturer.
 4. Steel: Cold Press Mechanical Joint Fitting shall conform to material requirements of ASTM A420 or ASME B16.3 and performance criteria ANSI/CSA LC4. Sealing elements for press fittings shall be HNBR. Sealing elements shall be factory installed, or an alternative supplied by the fitting manufacturer. Piping and fittings shall comply with CSA LC-4 and local codes.
- E. Mechanical Coupling Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents and exterior environment. Gasket design shall be such that the entire coupling housing is isolated from the system contents to prevent galvanic action and inhibit galvanic corrosion.
- F. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.
- G. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- H. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAgl, silver alloy for refrigerant piping, unless otherwise indicated.
- I. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Solvent Cements for Joining Plastic Piping: CPVC Piping: ASTM F 493. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
- K. Plastic-to-Metal Transition Fittings: one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.
- L. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657. Plain-End Pipe and Fittings: Use butt fusion. Plain-End Pipe and Socket Fittings: Use socket fusion.
- M. Provide dielectric isolation at the connection of dissimilar metals. Provide brass ball valves or fittings; or Watts Series LF3000 (lead free) or approved equal.
- 2.5 SLEEVES & ESCUTCHEONS
- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral water-stop unless otherwise indicated.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Provide penetration system where service pipes penetrate through foundation wall or floor. Make installation watertight. Mechanical Sleeve Seals: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve; Thunderline Link-Seal, Advanced Product & Systems, LLC, Garlock, or approved equal.
 - 1. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Glass-reinforced nylon.
 - 3. Connecting Bolts and Nuts: Stainless steel, of length required to secure pressure plates to sealing elements.
- G. Escutcheons shall be manufactured from nonferrous metals and shall be chrome-plated. Metals and finish shall conform to ASME A112.19.2. Escutcheons shall be one-piece type where mounted on chrome-plated pipe or tubing, and one-piece of split-pattern type elsewhere. ID shall closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers the opening. Escutcheons shall have setscrews for maintaining a fixed position against a surface.

2.6 ROOF PIPING

- A. Roof Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping. Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration. Bases: One or more; plastic. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.
- B. Roof Pipe Penetrations: Thybar TCC-3 curb system with cover and pipe boots.
 - 1. Prefabricated roof curb to be manufactured of prime galvanized steel construction, 20, 18, 16 or 14 gauge as required, meeting ASTM A653/653M, with welded corners and with seams joined by continuous welds. Roof curb shall be internally reinforced with angles 48" on center, factory insulated with 1-½" thick 3# density fiberglass insulation, and factory installed wood nailers. Height to be 18" above roof deck or as detailed. Top of all roof curbs shall be level, with pitch built into curb when deck slopes.

2. ABS Thermoplastic cover on top of curb.
3. Graduated Boots Molded or Weather-Resistant Plasticsol
4. SS pipe clamps, 2 per boot.

2.7 HANGERS AND SUPPORTS FOR PIPING AND EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. B-Line Systems, Inc.
 2. Carpenter & Patterson, Inc.
 3. Grinnell Corp.
 4. Hubbard Enterprises/Holdrite
 5. National Pipe Hanger Corp.
 6. Piping Technology & Products, Inc.
 7. Unistrut
 8. Anvil International, Inc.
 9. Empire
- B. Provide in accordance with MSS SP69 - Manufacturers Standardization Society: Pipe Hangers and Supports- Selection and Application. Steel pipe hangers and supports shall have the manufacturer's name, part number, and applicable size stamped on the part itself for identification.
- C. The materials of pipe hanging and supporting elements shall be in accordance with MSS SP-58. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Do not allow dissimilar metals to come into contact.
- D. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel." Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications." Comply with provisions in ASME B31 Series, "Code for Pressure Piping." Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.
- E. Delegated-Design Submittal: For hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation. Show fabrication and installation details and include calculations. Provide for the following: trapeze pipe hangers, metal framing systems, pipe stands, equipment supports.
- F. Hangers:
1. Uninsulated pipes 2 inch and smaller: Adjustable steel swivel ring (band type) hanger, Type 10, B-Line B3170; Adjustable steel swivel J-hanger, Type 5, B-Line B3690;

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- Malleable iron ring hanger, Type 12, B-Line B3198R or hinged ring hanger, B3198H. Adjustable steel clevis hanger, Type 1, B-Line B3100.
2. Uninsulated pipes 2-1/2 inch and larger: Adjustable steel clevis hanger, Type 1, B-Line B3100.
 3. Insulated Hot piping: 2 inch and smaller pipes: use adjustable steel clevis with galvanized sheet metal shield. Type 1, B-Line B3100 with Type 40, B-Line B3151 series insulation protection shield. 2-1/2 inch and larger pipes: Type 41 or Type 43 with Type 39A/39B, B3160-B3165 series pipe covering protection saddle.
 4. Insulated Cold piping: use adjustable steel clevis with galvanized sheet metal shield. Type 1, B-Line B3100 with Type 40, B-Line B3151 series insulation protection shield.
 5. Copper Tubing Supports Hangers shall be sized to fit copper tubing outside diameters. Adjustable steel swivel ring (band type) hanger, Type 10, B-Line B3170CT. Malleable iron ring hanger, Type 12, B-Line B3198RCT or hinged ring hanger B3198HCT. Adjustable steel clevis hanger, Type 1, B-Line B3104CT. For supporting copper tube to strut use plastic inserted vibration isolation clamps, B-Line BVT series.
 6. Plastic Pipe Supports: V-Bottom clevis hanger with galvanized 18-gauge continuous support channel, Type 1, B-Line B3106 and B3106V plastic pipe support channel, to form a continuous support system for plastic pipe or flexible tubing.
- G. Pipe Clamps: When flexibility in the hanger assembly is required due to horizontal movement, use pipe clamps with weldless eye nuts, Type 4, B-Line B3140. For insulated lines use double bolted pipe clamps, Type 3, B-Line B3144.
- H. Multiple or Trapeze Hanger: Trapeze hangers shall be constructed from 12-gauge roll formed ASTM A1011 SS Grade 33 structural steel channel, 1-5/8 inch by 1-5/8-inch minimum, B-Line B22 strut or stronger as required. Mount pipes to trapeze with 2-piece pipe straps sized for outside diameter of pipe, B-Line B2000 Series.
- I. Wall Supports: Pipes 4" and smaller: Carbon steel J-hanger, B-Line B3690. Pipes larger than 4": Welded strut bracket and pipe straps, Type 31 light welded steel bracket, B-Line B3064. Provide Type 32 or Type 33 for heavier loads.
- J. Floor Supports: Hot piping under 6 inch and cold piping: Carbon steel adjustable pipe saddle and nipple attached to steel base stand sized for pipe elevation. Type 38 adjustable pipe saddle, B-Line B3093 and B3088T base stand; or Type 39, B3090 and B3088 base stand. Pipe saddle shall be screwed or welded to appropriate base stand. Hot piping 6 inch and larger: Adjustable Roller stand with base plate, Type 46, B3118SL. Adjustable roller support and steel support sized for elevation, B-Line B3124.
- K. Vertical Supports: Steel riser clamp sized to fit OD of pipe, Type 8, B-Line B3373.
- L. Supplementary Structural Supports: Design and fabricate supports using structural quality steel bolted framing materials as manufactured by Cooper B-Line. Channels shall be roll formed, 12-gauge ASTM A1011 SS Grade 33 steel, 1-5/8 inch by 1-5/8 inch or greater as required by loading conditions. Submit designs for pipe tunnels, pipe galleries, etc., to engineer for approval. Use clamps and fittings designed for use with the strut system.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- M. Beam Clamps shall be used where piping is to be suspended from building steel. Clamp type shall be selected based on load to be supported, and load configuration. C-Clamps shall have locknuts and cup point set screws, Type 23, B-Line B351L. Refer to manufacturer's recommendation for setscrew torque. Retaining straps shall be used to maintain the clamps position on the beam where required.
- N. Concrete Inserts: Cast in place spot concrete inserts shall be used where applicable; either steel or malleable iron body, Type 18, B-Line B2500 or B3014. Spot inserts shall allow for lateral adjustment and have means for attachment to forms. Select inserts to suit threaded hanger rod sizes, B-Line N2500 or B3014N series. Continuous concrete inserts shall be used where applicable. Channels shall be 12 gauge, ASTM A1011 SS Grade 33 structural quality carbon steel, complete with Styrofoam inserts and end caps with nail holes for attachment to forms. The continuous concrete insert shall have a load rating of 2,000 lbs./ft. in concrete, B-Line B22I, 32I, or 52I. Select channel nuts suitable for strut and rod sizes.
- O. For air conditioning and other vibrating system applications, use a clamp that has a vibration dampening insert and a nylon inserted locknut. For copper and steel tubing use B-Line BVT-Series Vibraclamps. For larger tubing or piping subjected to vibration, use neoprene or spring hangers as required. For base mounted equipment use vibration pads, molded neoprene mounts, or spring mounts as required.
- P. Accessories
1. Hanger Rods shall be threaded both ends or continuous threaded rods of circular cross section. Use adjusting locknuts at upper attachments and hangers. No wire, chain, or perforated straps are allowed.
 2. Shields shall be 180-degree galvanized sheet metal, 12-inch minimum length, 18-gauge minimum thickness, designed to match outside diameter of the insulated pipe, B-Line B3151.
 3. Pipe protection saddles shall be formed from carbon steel, 1/8-inch minimum thickness, sized for insulation thickness. Saddles for pipe sizes greater than 12 inch shall have a center support rib.
- Q. Indoor Finishes: Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper®. Additional PVC coating of the epoxy painted hanger shall be used where necessary. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633; or shall have an electro-deposited green epoxy finish, B-Line Dura-Green®. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green®.
- R. Outdoor Finishes: Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. Hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
- S. Unistrut (MFMA) Manufacturer Metal Framing System:

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Unistrut Corporation
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. Thomas & Betts Corporation.
2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes. Standard: MFMA-4.
3. Channels: Continuous slotted steel channel with in-turned lips. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
4. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
5. Coating: Unistrut Perma-green or similar.

2.8 BRAIDED EXPANSION LOOPS (MANUFACTURED ONLY, NO FIELD FABRICATED)

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Metraflex Co.
 - b. Flex Hose Co., Inc.
 - c. Flexicraft
- B. Flexible loops shall consist of two flexible sections of hose and braid, two 90° elbows, and an 180° return assembled in such a way that the piping does not change direction but maintains its course along a single axis. Flexible loops shall have a factory supplied, center support nut located at the bottom of the 180° return, and a drain/air release plug. Flexible loops shall impart no thrust loads to system support anchors or building structure. Loops shall be provided in a neutral, pre-compressed or pre-extended condition as required for the application. For steam service, loops must be provided with flexible legs horizontal to prevent condensate buildup. Provide and guide per manufacturer's recommendations. Materials of construction and end fitting type shall be consistent with pipe material and equipment/pipe connection fittings. For natural gas service, connectors shall be A.G.A. certified. Basis of Design: Flexible expansion loops to be "Metraloop" as manufactured by the Metraflex Company.
- C. Loops for domestic hot water shall be NSF-372 lead free certified.
- D. For tight pipe runs, provide nested loops.
- E. Anchors: Metraflex Model PA anchor clamp or approved equal. Provide light weight anchor for low load; compatible with braided expansion loop manufactures recommendations for "no-thrust" expansion joints. Clamp to pipe.
- F. Guides: Metraflex Model PGIV shall be of the radial type employing a heavy wall guide cylinder with weld down or bolt down anchor base. A two-section guide spider, having 1/8"

maximum diametrical clearance with guide cylinder inside diameter, bolted or welded tight to the carrier pipe which slides through the guide cylinder I.D. Cylinder shall be of sufficient size to clear pipe insulation and long enough to prevent over travel of the spider.

2.9 THERMOMETERS AND PRESSURE GAUGES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ashcroft
 2. Weksler
 3. Ernst Gauge Co.
 4. Terrice: H. O. Terrice Co.
 5. Weiss Instruments, Inc.
- B. The proper range will be selected so that the operating temperature/pressure of the material being measured will fall approximately in the middle of the scale.
- C. Liquid-In-Glass Industrial Thermometers: shall be a blue reading (Fill Type Spirit: Blue colored, organic) liquid-in-glass adjustable angle type, 9" scale, cast aluminum case with cured polyester powder coating, clear acrylic window and brass separable thermowell. Thermometers will be Terrice BX9 Series or approved equal.
- D. Thermowells: Provide fitting with protective socket for installation in threaded pipe fitting to hold fixed thermometer stem. Material shall be compatible with the piping. Where insulation thickness exceeds 2", a longer stem thermometer will be used with an extension neck brass separable thermowell. The extension neck will be at least 2" long. Cap: Threaded, with chain permanently fastened to socket.
- E. Pressure gauges shall be 3½" dial size with a flangeless cast aluminum case, stainless steel friction ring and glass window. The movement will be brass with a bronze bourdon tube and brass socket. The dial face will be white with black figures; pointer will be friction adjustable type. Accuracy shall be ±1% of scale range, ASME B40.1 Grade 1A. Pressure gauges will be Terrice No. 600CB approved equal.
1. Connector: Brass, NPT 1/4.
 2. Units of Measure: PSI
 3. Provide silicone-damped movement.
 4. Provide pressure-gauge needle valve and snubber (Teric No. 872 pressure snubbers) in piping to pressure gauges; ASME B40.5, NPS 1/4 brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure.
 5. Needle Valves: Terrice 735 Series; NPS 1/4 brass or 316 stainless steel needle type.

2.10 MISCELLANEOUS

- A. Grout: ASTM C 1107, Grade B, non-shrink, and nonmetallic, dry hydraulic-cement grout. Characteristics: Post-hardening, volume adjusting, non-staining, non-corrosive, nongaseous, and recommended for interior and exterior applications. Design Mix: 5000-psi, 28-day compressive strength. Packaging: Premixed and factory packaged.
- B. Equipment shall be vibration isolated to prevent vibration transmission to the building structure.

PART 3 - EXECUTION

3.1 DEMOLITION AND REMOVALS

- A. Refer to Division 1 for general demolition requirements and procedures.
- B. Disconnect, demolish, and remove plumbing and mechanical systems, equipment, and components indicated to be removed.
 - 1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
 - 2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
 - 3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and cap and seal remaining ducts with same or compatible ductwork material.
 - 4. Ducts to Be Abandoned in Place: Cap and seal ducts with same or compatible ductwork material.
 - 5. Equipment to be Removed: Disconnect and cap services and remove equipment.
 - 6. Equipment to be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
 - 7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
- C. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.

3.2 COMMON REQUIREMENTS

- A. Work shall be conducted, installed, and completed in a neat and professional manner reflecting a minimum level of competent workmanship.
- B. The drawings show the general arrangement of systems and equipment but do not show all required fittings and offsets that may be necessary to connect pipes and ductwork to equipment, and to coordinate with other trades. Provide necessary fittings, offsets and runs based on field

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

measurements and at no additional cost. Coordinate with other trades for space available and relative location of equipment and accessories. Pipe and duct location on the drawings shall be altered by the contractor where necessary to avoid interferences and clearance difficulties.

- C. Fabricate based on field measurements.
- D. Corrections or comments made on the shop or coordination drawings during the review do not relieve Contractor from compliance with requirements of the drawings and specifications. The Contractor is responsible for: confirming and correcting quantities; checking electrical characteristics and dimensions; selecting fabrication processes and techniques of construction; coordinating his work with that of other trades; and performing work in a safe and satisfactory manner.
- E. Protection and Cleaning: Equipment and materials shall be carefully handled, properly stored, and adequately protected to prevent damage before and during installation, in accordance with the manufacturer's recommendations. Damaged or defective items shall be replaced. Protect finished parts of equipment. Close duct and pipe openings with caps or plugs during installation. Tightly cover and protect fixtures and equipment against dirt, water, chemical, or mechanical injury. At completion of work thoroughly clean fixtures, exposed materials, and equipment.
- F. Provide piping, ductwork, and equipment to allow maximum headroom unless specific mounting heights are indicated. Provide equipment level and plumb, parallel, and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- G. Provide equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- H. Coordinate location of piping, ductwork, sleeves, inserts, hangers, and equipment. Locate to clear other construction, services, and utilities.
- I. Provide piping and ductwork in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- J. Provide systems above accessible ceilings to allow sufficient space for ceiling panel removal.
- K. Verify final equipment locations for roughing-in.
- L. Do not enclose, cover, or put into operation until inspected and approved by authorities having jurisdiction.
- M. The contract documents indicate required valves, fittings, and accessories. If additional materials are required by code or manufacturer's instructions, they shall be provided at no cost to the owner.
- N. Any hot work operations that are performed during this project shall be permitted by use of the FM Global Hot Work Permit System. The FM Global Hot Work Permit System shall be used to

supervise all hot work operations (cutting, welding, brazing, grinding, soldering, etc.) performed outside of any designated welding areas. A written policy statement shall specify who has the authority to issue permits on all shifts. In addition, a constant fire watch shall be continued for 1 hr. after work is completed and the area shall be monitored for an additional 3 hrs. after that.

3.3 PIPING INSTALLATIONS

- A. Provide piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
 - 1. Provide piping to permit valve servicing.
 - 2. Provide equipment and other components to allow right of way for piping installed at required slope.
 - 3. Provide free of sags and bends.
 - 4. Provide unions or flanges at connections to equipment.
 - 5. Provide fittings for changes in direction and branch connections.
 - 6. Make allowances for application of insulation.
- B. Provide piping adjacent to equipment and machines to allow service and maintenance.
- C. Use transition fitting to join dissimilar piping materials. Connect piping in sizes indicated, but not smaller than sizes of unit connections.
- D. Select system components with pressure rating equal to or greater than system operating pressure.
- E. Plastic piping: Piping shall be installed to avoid damage from adjacent light fixtures. In certain construction situations, these plastic pipes may be installed near recessed light fixtures in ceilings. Light fixtures may have exterior temperatures as high as 194°F.
- F. Plumbing: General layout shown, provide piping and components as required by the local plumbing code. A licensed master plumber shall perform or supervise the work and provide layouts, piping, and fittings as required by code.

3.4 PIPING JOINT CONSTRUCTION

- A. Pipe and tube required by the applicable standard to be cleaned and capped shall be delivered to the job site with factory-applied endcaps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture. Protect stored pipe and tube from moisture and dirt. Elevate above grade. When stored inside, do not exceed the structural capacity of the floor. Protect fittings, flanges, and piping specialties from moisture and dirt. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- B. Joints shall be fabricated, joined, and tested per the piping and fitting manufacturer's instructions. Joint preparation, setting and alignment, joining process, timing, hanger spacing, and working pressure shall be in accordance with the pipe and fitting manufacturer's specifications.
- C. Join pipe and fittings according to the following requirements and the relevant specification section specifying piping systems.
- D. Ream ends of pipes and tubes and remove burrs. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- E. Installer Qualifications
 - 1. Pipe fitters shall be qualified in the procedure used to perform the pipe joining.
 - 2. The contractor is responsible for documenting the qualification and training records of each pipe fitter. Pipe fitters shall have current, formal training on the pipe joining method.
 - 3. Contractor must submit documentation that lists personnel assigned to this project prior to beginning construction who have successfully completed formal training conducted by an authorized manufacturer's representative. The Contractor Training documentation shall be specific to the manufacturer of the pipe and fittings.
 - 4. Personnel's training documentation must be current and have been updated within the past two (2) years. Training received more than two years prior to operation with no evidence of activity within the past 6 months shall not be considered current.
 - 5. Piping Warranty: Contractor shall provide, and document required training and required by the piping system manufacturer to maintain the piping manufacturer's warranty.
- F. Provide dielectric isolation at the connection of the dissimilar piping (copper and steel).
- G. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- H. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- I. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dry-seal threading is specified.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- J. Press connections:
1. The joints shall be pressed using the tools approved by the manufacturer.
 2. Always examine the pipe to ensure it is fully inserted into the fitting prior to pressing the joint.
 3. Pipe ends shall be cut on a right angle (square) to the pipe.
 4. Copper: The tubing shall be fully inserted into the fitting and the tubing marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing to assure the tubing is fully engaged (inserted) in the fitting. The joints shall be pressed using the tools approved by the manufacturer.
 5. Steel: Pipe ends shall be reamed chamfered, and paint, lacquer, grease, oil, or dirt shall be removed from the pipe end with an abrasive cloth, or with the Rigid MegaPress pipe end prep tool. Sealing elements shall be verified for the intended use. Visually examine the fitting sealing element to ensure there is no damage. Utilizing a Viega insertion depth inspection gauge mark the tube wall, with a felt tip pen, at the appropriate location, or insert the pipe fully into the fitting and mark the pipe wall at the face of the fitting.
- K. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid or flexible, where required, grooved-end-pipe couplings. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by the grooved coupling manufacturer. Grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove. A Victaulic factory trained field representative shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and installation of grooved piping products. Factory trained representative shall periodically review the product installation. The contractor shall remove and replace any improperly installed products.
- L. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators. Bevel plain ends of steel pipe. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- M. Flanged Joints: Provide appropriate gasket material, size, type, and thickness for service application. Provide gasket concentrically positioned. Use suitable lubricants on bolt threads.
- N. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix. PVC Piping: Join according to ASTM D 2855.

3.5 PIPE PENETRATIONS, SLEEVES, & ESCUTCHEONS

- A. Pipe penetrations shall be sealed, provide sealants for pipe penetrations
- B. Provide allowance for thermal expansion and contraction of copper tubing passing through a wall, floor, ceiling, or partition by wrapping with an approved tape or pipe insulation or by installing through an appropriately sized sleeve.
- C. Sleeve Clearance: Sleeve through floors, walls, partitions, and beams shall be one inch greater in diameter than external diameter of pipe. Sleeve for pipe with insulation shall be large enough to accommodate the insulation.
- D. Provide sleeves for pipes passing through concrete and masonry construction. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint. Cut sleeves to length for mounting flush with both surfaces. Provide sleeves in new walls and slabs as new walls and slabs are constructed. Provide steel pipe sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Piping through concrete or masonry shall not be subject to any load from the building construction.
 - 1. Sleeves are not required in drywall construction.
 - 2. Sleeves are not required for core-drilled holes. Provide core drilling as required.
- E. To prevent accidental liquid spills from passing to a lower level, provide the following:
 - 1. For sleeves: Extend sleeve 1-1/2 inch above finished floor and provide sealant for watertight joint.
 - 2. For blocked out floor openings: Provide 1-1/2-inch angle set in silicone adhesive around opening.
 - 3. For drilled penetrations: Provide 1-1/2-inch angle ring or square set in silicone adhesive around penetration.
- F. Exterior- Pipe Penetrations: Provide sleeve-seal systems in sleeves at service piping entries into building. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and provide in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.
- G. Escutcheons:
 - 1. Provide escutcheons at wall, floor, and ceiling penetrations in exposed finished locations and within cabinets and millwork.
 - 2. Provide escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 3. Use deep-pattern escutcheons if required to conceal protruding pipe fittings.

- H. Plastic and copper piping penetrating framing members, and within one-inch of the framing, shall be protected with 10-gauge steel nailing plates. The steel plate shall extend along the framing member a minimum of 1.5” beyond the OD of the pipe or tubing.

3.6 PIPE HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Provide hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or provide intermediate supports for smaller diameter pipes as specified for individual pipe hangers. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Provide per manufactures recommendations and calculations.
- D. Thermal-Hanger Shield Installation: Provide in pipe hanger or shield for insulated piping.
- E. Fastener System Installation: Provide powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Provide fasteners according to powder-actuated tool manufacturer's operating manual. Provide mechanical-expansion anchors in concrete after concrete is placed and completely cured. Provide fasteners according to manufacturer's written instructions.
- F. Provide hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- G. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- H. Provide hangers and supports to allow controlled thermal or seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- I. Provide lateral bracing with pipe hangers and supports to prevent swaying.
- J. Provide building attachments within concrete slabs or attach to structural steel. Provide additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Provide concrete inserts before concrete is placed; fasten inserts to forms and provide reinforcing bars through openings at top of inserts.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- K. Provide for expansion and contraction of the piping system. Since changes in direction in the system are usually sufficient to allow for expansion and contraction, hangers must be placed so as not to restrict this movement
- L. Pipe Slopes: Provide hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by plumbing code and ASME B31.9 for building services piping. Piping shall be supported in such a manner as to maintain its alignment and prevent sagging.
- M. Insulated Piping: Attach clamps and spacers to piping.
1. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 2. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
- N. Equipment Supports: Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor. Grouting: Place grout under supports for equipment and make bearing surface smooth. Provide lateral bracing, to prevent swaying, for equipment supports.
- O. Metal Fabrications: Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals. Obtain fusion without undercut or overlap. Remove welding flux immediately. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.
- P. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.
- Q. Hanger and Support Schedule
1. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
 2. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
 3. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- R. Hanger Spacing
1. Support piping and tubing not listed below according to MSS SP-69 and manufacturer's written instructions.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

2. Load Distribution: Provide hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment. Space hangers according to pipe manufacturer's written instructions for service conditions. Avoid point loading.
 3. Space and provide hangers with the fewest practical rigid anchor points.
 4. Piping shall be supported at intervals sufficiently close to maintain correct pipe alignment and to prevent sagging or grade reversal.
 5. Pipe shall be supported at branch ends and at changes of direction.
 6. Provide hangers for steel piping with the following maximum horizontal spacing and minimum rod sizes:
 - a. NPS $\frac{3}{4}$ to 1: Maximum span, 6 feet; minimum rod size, $\frac{3}{8}$ inch.
 - b. NPS 1- $\frac{1}{4}$: Maximum span, 8 feet; minimum rod size, $\frac{3}{8}$ inch.
 - c. NPS 1- $\frac{1}{2}$: Maximum span, 9 feet; minimum rod size, $\frac{3}{8}$ inch.
 - d. NPS 2: Maximum span, 10 feet; minimum rod size, $\frac{3}{8}$ inch.
 - e. NPS 2- $\frac{1}{2}$ to 3: Maximum span, 10 feet; minimum rod size, $\frac{1}{2}$ inch.
 - f. NPS 4 to 5: Maximum span, 10 feet; minimum rod size, $\frac{5}{8}$ inch.
 - g. NPS 6 to 8: Maximum span, 10 feet; minimum rod size, $\frac{3}{4}$ inch.
 - h. NPS 10 to 12: Maximum span, 10 feet; minimum rod size, $\frac{7}{8}$ inch.
 7. Provide hangers for copper piping with the following maximum horizontal spacing and minimum rod sizes:
 - a. NPS $\frac{1}{2}$ and $\frac{3}{4}$: Maximum span, 5 feet; minimum rod size, $\frac{1}{4}$ inch.
 - b. NPS 1: Maximum span, 6 feet; minimum rod size, $\frac{1}{4}$ inch.
 - c. NPS 1- $\frac{1}{4}$: Maximum span, 7 feet; minimum rod size, $\frac{3}{8}$ inch.
 - d. NPS 1- $\frac{1}{2}$ to 2: Maximum span, 8 feet; minimum rod size, $\frac{3}{8}$ inch.
 - e. NPS 2- $\frac{1}{2}$: Maximum span, 9 feet; minimum rod size, $\frac{3}{8}$ inch.
 - f. NPS 3: Maximum span, 10 feet; minimum rod size, $\frac{3}{8}$ inch.
 - g. NPS 4: Maximum span, 10 feet; minimum rod size, $\frac{1}{2}$ inch.
 - h. Maximum vertical steel and copper pipe attachment spacing: 10 feet.
- S. Place a hanger within 12 inches of each horizontal elbow.

3.7 VALVE INSTALLATION

- A. Valves shall be installed in accordance with the manufacturer's recommendations.
- B. Provide valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown. Locate valves for easy access and provide separate support where necessary.
- C. Provide valves in horizontal piping with stem at or above center of pipe.
- D. Provide valves in position to allow full stem movement.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- E. Provide strainers on supply side of each control valve and elsewhere as indicated or recommended by component manufacturer to have strainer protection. Provide valved drain and hose connection on strainer blow down connection.
 - 1. Provide with provisions for service clearance.
 - 2. Remove and clean strainer after 24 hours of operation and after 30 days of operation.
- F. Control valves shall be installed so that they are accessible and serviceable and so that actuators may be serviced and removed without interference from structure or other pipes and/or equipment.
- G. Isolation valves shall be installed so that the control valve body may be serviced without draining the supply/return side piping system. Unions shall be installed at connections to screw-type control valves.
- H. Provide check valves at each pump discharge and elsewhere as required to control flow direction.
- I. Provide hose end drain valves for equipment, at base of each water riser, at low points in horizontal piping, and where required to drain water piping.

3.8 IDENTIFICATION

- A. Provide equipment markers on each item of scheduled equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated. Locate markers where accessible and visible. Equipment located above the ceiling that requires servicing shall be labeled on the ceiling using a labeling machine.
 - 1. Letters shall be ¼" high, black.
 - 2. Label equipment above ceiling that requires servicing or access. Locate labels on the ceiling grid, adjacent to the ceiling tile that provides the best access to the valve or item that requires servicing.
- B. Piping Identification:
 - 1. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; mechanical rooms; accessible maintenance spaces such as shafts and plenums; and exterior exposed locations as follows:
 - a. Near each valve and control device.
 - b. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - c. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - d. At access doors and similar access points that permit view of concealed piping.
 - e. Near major equipment items and other points of origination and termination.
 - f. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

- g. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
 - 2. Directional Flow Arrows: Arrows shall be provided to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
 - 3. Apply "Electric Traced" labels to the outside of heat-traced insulation.
- C. Provide tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule. Mount valve schedule on wall in accessible location in each major equipment room. Provide (2) copies of valve schedules in digital format.
- D. Relocate mechanical identification materials and devices that have become visually blocked by other work. Clean faces of mechanical identification devices.

3.9 THERMOMETERS AND PRESSURE GAUGES

- A. Provide thermometers and adjust vertical and tilted positions. Provide thermowells with extension on insulated piping. Provide separable sockets in vertical position in piping tees.
- B. Provide pressure gauges in piping tees with pressure-gauge valve located on pipe at most readable position. Provide valve and snubber in piping for each pressure gage for fluids.
- C. Calibrate according to manufacturer's written instructions, after installation.
- D. Adjust faces to proper angle for best visibility. Clean windows and clean factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touchup paint.

3.10 BRAIDED EXPANSION LOOP INSTALLATION

- A. Provide and guide per manufacturers' installation instructions and Mechanical Contractors Association of America "Guidelines for Quality Piping Installations". Flexible hose expansion loop return fittings shall be supported to allow movement.
- B. Nesting Clearance. Often several Metraloops are nested inside of each other, when this is the case, the installer shall verify that there is enough clearance between the Metraloops after insulation to allow for the full expected movement.
- C. Provide pipe anchors according to expansion fitting manufacturer's written instructions.
 - 1. Provide anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
 - 2. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

3. Anchor Attachment to Copper Tubing: Attach with pipe hangers. Use MSS SP-69, Type 24, U-bolts bolted to anchor.
 4. Concrete Anchors: Attach by fasteners, follow fastener manufacturer's written instructions.
- D. A pipe guide shall be provided anywhere within 15 pipe diameters on each side of the braided expansion loop. Loops anchored on one side need only one guide on the traveling side. Attach guides to pipe and secure to building structure.

3.11 ERECTION OF SUPPORTS AND ANCHORAGES

- A. Fasten wall-hanging items securely to supports attached to building substrate if supports are specified and to building wall construction if no support is indicated. Fasten recessed-type items to reinforcement built into walls.
- B. Wood: Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor materials and equipment. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Provide fasteners without splitting wood members. Attach to substrates as required to support applied loads.
- C. Metal: Provide in accordance with Division 5. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor materials and equipment. Field Welding: Comply with AWS D1.1.
- D. Grouting: Provide per manufacturer's instructions. Mix and provide grout for equipment base bearing surfaces, pump and other equipment base plates, and anchors. Clean surfaces that will encounter grout. Provide forms as required for placement of grout. Avoid air entrapment during placement of grout. Place grout, completely filling equipment bases. Place grout on concrete bases and provide smooth bearing surface for equipment. Place grout around anchors. Cure placed grout.

3.12 FIRESTOPPING

- A. Provide through-penetration firestop systems to comply with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. UL-Classified Systems shall be provided for rated walls and floors.
- C. Engage an experienced installer who is certified, licensed or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to provide firestop products per specified requirements.
- D. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are provided according to specified requirements.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- E. Provide through-penetration firestop systems that are compatible with one another, with the substrates forming openings, and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- F. Provide components for each through-penetration firestop system that are needed to provide fill materials. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- G. General: Use only through-penetration firestop system products that have been tested for specific fire-resistance-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance. Keep areas of work accessible until inspection by authorities having jurisdiction.
- H. Inspecting Agency: Owner may 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. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.
- I. 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 through-penetration firestop systems immediately and provide new materials to produce systems complying with specified requirements.

3.13 PAINTING

- A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.14 ROOFING

- A. Coordinate installation of roof curbs, equipment supports, and roof penetrations.
- B. Roof Pipe Stand Installation: Provide per manufactures recommendations and calculations. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount them on a smooth roof surface. Do not penetrate roof membrane. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb.
- C. Roof Pipe Penetrations: Provide curb system with cover and pipe boots.
- D. Do not locate mechanical equipment within 10-feet of the roof edge.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- E. Roof Edge Fall Protection: Basis of Design: Keegard “Rooftop Guardrail for Narrow Spaces”, or equal. Provide freestanding/non-penetrating roof edge protection system, including pipe railings, uprights, bases, counterweights, and fittings. Freestanding counterweighted guardrail system with 42 inches minimum height to provide a pedestrian egress barrier on the roof to withstand a minimum load of 200 lb. in any direction to the top rail per OSHA Regulation 29 CFR 1910.23. Pipe: Steel, 1-1/2 inches schedule 40, galvanized, galvanized or stainless-steel construction. Provide galvanized steel bases are galvanized with a rubber pad on underside of the component (set on roof, without disturbing existing adhered roof membrane).

3.15 PROJECT CLOSEOUT

A. Starting and Adjusting

1. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace them with new units, and retest.
2. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.
3. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
4. Provide commissioning per manufacturer's instructions. This start-up shall include verification of proper installation, system initiation, adjustment, and fine tuning.
5. Start-up shall not be considered complete until the sequence of operation, including alarms, has been sufficiently demonstrated to the Owner or Owner's designated representative. This jobsite visit shall occur only after hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.

B. Follow Closeout procedures as per Division 1.

C. Provide Demonstration and Training in accordance Division 1.

D. Provide Project Record Documents in accordance with Division 1. In addition, per ASHRAE 90.1-2016: Provide record drawings of the actual installation to the building owner. Record drawings shall include, as a minimum, the location and performance data on each piece of equipment; general configuration of the duct and pipe distribution system, including sizes; and the terminal air or water design flow rates.

E. Provide Operation and Maintenance information in accordance with Division 1. In addition, per ASHRAE 90.1: Provide an operating manual and a maintenance manual to the building owner. Manuals shall include, at a minimum, the following:

1. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
2. Operation manuals and maintenance manuals for each piece of equipment and system requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
3. Names and addresses of at least one service agency.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

4. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.

END OF SECTION 230500

SECTION 230533 - HEAT TRACING FOR PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.
- B. Related Sections include the following:
 - 1. Section: "Common Work Results"
 - 2. Section 230700 "Mechanical Insulation".

1.2 SUMMARY

- A. Section includes heat tracing for piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, and furnished specialties and accessories.
 - 2. Schedule heating capacity, length of cable, spacing, and electrical power requirement for each electric heating cable required.
 - 3. Include plans, elevations, sections, and attachment details.
 - 4. Include diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For electric heating cables to include in operation and maintenance manuals.

1.5 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace electric heating cable that fails in materials or workmanship within specified warranty period. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ELECTRICAL HEAT TRACING SYSTEM

- A. The heating cable shall be XL-Trace cable as manufactured by Raychem Corporation, or approved equal. Voltage: 120/1/60.
- B. Comply with IEEE 515.1 “Standard for the Testing, Design, Installation, and Maintenance of Electrical Resistance Trace Heating for Commercial Applications”.
- C. The self-regulating heating cable shall consist of two (2) 16 AWG nickel-copper bus wires embedded in parallel in a self-regulating polymer core that varies its power output to respond to temperature all along its length, allowing the heating cable to be cut to length in the field. The heating cable shall be covered by a radiation-cross-linked, modified polyolefin dielectric jacket. To provide a ground path and to enhance the heating cable’s ruggedness, the heating cable shall have a braid of tinned copper and an outer jacket per section 427-23 of the NEC-1996.
- D. All heating-cable components shall be UL Listed for use as part of the system to provide pipe freeze protection. Component enclosures shall be rated NEMA 4X to prevent water ingress and corrosion. Installation shall not require the installing contractor to cut into the heating-cable core to expose the bus wires. Connection systems that require the installing contractor to strip the bus wires or that use crimps or terminal blocks, shall not be acceptable. All components that make an electrical connection shall be re-enterable for servicing. No component shall use silicone to seal the electrical connections. An exception will be made in areas where a conduit transition is required.
- E. Provide sufficient cable, as recommended by the manufacturer, to keep the pipe surface at 40°F minimum at -10°F winter outdoor design temperature.
 - 1. Outdoor Condenser Piping: 8 watts/foot
 - 2. Outdoor Makeup water piping: 8 watts/foot
- F. For plastic piping, furnish and install AT180 aluminum tape, 3” wide between the cable and the pipe surface.
- G. Provide automatic controls capable of and configured to shut off the systems when outdoor air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing.
- H. Provide Accessories
 - 1. Rayclic-PC power connection and end seal
 - 2. Rayclic fast connection system
 - 3. DigiTrace 1pt controller
 - 4. RTD with 10 ft flexible armor
 - 5. Electric Traced Label
 - 6. Glass tape

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces and substrates to receive electric heating cables for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. The system shall be installed according to the drawings and the manufacturer's instructions. The installer shall be responsible for providing a functional system, installed in accordance with applicable national and local requirements. Provide electric heating cable across expansion joints according to manufacturer's written instructions; use slack cable to allow movement without damage to cable.
- B. Provide electric heating cables after piping has been tested and before insulation is installed.
- C. Plumber shall purchase material, and shall be responsible for entire system, including testing before and after insulation. Installation, including all splices, tees and end terminations, shall be performed by plumbing contractor, with the exception of any power connections, which shall be installed and connected to power by the electrical sub-contractor.
- D. Provide electric heating cables according to IEEE 515.1.
- E. Provide coverage for piping, fittings, etc. exposed to freezing temperatures.
- F. Apply the heating cable linearly on the pipe after piping has been successfully pressure-tested. Secure the heating cable to piping with cable ties or fiberglass tape.
- G. Apply "Electric Traced" labels to the outside of the thermal insulation.

3.3 CONNECTIONS

- A. Ground equipment according to Division 26.
- B. Connect wiring according to Division 26. Each circuit shall be protected with a 30 mA Ground-Fault protection device.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform tests after cable installation but before application of coverings such as insulation, wall or ceiling construction, or concrete.
 - 2. Test cables for electrical continuity and insulation integrity before energizing.
 - 3. Set field-adjustable switches and circuit-breaker trip ranges.
 - 4. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
- C. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation on pipe-mounted cables.
- D. Cables will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 PROTECTION

- A. Protect installed heating cables, including non-heating leads, from damage during construction.
- B. Remove and replace damaged heat-tracing cables.

END OF SECTION 230533

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division Section: "Common Work Results"

1.2 SUMMARY

- A. Testing, Adjusting, and Balancing

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Reports:
 - 1. Deficiency Report: Following examination of installed system, prior to balancing, submit report indicating system deficiencies that would prevent proper testing, adjusting, and balancing of systems and equipment to meet specified performance.
 - 2. TAB Report: Submit the complete testing, adjusting, and balancing report, including any drawings indicating air outlets, thermostats, and equipment identified to correspond with data sheets.
 - 3. Reports shall be on TABB/SMACNA, AABC, or NEBB forms that indicate information addressing each of the testing methods, readings, and adjustments.
- C. Closeout Submittals: Provide complete copy of TAB report. Include report in Operation and Maintenance Manual.

1.4 QUALITY ASSURANCE

- A. An independent entity shall perform the TAB work.
- B. Special Warranty

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

1. Provide warranty for period of 90 days following submission of completed report, during which time Owner may request a recheck of up to 10% of total number of terminals, or resetting of any outlet, coil, or device listed in the test report.
2. Warranty shall meet the requirements of the following programs:
 - a. TABB – Quality Assurance Program
 - b. AABC – National Project Performance Guarantee
 - c. NEBB – Conformance Certification
- C. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."
- E. TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
 1. Systems are started and operating in a safe and normal condition.
 2. Temperature control systems are installed, complete, and operable.
 3. Verify HVAC control system is operating within the design limitations.
 4. Confirm that the sequences of operation comply with Contract Documents.
 5. Automatic and manual dampers are operable and fully open.
 6. Verify that controllers are calibrated and function as intended.
 7. Verify that controller set points are as indicated.
 8. Verify the operation of lockout or interlock systems.
 9. Verify the operation of valve and damper actuators.
 10. Verify that controlled devices are properly installed and connected to correct controller.
 11. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 12. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
 13. Suitable access to balancing devices and equipment is provided.
 14. Thermal overload protection is in place for equipment.
 15. Start-up air filters are removed.
 16. Final filters are clean and properly installed.

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BARROWS HALL
UNIVERSITY OF MAINE
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17. Duct and fan systems are clean.
 18. Fans are rotating correctly.
 19. Life safety and volume dampers are in place and open.
 20. Air coil fins are cleaned and combed.
 21. Access doors are closed, and duct end caps are in place.
 22. Air outlets are installed and connected.
 23. Hydronic systems are pressure tested, flushed, filled, and properly vented.
 24. Leak testing on duct system has been performed.
 25. Pumps are rotating correctly.
 26. Start-up/construction strainers have been removed and all permanent strainers are clean and in place.
 27. Gauges and/or test ports are properly located for balancing.
 28. Service and balance valves are fully open.
- B. If deficiencies are evident, submit Deficiency Report to Architect. Do not begin testing, adjusting, and balancing of environmental systems until deficiencies have been remedied.
- C. Existing Systems Pre-balance: Existing conditions and operations shall be documented prior to initiation of the project. This shall include measurement and documentation of existing airflows and water flows. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
1. Measure and record the operating speed, airflow, and static pressure of each fan and equipment with fans.
 2. Measure and record flows, temperatures, and pressures of each piece of equipment in each hydronic system. Compare the values to design or nameplate information, where information is available.
 3. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 4. Check the condition of filters.
 5. Check the condition of coils.
 6. Check bearings and other lubricated parts for proper lubrication.
 7. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.

3.2 HYDRONIC SYSTEM PROCEDURES

- A. Adhere to the follow procedure:
1. TABB – SMACNA TAB Procedural Guide, with particular focus on the following chapter: Hydronic System TAB Procedures.
 2. AABC – National Standards for Total System Balance.
 3. NEBB – Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems.

B. Hydronic balancing shall include the following minimum data:

1. Provide TAB for all hydronic systems and components.
2. Prepare itemized equipment schedules listing all heating and/or cooling elements and equipment in the systems to be balanced. List in order on equipment schedules, by pump or zone according to the design, all heating and/or cooling elements, all zone balancing valves, and circuit pumps, ending with the last items of equipment or transfer element in the respective zone or circuit. Include on schedule sheet column titles listing the location, type of element or apparatus, design conditions, and measured conditions. Prepare individual pump report sheets for each zone or circuit.
3. Adjust hydronic systems to provide plus or minus 10 percent of required design quantities.
4. Use calibrated Venturi tubes, orifices, metered fittings, pressure gages, and direct-reading instrumentation to determine flow rates for system balance. Where flow-metering devices are not installed, flow balance on temperature difference across various heat transfer elements in the system is acceptable.
5. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
6. Effect system balance with automatic control valves fully open to heat or cooling transfer elements.
7. Adjust hydronic distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
8. Test pumps and adjust flow. Record the following on pump report sheets:
 - a. Suction and discharge pressure.
 - b. Running amps and brake horsepower of pump motor under full flow and no flow conditions.
 - c. Pressure-drop across pump in feet of water and total GPM pump is handling under full flow conditions.
9. Where available pump capacity is less than total flow requirements or individual system parts, proportional balancing must be performed.

C. Set system's water flow rates within the following tolerances:

1. Hydronic Systems: Adjust to within 10 percent of design flow.
2. Hydronic terminal devices: Adjust to within plus or minus 10 percent of design flow.

3.3 ADJUSTING

- A. Recorded data shall represent actual measured or observed conditions.
- B. Permanently mark the setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.
- C. Final report to include identification of all key outlets, key branches, and key trunks in each air system that shows a critical path of no dampening from the fan to terminal device.

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BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- D. Final report to include identification of all key terminal devices, key branches, and key trunks in each hydronic system that shows a critical path of no throttling of valves from the pump to terminal device.
- E. Leave systems in proper working order by replacing guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

END OF SECTION 230593

SECTION 230700 – MECHANICAL INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section "Common Work Results for Mechanical"
 - 2. Division 23 Section "Heat Tracing for Piping"

1.2 SUMMARY

- A. This Section includes insulation and related components for Division 22 & Division 23.

1.3 ACTION SUBMITTALS

- A. Product Data: Identify thermal conductivity, Greenguard Certification, thickness, and jackets (both factory and field applied, if any), for each type of product indicated. For adhesives and sealants, provide documentation including printed a statement of VOC content.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
- C. Indoors: Materials shall have a flame spread index of less than 25 and a smoke developed index of less than 50 when tested in accordance with ASTM E 84, latest revision.
- D. Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.
- E. Provide accessory materials as part of insulation work under his section shall include closure materials, adhesives, mastics, and support materials; shall be as recommended by insulation material manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.
- B. All of the insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification.
- C. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer.
- D. Follow manufacturer's recommended handling practices.
- E. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades.
- F. Fiber Glass and Mold: Contractor shall take precaution to protect insulation. Any fiber glass insulation that becomes wet or torn should be replaced at no additional cost. Air handling insulation used in the air stream must be discarded if exposed to water.

1.6 COORDINATION

- A. Coordinate size and location of supports, hangers, and insulation shields. Coordinate clearance requirements with other trades for insulation application.
- B. Schedule insulation application after testing systems. Insulation application may begin on segments of systems that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Certainteed
 - 2. Knauf
 - 3. Owens-Corning
 - 4. John Mansville
 - 5. Armstrong
 - 6. Aeroflex USA

7. Nomaco K-Flex
8. Pabco.

2.2 PIPING INSULATION MATERIALS

A. Glass Fiber:

1. Knauf 1000° Pipe Insulation with ECOSE Technology meeting ASTM C547 Type IV Grade A, ASTM C585, and ASTM C795; rigid, molded, noncombustible per ASTM E136; k value: ASTM C335, 0.23 at 75°F mean temperature. Maximum Service Temperature: 1000°F, or Johns Manville's Micro-Lok® *HP* meeting ASTM C547, Type I, maximum service temperature of 850°F meeting the other requirements. Vapor Retarder Jacket: ASJ/SSL conforming to ASTM C1136 Type I, secured with self-sealing longitudinal laps and butt strips.
2. PVC Fitting Covers: The Proto Fitting Cover System or Johns Manville Zeston® polyvinyl chloride (PVC) parts shall consist of one piece and two piece pre-molded high impact UV-resistant PVC fitting covers with fiberglass inserts and accessories, which include elbows, tee/valves, end caps, mechanical line couplings, and specialty fittings. Fittings shall be made of Zeston® or LoSMOKE® grade PVC, 25/50 rated per ASTM E-84. Thermal Value of fiberglass insert: K value of 0.26 at 75°F; resistance to fungi and bacteria. (ASTM G 21, ASTM G 22): does not promote growth of fungi or bacteria.

B. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
3. Materials shall have a maximum thermal conductivity of 0.27 Btu-in/h-ft²- °F at a 75°F mean temperature when tested in accordance with ASTM C 177 or ASTM C 518, latest revisions.
4. Materials shall have a maximum water vapor transmission of 0.08 perm-inches when tested in accordance with ASTM E 96, Procedure-A, latest revision.
5. Provide Armaflex WB finish for outdoor exposed piping.

C. Closed Cell Pipe Insulation: Pittsburgh Corning Foamglas, or approved equal; a lightweight, rigid insulating material composed of millions of completely sealed glass cells, each an insulating space. ASTM C 552-00 "Specification for Cellular Glass Thermal Insulation" operating temperatures from -450°F to +900°F; water permeability 0.00 perm-inch.

D. Field-Applied Jackets For Piping: ASTM C 921, Type 1, unless otherwise indicated.

1. PVC: Johns Manville's Zeston® PVC fittings, jacketing, and accessories or Proto Corporation 25/50 or Indoor/Outdoor, UV-resistant fittings, jacketing and accessories, white. The fitting cover system consists of pre-molded, high-impact PVC materials with

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BARROWS HALL
UNIVERSITY OF MAINE
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- fiber glass inserts. Fiber glass insert has a thermal conductivity (k value) of 0.26 at 75° F mean temperature. Closures: stainless steel tacks, matching PVC tape, or PVC adhesive per manufacturer's recommendations.
2. Metal jackets: provide with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
 3. Aluminum Jacket: Factory cut and rolled to required size. Comply with ASTM B 209, 3003 alloy, and H-14 temper. Finish and Thickness: Corrugated finish, 0.010 inch thick. Moisture Barrier: 1-mil- thick, heat-bonded polyethylene and Kraft paper. Elbows: Preformed, 45- and 90-degree, short- and long-radius elbows; same material, finish, and thickness as jacket.
- E. www.ValveWraps.com "NO SWEAT" valve wraps. The removable and reusable wraps provide an ongoing protective covering to insulated valves. The valve wrap shall have a 1" thick fiberglass blanket insert to completely cover the insulated valve. The outer cover shall be made of DuPont Tychem QC that easily stretches around the insulated valve and is secured with a Velcro closure. Tychem QC consists of a durable Tyvek substrate quality coated with polyethylene.
1. Temperature Limits: 0°F to 450°F
 2. Sanitary/Odorless: Will not absorb odors. Provides no food for insects, rodents, or mildew. Resistant to fungi and bacteria. Does not promote mold growth.
 3. Jacket shall be impermeable to water.
 4. UV Resistant: Use indoors or outdoors.
 5. Long Lasting: Can be used and re-used once applied.
 6. Vibration Resistant: Will not settle or separate.
 7. Fire Safety: DuPont Tychem ® QC fabric is rated as "Class 1: Normal Flammability" with no unusual burning characteristics. The removable valve wrap fiberglass insulation inserts shall have a UL25/50 rating and are non-combustible per ASTM E 136.

PART 3 - EXECUTION

3.1 GENERAL APPLICATION REQUIREMENTS

- A. Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature. Insulation materials and accessories covered by this specification shall be delivered to the job site and stored in a safe, dry place with appropriate labels and/or other product identification. Store tapes, adhesives, mastics, cements, and insulation materials in ambient conditions in accordance with the recommendations of the manufacturer. Follow manufacturer's recommended handling practices. The contractor shall use whatever means are necessary to protect the insulation materials and accessories before, during, and after installation. No insulation material shall be installed that has become damaged in any way. The contractor shall also use all means necessary to protect work and materials installed by other trades. Contractor shall take precaution to protect insulation. Any fiber glass insulation that becomes wet or torn should be

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BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

replaced at no additional cost. Air handling insulation used in the air stream must be discarded if exposed to water.

- B. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application. Verify that systems to be insulated have been tested and are free of defects. Verify that surfaces to be insulated are clean and dry. Proceed with installation only after unsatisfactory conditions have been corrected. Before starting work under this section, carefully inspect the site and installed work of other trades and verify that such work is complete to the point where installation of materials and accessories under this section can begin. Ensure that pipe and fitting surfaces over which insulation is to be installed are clean and dry. Ensure that insulation is clean, dry, and in good mechanical condition with factory-applied vapor or weather barriers intact and undamaged. Wet, dirty, or damaged insulation shall not be acceptable for installation. Ensure that pressure testing of piping and fittings has been completed prior to installing insulation.
- C. Installer Qualifications: Skilled mechanics shall have successfully completed an apprenticeship program or another craft training program.
- D. Provide insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout, including the length of ducts and fittings, valves, and specialties. Provide per "National Commercial & Industrial Insulation Standards" – MICA Manual.
- E. Provide insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each system as specified in insulation system schedules.
- F. Provide accessories compatible with insulation materials and suitable for the service.
- G. Provide insulation with longitudinal seams at top and bottom of horizontal pipe runs and equipment. Provide multiple layers of insulation with longitudinal and end seams staggered.
- H. There shall be no glass fibers exposed to the air. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
- I. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- J. Jackets And Finishes: Draw jacket tight and smooth. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c. For below ambient services, apply vapor-barrier mastic over staples. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.
- K. Keep insulation materials dry during application and finishing.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- L. Provide insulation over fittings, valves, and specialties, with continuous thermal and the least number of joints practical.
- M. Provide removable insulation covers at fittings and equipment that require servicing and locations with service requirements.
- N. Locate seams in the least visible location.
- O. Cold surfaces that may “sweat” must be insulated. Vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal.
 - 1. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.
 - 2. Hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.
 - 3. Seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
 - 4. Provide insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity.
 - 5. Extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic. Provide insert materials and provide insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
 - 6. Provide No-Sweat valve wraps at all valves and fittings.
- P. For above-ambient services, do not install insulation to the following: testing agency labels and stamps, nameplates, and cleanouts.
- Q. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance. If piping type is omitted from list below, provide insulation per energy code or as per similar duty.
- R. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- S. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- T. Insulate instrument connections for specialties (examples: thermometers, sensors, etc.) on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- U. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

- V. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

- W. Penetrations
 - 1. Division 7 for firestopping materials and requirements for penetrations through fire and smoke barriers.
 - 2. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Provide insulation continuously through walls and partitions.
 - 3. Insulation Installation at Roof or Aboveground Exterior Wall Penetrations: Provide insulation continuously through penetrations.
 - a. Seal penetrations with flashing sealant.
 - b. For applications requiring only indoor insulation, terminate insulation above roof/wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, provide insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - c. Extend jacket of outdoor insulation outside roof/wall flashing at least 2 inches below top of roof flashing.
 - d. Seal jacket to roof/wall flashing with flashing sealant.

3.2 INSTALLATION OF PIPING INSULATION

- A. Metal shields shall be provided between hangers or supports and the piping insulation.

- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
 - 1. Provide No-Sweat valve wraps at all valves and fittings.
 - 2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement and finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
 - 3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section close to the next and hold in place with tie wire. Bond pieces with adhesive.
 - 4. Insulate using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement.
 - 5. For below-ambient services, provide a design that maintains vapor barrier.
 - 6. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Provide vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

7. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric, provide fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.

C. Flexible Elastomeric Insulation

1. Seal longitudinal seams and end joints with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
2. Insulation Installation on Pipe Flanges: Provide pipe insulation to outer diameter of pipe flange. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation. Secure insulation to flanges and seal seams with manufacturers recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
3. Insulation Installation on Pipe Fittings and Elbows: Provide mitered sections of pipe insulation. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
4. Insulation Installation on Valves and Pipe Specialties: Provide preformed valve covers manufactured of the same material as pipe insulation when available. When preformed valve covers are not available, provide cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. Provide insulation to flanges as specified for flange insulation application. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
5. After the adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating. Prior to applying the finish, the insulation shall be wiped clean with denatured alcohol. The finish shall not be tinted. To insure good adhesion, the temperature should be above 50°F during application and drying.
6. Outdoor exposed piping shall be painted with two coats of Armaflex WB Finish. Prior to applying the Finish, the insulation shall be wiped clean with denatured alcohol. The Finish shall not be tinted. Outdoor exposed piping shall have seams located on the lower half of the pipe.

3.3 PIPE APPLICATION SCHEDULE

- A. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements. For piping systems not indicated, insulate to with a similar thickness and type as those specified. Insulation thicknesses and installations shall meet or exceed the requirements of the local energy code, or thicknesses indicated, whichever is of superior insulating performance.

B. Outdoor Piping where heat tracing is provided:

1. Pipe size 2-1/2" and less: Glass Fiber, 1-1/2" thickness; Jacket: Aluminum.
2. Pipe size 3" and larger: Glass Fiber, 2" thickness; Jacket: Aluminum.

C. Chilled Water:

1. Pipe size 1-1/4" and less: Glass Fiber, 1/2" thickness.
2. Pipe size 1-1/2" and larger: Glass Fiber, 1" thickness.
3. Pipe size 1-1/4" and less: Flexible Elastomeric, 1/2" thickness.
4. Pipe size 1-1/2" and larger: Flexible Elastomeric, 1" thickness.

D. Condenser Water: Condenser: insulate same as chilled water piping.

E. EQUIPMENT / TANK INSULATION

1. For equipment not indicated, insulate to with a similar thickness and type as those specified.
2. Provide insulation over the entire surface of tanks and vessels. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive. Seal longitudinal seams and end joints.
3. For below ambient services, provide a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.
4. Fiber Glass: Apply insulation to the equipment surface with joints firmly butted and as close as possible to the equipment surface. Insulation shall be secured as required with mechanical fasteners or banding material. Fasteners shall be located a maximum of 3" from each edge and spaced no greater than 12" on center. For below ambient systems, vapor retarder jacketing shall overlap a minimum of 2" at seams and be sealed with appropriate pressure-sensitive tape or mastic. Penetrations and facing damage shall be covered with a minimum 2" overlap of tape or mastic.
5. Flexible Elastomeric: Provide insulation over entire surface of tanks and vessels. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive. Seal longitudinal seams and end joints.
6. Pump Insulation
 - a. Insulate pumps by forming a flexible elastomeric box around the pump housing. Construct the box by forming the bottom and sides using joints that do not leave raw ends of insulation exposed. Join joints between sides and between sides and bottom by contact adhesive for flexible elastomeric cellular insulation. Ensure box conforms to the requirements of MICA Insulation Standards Plate No. 49. Ensure joints between top cover and sides fit tightly forming a female shiplap joint on the side pieces and a male joint on the top cover, thus making the top cover removable.
 - b. Protect exposed insulation corners with corner angles.
 - c. Provide a complete vapor barrier.
 - d. Provide a parting line between the box and the removable sections allowing the removable sections to be removed without disturbing the insulation coating. Apply flashing sealant to parting line, between equipment and removable section insulation, and at all penetrations.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

7. Omit insulation from the following, except for cold surfaces, which shall be provided with removable covers:
 - a. Vibration-control devices.
 - b. Testing agency labels and stamps.
 - c. Nameplates and data plates.
 - d. Manholes, hand holes, or cleanouts.
8. Removable Covers for Maintenance Access: Construct insulation on parts of equipment which must be opened periodically for maintenance or repair, so insulation can be removed and replaced without damage.
9. Cooling & heating air separators, low loss headers, chemical feed tanks, buffer tanks and similar equipment: same as water piping.

END OF SECTION 230700

SECTION 230900 – DIRECT DIGITAL CONTROL (DDC) SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Provide alterations and extension to the existing Johnson Controls Building Automation System as required to integrate the new chiller, cooling tower (Alternate #2), bypass valve (Alternate #1), chilled water pumps (Alternate #1), and condenser water pumps (Alternate #2) with the existing system. Provide all labor, materials, equipment, and service necessary for a complete and operating BAS.
- B. Provide an extension of the existing Building Automation System (BAS) to integrate and control equipment associated with this project. Provide all labor, materials, equipment, and service necessary for a complete and operating BAS.
- C. System software shall be based on a server/thin client architecture, designed around the open standards of web technology. The control system server shall be accessed using a Web browser over the control system network, the owner's local area network, and (at the owner's discretion) over the Internet. The intent of the thin-client architecture is to provide operators complete access to the control system via a Web browser. No special software other than a web browser shall be required to access graphics, point displays, and trends, configure trends, configure points and controllers, or to download programming into the controllers.
- D. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules. I/O points, schedules, setpoints, trends and alarms shall be BACnet objects.
- E. The Controls Contractor's work shall consist of the provision of all labor, materials, special tools, equipment, enclosures, power supplies, software, software licenses, project-specific software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, warranty, specified services and items required by the Contract that are required for the functional turn-key operation of the complete and fully functional Controls Systems. Documents are diagrammatic only. Equipment and labor not specifically referred to herein or on the plans, which are required to meet the functional intent, shall be provided without additional cost to the Owner.
- F. Provide all labor, materials, equipment, and service necessary for a complete and operating building automation system.
- G. Related Sections include the following:
 - 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

2. Division 13 Section "Fire Alarm"
3. Division 23 Section "Common Work Results"
4. Division 23 Sections with controller interfaces shall be integrated with the work of this Section.
5. Division 23 Section "Testing, Adjusting, and Balancing"
6. Division 26
7. Division 28 Section "Fire Alarm"

1.2 SUBMITTALS

- A. Product Data and Shop Drawings: Meet requirements of Division 1. In addition, the contractor shall provide shop drawings or other submittals on hardware, software, and equipment to be installed or provided. No work may begin on any segment of this project until submittals have been approved for conformity with design intent. Provide drawings in PDF format. When manufacturer's cutsheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawing shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements. Select and show submittal quantities appropriate to scope of work. Submittal approval does not relieve Contractor of responsibility to supply enough to complete work. BAS manufacturer is responsible for furnishing quantities required based upon contract documents.
- B. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.
- C. BAS manufacturer shall provide shop drawings and manufacturers' standard specification data sheets on all hardware and software being provided for this project. No work may begin on any segment of this project until the Engineer and Owner have reviewed submittals for conformity with the plan and specifications.
- D. Quantities of items submitted shall be reviewed by the Engineer and Owner. Such review shall not relieve the BAS manufacturer of furnishing quantities required based upon contract documents.
- E. Provide the Engineer and Owner, any additional information or data which is deemed necessary to determine compliance with the specifications or which is deemed valuable in documenting and understanding the system to be installed.
- F. All shop drawings shall be provided to the Owner electronically as .dwg or .dxf file formats once they have been approved and as-built drawings have been completed.
- G. Submit the following:
 1. A complete bill of materials of equipment to be used indicating quantities, manufacturers, and model numbers.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

2. A schedule of all control valves including the valve size, pressure drop, model number (including pattern and connections), flow, CV, body pressure rating, and location.
 3. A schedule of all control dampers including damper size, pressure drop, manufacturer, and model number.
 4. Provide all manufacturers' technical cut sheets for major system components. When technical cut sheets apply to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Include:
 - a. Building Controllers
 - b. Custom Application Controllers
 - c. Application Specific Controllers
 - d. Operator Workstations
 - e. Portable Operator Terminals
 - f. Auxiliary Control Devices
 5. Provide proposed BAS architectural diagram depicting various controller types, workstations, device locations, addresses, and communication cable requirements.
 6. Provide detailed termination drawings showing all required field and factory terminations, as well as terminal tie-ins to DDC controls provided by mechanical equipment manufacturers. Terminal numbers shall be clearly labeled.
 7. Provide a sequence of operation for each controlled mechanical system and terminal end devices.
 8. Provide a BACnet Protocol Implementation Conformance Statement (PICS) for each BACnet system level device (i.e. Building Controller & Operator Workstations) type. This defines the points list for proper coordination of interoperability with other building systems for this project.
- H. Project Record Documents: Upon completion of installation, record (as-built) documents. The documents shall be submitted for approval prior to final completion and include:
- I. Project Record Drawings - These shall be as-built versions of the submittal shop drawings. One set of electronic media including CAD .dwg and .pdf drawing files shall be provided.
1. Testing and Commissioning Reports and Checklists signed off by trained factory (equipment manufacturers) and field (BAS) commissioning personnel.
 2. Operating and Maintenance (O & M) Manuals - These shall be as-built versions of the submittal product data. In addition to the information required for the submittals, Operating & Maintenance manual shall include:
 - a. Procedures for operating the BAS including logging on/off, alarm management, generation of reports, trends, overrides of computer control, modification of setpoints, and other interactive system requirements.
 - b. Explanation of how to design and install new points, new DDC controllers, and other BAS hardware.
 - c. Documentation, installation, and maintenance information for all third-party hardware/software products provided including personal computers, printers, hubs, sensors, valves, etc.

- d. Original issue media for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
 - e. Licenses, Guarantee, and Warranty documents for all equipment and systems.
- J. Training Manuals: The BAS manufacturer shall provide a course outline and copies of training manuals at least two weeks prior to the start of any corporate training class to be attended by the Owner.

1.3 QUALITY ASSURANCE

- A. All products used in this project installation shall be new and currently under manufacture and shall have been applied in similar installations for a minimum of two years. This installation shall not be used as a test site for any new products unless explicitly approved by the owner's representative in writing. Spare parts shall be available for at least five years after completion of this contract.
- B. All work described in this section shall be installed, wired, circuit tested and calibrated by factory certified technicians qualified for this work and in the regular employment of the temperature control system manufacturer. Use only employees who are qualified, skilled, experienced, manufacturer trained and familiar with the specific equipment, software and configurations to be provided for this Project.
 - 1. Installer shall have an established working relationship with Control System Manufacturer.
 - 2. Installer shall have successfully completed Control System Manufacturer's control system training. Upon request, Installer shall present record of completed training including course outlines.
- C. Provide a complete, neat and workmanlike installation.
- D. All work, materials, and equipment shall comply with the rules and regulations of all codes and ordinances of the local, state, and federal authorities. Such codes, when more restrictive, shall take precedence over these plans and specifications.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- F. Comply with NFPA 90A and IMC-2021.
- G. Comply with ASHRAE 135 for DDC system control components.
- H. The contractor shall protect all work and material from damage by his/her work or employees. The contractor shall be responsible for his/her work and equipment until finally inspected, tested, and accepted. The contractor shall protect any material that is not immediately installed. The contractor shall close all open ends of work with temporary covers or plugs during storage and construction to prevent entry of foreign objects.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- I. Codes and Standards: Meet requirements of all applicable standards and codes, except when more detailed or stringent requirements are indicated by the Contract Documents, including requirements of this Section.
 - 1. Underwriters Laboratories: Products shall be UL-916-PAZX listed.
 - 2. National Electrical Code -- NFPA 70.
 - 3. Federal Communications Commission -- Part J.
 - 4. ASHRAE/ANSI 135-2012 (BACnet) - Controllers shall conform to the listed version of the BACnet specification to improve interoperability with various building system manufacturers' control systems and devices.

- J. BACnet Specific Definitions:
 - 1. BACnet: Building Automation Control Network Protocol, ASHRAE 135. A communications protocol allowing devices to communicate data and services over a network.
 - 2. BACnet Interoperability Building Blocks (BIBBs): BIBB defines a small portion of BACnet functionality that is needed to perform a particular task. BIBBs are combined to build the BACnet functional requirements for a device.
 - 3. BACnet MS/TP: MS/TP bus protocol is part of the BACnet ANSI/ASHRAE™ Standard 135-2008 that uses the EIA-485 (RS-485) physical layer standard for data transmission (called the segment). Multiple segments can be logically tied together.
 - 4. BACnet-IP: Defines and allows using a reserved UDP socket to transmit BACnet messages over IP networks. A BACnet/IP network is a collection of one or more IP subnetworks that share the same BACnet network number.
 - 5. BACnet Testing Laboratories (BTL): Organization responsible for testing products for compliance with ASHRAE 135, operated under direction of BACnet International.

1.4 CONTRACTOR QUALIFICATIONS

- A. Qualified Bidders: System shall be as manufactured, installed, and serviced by:
 - 1. Johnson Controls, Inc.

- B. The BAS Manufacturer shall have factory trained and certified personnel providing all engineering, service, startup, and commissioning field labor for the project from their local office location. BAS manufacturer shall be able to provide training certifications for all local office personnel upon request.

- C. The BAS shall be provided by a single manufacturer and this manufacturer's equipment must consist of operator workstation software, web-based hardware/software, open standard protocol hardware/software, custom application programming language, graphical programming language, building controllers, custom application controllers, and application specific controllers. All other products specified herein (i.e., sensors, valves, dampers, actuators, etc.) need not be manufactured by the BAS manufacturer listed in this specification.

- D. Longevity: The Facilities Management System contractor shall have a minimum of ten years' experience installing and servicing computerized Building Automation Systems (BAS). All

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

subcontractors utilized by the BAS contractor shall have a minimum of five-year experience within their appropriate trades.

- E. Past Projects: The BAS contractor shall have completed a minimum of ten projects within the last five years that are at least equal in dollar value and scope to this project. A list of similar projects, dollar volume, scope, contact name and contact number shall be provided by the BAS contractor if asked for by the owner.
- F. The BAS manufacturer shall have an established business office within 50 miles of the project site and must provide 24 hours/day, 7 days/week response in the event of a customer warranty or service call.
- G. The BAS contractor shall have an established 24-hour emergency service organization. A dedicated telephone number shall be provided to the owner for requesting emergency service. A maximum of four-hour, electronic service technician on sight, response time shall be guaranteed by the BAS contractor.
- H. Parts Stocking: The BAS contractor shall have an independently verifiable inventory of electronic service parts. This electronic service parts inventory must have a worth of at least \$100,000 per year over the last five years.

1.5 COORDINATION

- A. Where the mechanical work will be installed near, or will interfere with, work of other trades, the contractor shall assist in working out space conditions to make a satisfactory adjustment. If the contractor installs his/her work before coordinating with other trades, to cause any interference with work of other trades, the contractor shall make the necessary changes in his/her work to correct the condition.
- B. Coordinate details of telephone line, internet service provider, and associated requirements.
- C. Coordinate and schedule work with all other work in the same area, or with work that is dependent upon other work, to facilitate mutual progress.
- D. Coordinate location of thermostats and other exposed control sensors with plans and room details before installation.
- E. Coordination with controls specified in other sections or divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the controls system specified in this section. These controls shall be integrated into the system and coordinated by the contractor.
- F. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to unit manufacturer.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

G. Sheet Metal Subcontractor:

1. Installation of duct-mounted control devices.
2. Access doors where indicated and as required for proper servicing.

H. HVAC Contractor:

1. Installation of immersion wells and sockets, along with associated shut-off cocks.
2. Installation of pipe-mounted control devices.

I. Testing and Balancing Contractor:

1. The contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.
2. The contractor shall provide training in the use of these tools.
3. In addition, the contractor shall provide a qualified technician to assist in the test and balance process, until the first 20 terminal units are balanced.
4. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

J. Electrical Subcontractor: Complying with the principle of "unit responsibility" all electrical work for automatic controls, except as otherwise specified, or shown on the electrical drawings shall be included in Division 23. Electrical work shall, in general, comply with the following, unless otherwise directed by Division 26:

1. Power wiring.
2. All control wiring shown on electric plans such as unit heater line-voltage room thermostats.
3. Duct smoke detectors required for air handler shutdown are supplied under Division 26. Coordinate required length of sampling tube, for full span of ductwork. The contractor shall connect the DDC system to the auxiliary contacts provided on the smoke detector for system safeties and to provide alarms to the DDC system.
4. All electrical work shall comply with the N.E.C. and local electrical codes.
5. All safety devices shall be wired through both hand and auto positions of motor starting device to insure 100% safety shut-off.
6. Provide auxiliary contacts as required for interlock by BAS Contractor; the supplier shall estimate an allowance of at least one auxiliary contract per starter.

K. Coordinate with controls specified in other sections of divisions. Other sections and/or divisions of this specification include controls and control devices that are to be part of or interfaced to the control system specified in this section. These controls shall be integrated into the system and coordinated by the BAS contractor as follows:

1. All communication media and equipment shall be provided as specified hereinafter.
2. Each supplier of a control product is responsible for the configuration, programming, start-up, and testing of that product to meet the sequences of operation described in this section.

3. The BAS contractor shall coordinate and resolve any incompatibility issues that arise between the control products provided under this section and those provided under other sections or divisions of this specification.
4. The BAS contractor is responsible for providing all controls described in the contract documents regardless of where within the contract documents these controls are described.
5. The contractor is responsible for the interface of control products provided by multiple suppliers regardless of where this interface is described within the contract documents.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.7 WARRANTY

- A. At the end of the final start-up, testing, and commissioning phase, if equipment and systems are operating satisfactorily to the engineer, the engineer shall sign certificates certifying that the control system's operation has been tested and accepted in accordance with the terms of this specification. The date of acceptance shall be the start of warranty. All work shall have a single warranty date, even when the owner has received beneficial use due to an early system start-up.
- B. All components, system software, and parts supplied by the BAS contractor shall be guaranteed against defects in materials and workmanship for one year from acceptance date. The BAS contractor at no charge shall furnish Labor to repair, reprogram, or replace components during the warranty period. All corrective software modifications made during warranty periods shall be updated on all user documentation and on user and manufacturer archived software disks. The Contractor shall respond to the owner's request for warranty service within 24 hours during normal business hours.
- C. Provide remote service diagnostic monitoring from the nearest service location. At the request of the owner, a service diagnostic call will be made to troubleshoot and resolve (if possible) any reported system complaints. The owner will provide a dedicated telephone line for connection to the system.
- D. Operator workstation software, project-specific software, graphic software, database software, and firmware updates that resolve known software deficiencies as identified by the contractor shall be provided at no charge during the warranty period. Any upgrades or functional enhancements associated with the above-mentioned items also can be provided during the warranty period for an additional charge to the owner by purchasing an in-warranty service agreement from the contractor. Written authorization by the owner must, however, be granted prior to the installation of any of the above-mentioned items.

1.8 SYSTEM MAINTENANCE AND REMOTE ANALYSIS

- A. The BAS Manufacturer shall provide BAS remote support and system analysis for a period of two (2) years, beginning at the date of substantial completion.
- B. The BAS manufacturer shall setup a secure remote connection for data collection, analytics and remote technical support for the HVAC systems included in this contract.
 - 1. Provide technician support during the warranty period to diagnose issues remotely through the secure remote connection.
 - 2. The building owner is responsible for providing adequate internet access.
- C. Connectivity / Remote Access / Network Security
 - 1. Provide and maintain secure remote access to the facilities BAS or other building systems. Users accessing service through this connection shall not have access to the building owners' network. Secure remote access to the BAS shall not require ANY inbound ports on a firewall to be "exposed" or "forwarded".
 - 2. Secure remote access to the BAS shall be available anywhere, anytime, using a compatible client device (PC/tablet/phone)
 - 3. The Owner will provide up to Three (3) IP drops and IP addresses on the owner's network to gain access to the internet. The BAS manufacturer shall coordinate with the Owners IT team, verify the proposed system shall meet all network security requirements and any other network configuration information necessary to each control contractor for the purpose of configuring each Area Controller on the network. It shall be the responsibility of the BAS manufacturer to coordinate with the owner for network connectivity.
- D. The BAS Manufacturer shall provide a professional analysis for the facility HVAC systems. The analysis shall consist of an evaluation of HVAC systems including charts and graphs which indicate both current building performance and opportunities for building and HVAC system performance improvement.
- E. The following shall be provided after substantial completion of the project:
 - 1. Orientation meeting with the building owner's representative to identify the HVAC systems that will be evaluated.
 - 2. System setup for data collection and analytics. BAS Manufacturer to setup a secure remote data collection and analytics for identified systems.
 - 3. Assessment analysis shall be performed by trained personnel with relevant professional credentials in HVAC systems, energy management, and building optimization methodologies.
 - 4. Consultation meeting with owner to review performance reports and improvement opportunities.

- F. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of owner.

1.9 OWNERSHIP OF PROPRIETARY MATERIAL

- A. Project specific software and documentation shall become the owner's property upon project completion. This includes the following:
 - 1. Operator Graphic files
 - 2. As-built hardware design drawings
 - 3. Operating & Maintenance Manuals
 - 4. BAS System software database

PART 2 - PRODUCTS

2.1 BUILDING AUTOMATION SYSTEM

- A. DDC system shall consist of a high-speed, peer-to-peer network of distributed DDC controllers, other network devices, operator interfaces, and software. System shall use the BACnet protocol for communication to the operator workstation or web server and for communication between control modules.
- B. Provide new wiring and network devices as required to provide a complete and workable control network.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional to design DDC system to satisfy requirements indicated. System Performance Objectives:
 - 1. DDC system shall manage HVAC systems.
 - 2. DDC system control shall operate HVAC systems to achieve optimum operating costs while using least possible energy and maintaining specified performance.
 - 3. DDC system shall respond to power failures, HVAC equipment failures, and adverse and emergency conditions encountered through connected I/O points.
 - 4. DDC system shall operate while unattended by an operator and through operator interaction.
 - 5. DDC system shall record trends and transaction of events and produce report information such as performance, energy, occupancies, and equipment operation.
- B. DDC System Data Storage:

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

1. Include server(s) with disk drive data storage to archive not less than 36 consecutive months of historical data for all I/O points connected to system, including alarms, event histories, transaction logs, trends and other information indicated.
 2. When logged onto a server, operator shall be able to also interact with any DDC controller connected to DDC system as required for functional operation of DDC system.
 3. Server(s) shall be used for application configuration; for archiving, reporting and trending of data; for operator transaction archiving and reporting; for network information management; for alarm annunciation; and for operator interface tasks and controls application management.
 4. Server(s) shall use IT industry-standard database platforms such as Microsoft SQL Server and Microsoft Data Engine (MSDE).
- C. Performance Standards. System shall conform to the following minimum standards over network connections. Systems shall be tested using manufacturer's recommended hardware and software for operator workstation (server and browser for web-based systems).
1. Graphic Display. A graphic with 20 dynamic points shall display with current data within 10 sec.
 2. Graphic Refresh. A graphic with 20 dynamic points shall update with current data within 8 sec. and shall automatically refresh every 15 sec.
 3. Configuration and Tuning Screens. Screens used for configuring, calibrating, or tuning points, PID loops, and similar control logic shall automatically refresh within 6 sec.
 4. Object Command. Devices shall react to command of a binary object within 2 sec. Devices shall begin reacting to command of an analog object within 2 sec.
 5. Alarm Response Time. An object that goes into alarm shall be annunciated at the workstation within 45 sec.
 6. Program Execution Frequency. Custom and standard applications shall be capable of running as often as once every 5 sec. Select execution times consistent with the mechanical process under control.
 7. Performance. Programmable controllers shall be able to completely execute DDC PID control loops at a frequency adjustable down to once per sec. Select execution times consistent with the mechanical process under control.
 8. Multiple Alarm Annunciation. Each workstation on the network shall receive alarms within 5 sec of other workstations.
 9. Reporting Accuracy. System shall report values with minimum end-to-end accuracy listed in Table 1.
 10. Control Stability and Accuracy. Control loops shall maintain measured variable at setpoint within tolerances listed below.
 11. Measured Variable and Reported Accuracy
 - a. Space Temperature; $\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$)
 - b. Ducted Air: $\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$)
 - c. Outside Air: $\pm 1.0^{\circ}\text{C}$ ($\pm 2^{\circ}\text{F}$)
 - d. Dew Point: $\pm 1.5^{\circ}\text{C}$ ($\pm 3^{\circ}\text{F}$)
 - e. Water Temperature: $\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{F}$)
 - f. Delta-T: $\pm 0.15^{\circ}$ ($\pm 0.25^{\circ}\text{F}$)
 - g. Relative Humidity: $\pm 5\%$ RH
 - h. Water Flow: $\pm 2\%$ of full scale

- i. Airflow (terminal): $\pm 10\%$ of full scale; Accuracy applies to 10%–100% of scale.
- j. Airflow (measuring stations): $\pm 5\%$ of full scale.
- k. Airflow (pressurized spaces): $\pm 3\%$ of full scale
- l. Air Pressure (ducts): ± 25 Pa (± 0.1 in. w.g.)
- m. Air Pressure (space): ± 3 Pa (± 0.01 in. w.g.)
- n. Water Pressure: $\pm 2\%$ of full scale
- o. Electrical: $\pm 1\%$ of reading, Not including utility-supplied meters
- p. Carbon Monoxide (CO): $\pm 5\%$ of reading
- q. Carbon Dioxide (CO₂): ± 50 ppm

12. Control Stability and Accuracy

- a. Air Pressure: ± 50 Pa (± 0.2 in. w.g.); Range of Medium: 0–1.5 kPa (0–6 in. w.g.)
- b. Air Pressure: ± 3 Pa (± 0.01 in. w.g.); Range of Medium: 25 to 25 Pa (-0.1 to 0.1 in. w.g.)
- c. Airflow: $\pm 10\%$ of full scale
- d. Space Temperature: $\pm 1.0^{\circ}\text{C}$ ($\pm 2.0^{\circ}\text{F}$)
- e. Duct Temperature: $\pm 1.5^{\circ}\text{C}$ ($\pm 3^{\circ}\text{F}$)
- f. Humidity: $\pm 5\%$ RH
- g. Fluid Pressure: ± 10 kPa (± 1.5 psi); Range of Medium: 1–150 psi

D. Environmental Conditions for Controllers, Gateways, Routers, Instruments and Actuators: Products shall operate without performance degradation under ambient environmental temperature, pressure and humidity conditions encountered for installed location. If product alone cannot comply with requirement, install product in a protective enclosure that is isolated and protected from conditions impacting performance. Enclosure shall be internally insulated, electrically heated, cooled and ventilated as required by product and application. Products shall be protected with NEMA enclosures suitable for the location where installed.

E. Continuity of Operation after Electric Power Interruption: Equipment and associated factory-installed controls, field-installed controls, electrical equipment, and power supply connected to building normal and backup power systems shall automatically return equipment and associated controls to operating state occurring immediately before loss of normal power, without need for manual intervention by operator when power is restored either through backup power source or through normal power if restored before backup power is brought online.

2.3 COMMUNICATION

- A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to ANSI/ASHRAE Standard 135, BACnet.
- B. Provide new wiring and network devices as required to provide a complete and workable control network.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- C. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.
- D. Internetwork operator interface and value passing shall be transparent to internetwork architecture.
- E. An operator interface connected to a controller shall allow the operator to interface with each internetwork controller as if directly connected. Controller information such as data, status, and control algorithms shall be viewable and editable from each internetwork controller.
- F. Inputs, outputs, and control variables used to integrate control strategies across multiple controllers shall be readable by each controller on the internetwork. Program and test all cross-controller links required to execute control strategies specified in Section 230993. An authorized operator shall be able to edit cross-controller links by typing a standard object address or by using a point-and-click interface.
- G. Workstations, Building Control Panels, and Controllers with real-time clocks shall use the BACnet Time Synchronization service. System shall automatically synchronize system clocks daily from an operator-designated device via the internetwork. The system shall automatically adjust for daylight saving and standard time as applicable.
- H. System shall be expandable to at least twice the required input and output objects with additional controllers, associated devices, and wiring.

2.4 DDC EQUIPMENT

- A. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.

3. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, anti-short-cycling, PID control, DDC with fine tuning, and trend logging.
 - b. HVAC Control Programs
 - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - d. Remote communications.
 - e. Maintenance management.
 4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- B. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include given communications; discrete/digital, analog, and pulse I/O; and monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
- C. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation.
 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA).
 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 7. Universal I/Os: Provide software selectable binary or analog outputs.

- D. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.
 3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- E. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
 2. Maximum response time of 10 nanoseconds.
 3. Minimum transverse-mode noise attenuation of 65 dB.
 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.5 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics, monitor system and report failures.
 3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
 4. Enclosure: Dustproof rated for operation at extreme ambient temperatures.

2.6 SENSING DEVICES

- A. Where feasible, provide the same sensor type throughout the project. Avoid using transmitters unless necessary.
- B. Thermistors: Precision thermistors may be used in applications below 200°F. Sensor accuracy over the application range shall be 0.36°F or less between 32 to 150°F. Stability error of the thermistor over five years shall not exceed 0.25°F cumulative. A/D conversion resolution error shall be kept to 0.1°F. Total error for a thermistor circuit shall not exceed 0.5 °F.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- C. Resistance Temperature Detectors (RTDs): Provide RTD sensors with platinum elements compatible with the digital controllers. Encapsulate sensors in epoxy, series 300 stainless steel, anodized aluminum, or copper. Temperature sensor accuracy shall be 0.1 percent (1 ohm) of expected ohms (1000 ohms) at 32°F. Temperature sensor stability error over five years shall not exceed 0.25°F cumulative. Direct connection of RTDs to digital controllers without transmitters is preferred. When RTDs are connected directly, lead resistance error shall be less than 0.25°F. The total error for a RTD circuit shall not exceed 0.5°F.
- D. Per ASHRAE 90.1-2016: Outdoor air, return air, mixed air, and supply air sensors shall be calibrated within the following accuracies:
1. Dry-bulb and wet-bulb temperatures shall be accurate to $\pm 2^\circ\text{F}$ over the range of 40°F to 80°F.
 2. Enthalpy and the value of a differential enthalpy sensor shall be accurate to ± 3 Btu/lb. over the range of 20 to 36 Btu/lb.
 3. Relative humidity shall be accurate to $\pm 5\%$ over the range of 20% to 80% RH.
- E. Temperature Sensor Details
1. Pipe Immersion Type: Provide minimum three-inch immersion. Provide each sensor with a corresponding pipe-mounted sensor well, unless indicated otherwise. Sensor wells shall be stainless steel when used in steel piping, and brass when used in copper piping. Provide the sensor well with a heat-sensitive transfer agent between the sensor and the well interior.
- F. Transmitters: Provide transmitters with 4 to 20 mA or 0 to 10 VDC linear output scaled to the sensed input. Transmitters shall be matched to the respective sensor, factory calibrated and sealed. Size transmitters for an output near 50 percent of its full-scale range at normal operating conditions. The total transmitter error shall not exceed 0.1 percent at any point across the measured span. Supply voltage shall be 12 to 24 volts AC or DC. Transmitters shall have non-interactive offset and span adjustments. For temperature sensing, transmitter drift shall not exceed 0.03 °F a year.
- G. Current Transducers: Provide current transducers to monitor motor amperage, unless current switches are shown on design drawings or point tables.
- H. Input Switches
1. Timed Local Overrides: Provide buttons or switches to override the DDC occupancy schedule programming for each major building zone during unoccupied periods, and to return HVAC equipment to the occupied mode. This requirement is waived for zones clearly intended for 24-hour continuous operation.
 2. Freeze Protection Thermostats: Provide special purpose thermostats with flexible capillary elements 20-foot minimum length for coil face areas up to 40-SF. Provide longer elements for larger coils at 1-foot of element for every 4-SF of coil face area or provide additional thermostats. Provide switch contacts rated for the respective motor starter's control circuit voltage. Include auxiliary contacts for the switch's status condition. A freezing condition at any 18-inch increment along the sensing element's length shall activate the switch. The thermostat shall be equipped with a manual push-button reset switch so that when tripped, the thermostat requires manual resetting before the HVAC equipment can restart.

I. Pressure Transmitters/Transducers:

1. Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 - g. Kele
2. Hydronic Differential Pressure Transmitters: Bell & Gossett ST Series; Setra or approved equal. Transmitter shall provide an isolated linear 4-20 mA dc output. The unit shall be accurate to $\pm 0.07\%$ of full span and shall withstand over ranges up to a static pressure of 2300 psi with negligible change in output. It shall have stainless steel wetted parts with 1/4" NPT process connection. Unit shall be protected against radio frequency interference and shall have a watertight (NEMA Type 6/6P) electrical enclosure with 1/2" NPT conduit connection.

2.7 OUTPUT HARDWARE

A. Electronic damper/valve actuation shall be provided.

1. Manufactured, brand labeled or distributed by Belimo or approved equal.
2. Size for torque required for damper seal at load conditions.
3. Coupling: V-bolt dual nut clamp with a V-shaped, toothed cradle.
4. Mounting: Actuators shall be capable of being mechanically and electrically paralleled to increase torque if required.
5. Overload protected electronically throughout rotation.
6. Fail-Safe Operation: Mechanical, spring-return mechanism.
7. Manual Positioning. Operators shall be able to manually position each actuator when the actuator is not powered. Non-spring-return actuators shall have an external manual gear release. Spring-return actuators with more than 60 in.-lb. torque capacity shall have a manual crank.
8. Proportional Actuators shall be fully programmable through an EEPROM without the use of actuator mounted switches.
9. Proportional actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
10. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control signal and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10 VDC position feedback signal.
11. Temperature Rating: -22 to +122°F.
12. Housing: Minimum requirement NEMA type 2 mounted in any orientation.
13. Agency Listings: ISO 9001, cULus, CE or CSA
14. The manufacturer shall warrant all components for a period of 5 years from the date of production, with the first two years unconditional.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- B. Control Valves: Control valves shall be two-way or three-way type for two-position or modulating service as shown.
1. Close-off (differential) Pressure Rating: Valve actuator and trim shall be furnished to provide the following minimum close-off pressure ratings:
 - a. Two-way: 150% of total system (pump) head.
 - b. Three-way: 300% of pressure differential between ports A and B at design flow or 100% of total system (pump) head.
 2. Water Valves: Body and trim style and materials shall be in accordance with manufacturer's recommendations for design conditions and service shown, with equal percentage ports for modulating service.
 - a. Sizing Criteria:
 - 1) Two-position service: Line size.
 - 2) Two-way modulating service: Pressure drop shall be equal to twice the pressure drop through heat exchanger (load), 50% of the pressure difference between supply and return mains, or 5 psi, whichever is greater.
 - 3) Three-way modulating service: Pressure drop equal to twice the pressure drop through the coil exchanger (load); 5 psi maximum.
 - b. Application:
 - 1) VAV-reheat coils: two-way floating control, non-spring return.
 - 2) CUH and Convectors: two-way two position, spring open 100%.
 - 3) AHU main heating coils: two-way modulating control, spring open 100%.
 - 4) Fintube radiation: zone valves. Zone valves shall have brass bodies with female NPT or sweat ends and a stainless-steel stem. Normally open zone valve actuators shall on/off and shall be available in 24VAC or 120VAC. Zone valves shall have push button for quick removal of actuator. Zone valves shall have a leakage rate of 0.1% or lower.
 - c. Valves ½ in. through 2 in. shall be bronze body or cast brass ANSI Class 250, spring-loaded, PTFE packing, quick opening for two-position service. Two-way valves to have replaceable composition disc or stainless-steel ball.
 - d. Valves 2½ in. and larger shall be cast iron ANSI Class 125 with guided plug and PTFE packing.
 - e. Water valves shall fail normally open or closed, as specified.
- C. Output Switches: Control Relays; Field installed and DDC panel relays shall be double pole, double throw, UL864 listed, with contacts rated for the intended application, indicator light, and dust proof enclosure. The indicator light shall be lit when the coil is energized and off when coil is not energized. Relays shall be the socket type, plug into a fixed base, and replaceable without tools or removing wiring. Encapsulated "PAM" type relays may be used for terminal control applications.

2.8 STATUS SENSORS

- A. VFD Motor Current Switches: Veris Hawkeye H614, or equal; microprocessor based, self-learning, self-calibrating current-sensitive switching device designed for use with VFD systems. At initial power-up, the H614 automatically learns the average current on the line with no action required by the installer. Once a current is learned, the switch monitors for changes in current greater than +/-20% of the learned load. When calibrated for a given VFD system, the H614 is tolerant of gradual drifts in frequency due to expected conditions, such as an accumulation of debris in a filter, while still detecting a sudden drop due to a potential abnormal system condition (e.g., belt loss or other mechanical failure).
1. Microcontroller based learning technology - automatically learns load upon initial power-up minimizes calibration labor.
 2. Automatic trip point - automatic trip point (1.5 to 150 A, 12 to 115 Hz) detects abnormal events.
 3. Under and over-load - microcontroller based learning technology automatically learns load.
 4. Saves space - small size fits easily inside small starter enclosures.
 5. 100% solid-state no. moving parts to fail.
 6. LED status
 7. Induced from monitored conductor sensor power.
- B. ECM Motor Current Switch: Veris H6ECM, or equal: current-sensitive switching device that monitors current (amperage) in the conductor passing through it. A change in amperage in the monitored conductor that crosses the switch (setpoint) causes the resistance of the FET status output to change state, like the action of a mechanical switch. The status output is suitable for connection to building controllers or other appropriate data acquisition equipment operating at up to 30 V. The product requires no external power supply to generate its output. The ECM is a brushless DC motor that is supplied AC power, converts that power to DC current and uses electronic switching to control the motor rotation. The ECM motor shaft speed can be reduced to save energy, resulting in lower cost and less component wear. The H6ECM is optimized to provide meaningful proof of rotation which verifies that the ECM motor is operating as expected.
1. High performance device, split-core housing.
 2. Precise current trip point setting.
 3. Small size - fits easily inside small enclosures.
 4. Self-gripping iris for easy installation.
 5. Status LEDs - for easy setup and local indication.
 6. Up to 1 A status output - increased application flexibility.
 7. Induced from monitored conductor sensor power.
- C. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
- D. Water-Flow Switches: Bellows-actuated mercury or snap-acting type with pilot-duty rating, stainless-steel or bronze paddle, with appropriate range and differential adjustment, in NEMA 250, Type 1 enclosure.

2.9 ELECTRICAL POWER AND DISTRIBUTION

- A. Transformers: Transformers shall conform to UL 506. For control power other than terminal level equipment, provide a fuse or circuit breaker on the secondary side of each transformer.
- B. Surge and Transient Protection
1. Provide each digital controller with surge and transient power protection. Surge and transient protection shall consist of the following devices, installed externally to the controllers.
 2. Power Line Surge Protection: Provide surge suppressors on the incoming power at each controller or grouped terminal controllers. Surge suppressors shall be rated in accordance with UL 1449, have a fault indicating light, and conform to the following:
 - a. The device shall be a transient voltage surge suppressor, hard-wire type individual equipment protector for 120 VAC/1 phase/2 wire plus ground.
 - b. The device shall react within 5 nanoseconds and automatically reset.
 - c. The voltage protection threshold, line to neutral, shall be no more than 211 volts.
 - d. The device shall have an independent secondary stage equal to or greater than the primary stage joule rating.
 - e. The primary suppression system components shall be pure silicon avalanche diodes.
 - f. The secondary suppression system components shall be silicon avalanche diodes or metal oxide varistors.
 - g. The device shall have an indication light to indicate the protection components are functioning.
 - h. All system functions of the transient suppression system shall be individually fused and not short circuit the AC power line at any time.
 - i. The device shall have an EMI/RFI noise filter with a minimum attenuation of 13 dB at 10 kHz to 300 MHz
 - j. The device shall comply with IEEE C62.41.1 and IEEE C62.41.2, Class "B" requirements and be tested according to IEEE C62.45.
 - k. The device shall be capable of operating between -20 °F and 122 °F.
 3. Telephone and Communication Line Surge Protection: Provide surge and transient protection for DDC controllers and DDC network related devices connected to phone and network communication lines. The device shall provide continuous, non-interrupting protection, and shall automatically reset after safely eliminating transient surges. The protection shall react within 5 nanoseconds using only solid-state silicon avalanche technology. The device shall be installed at the distance recommended by its manufacturer.
 4. Controller Input/Output Protection: Provide controller inputs and outputs with surge protection via optical isolation, metal oxide varistors (MOV), or silicon avalanche devices. Fuses are not permitted for surge protection.
- C. Wiring: Provide complete electrical wiring for the DDC System, coordinate line of demarcation with Division 26. Unless indicated otherwise, provide all normally visible or otherwise exposed wiring in conduit. Where conduit is required, control circuit wiring shall not run in the same conduit as power wiring over 100 volts. Circuits operating at more than 100 volts shall be in accordance with Division 26. Run all circuits over 100 volts in conduit, metallic tubing, covered

metal raceways, or armored cable. Use plenum-rated cable for circuits under 100 volts in enclosed spaces. Examples of these spaces include HVAC plenums, within walls, attics, or above suspended ceilings.

- D. Power Wiring: The following requirements are for field-installed wiring:
1. Wiring for 24 V circuits shall be insulated copper 18 AWG minimum and rated for 300 VAC service.
 2. Wiring for 120 V circuits shall be insulated copper 14 AWG minimum and rated for 600 VAC service.
- E. Analog Signal Wiring: Field-installed analog signal wiring shall be 18 AWG single or multiple twisted pair. Each cable shall be 100 percent shielded and have a 20 AWG drain wire. Each wire shall have insulation rated for 300 VAC service. Cables shall have an overall aluminum-polyester or tinned-copper cable-shield tape.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. The project plans shall be thoroughly examined for control device and equipment locations. Any discrepancies, conflicts, or omissions shall be reported to the architect/engineer for resolution before rough-in work is started.
- B. The contractor shall inspect the site to verify that equipment may be installed as shown. Any discrepancies, conflicts, or omissions shall be reported to the engineer for resolution before rough-in work is started. Verify that duct-, pipe-, and equipment-mounted devices and wiring are installed before proceeding with installation.
- C. The contractor shall examine the drawings and specifications for other parts of the work. If head room or space conditions appear inadequate—or if any discrepancies occur between the plans and the contractor's work or others—the contractor shall report these discrepancies to the engineer and shall obtain written instructions for any changes necessary to accommodate the contractor's work with the work of others. Any changes in the work covered by this specification made necessary by the failure or neglect of the contractor to report such discrepancies shall be provided at the expense of this contractor.

3.2 INSTALLATION

- A. Provide software in control units and operator workstation(s). Implement all features of programs to specified requirements and as appropriate to sequence of operation. Connect and configure equipment and software to achieve sequence of operation specified.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- B. Provide all components in accordance with the manufacturer's recommendations. Perform the installation under the supervision of competent technicians regularly employed in the installation of DDC systems.
- C. Provide equipment, piping, and wiring/raceway parallel to building lines (i.e., horizontal, vertical, and parallel to walls) wherever possible.
- D. Provide sufficient slack and flexible connections to allow for vibration of piping and equipment.
- E. All equipment, installation, and wiring shall comply with acceptable industry specifications and standards for performance, reliability, and compatibility and be executed in strict adherence to local codes and standard practices. Contractor shall continually monitor the field installation for code compliance and quality of workmanship. Contractor shall have work inspected by local and/or state authorities having jurisdiction over the work.
- F. Provide labels and nameplates to identify control components according to Section 230500 "Common Work Results".
- G. Provide hydronic instrument wells, valves, and other accessories according to Section 232113 "Hydronic HVAC Piping". Provide thermowells for sensors measuring piping, tank, or pressure vessel temperatures. Locate wells to sense continuous flow conditions. Do not install wells using extension couplings. Where piping diameters are smaller than the length of the wells, provide wells in piping at elbows to sense flow across entire area of well. Wells shall not restrict flow area to less than 70 percent of pipe area. Increase piping size as required to avoid restriction. Provide thermal conductivity material within the well to fully coat the inserted sensor.

3.3 WIRING

- A. All control and interlock wiring shall comply with national and local electrical codes, and Division 26 of this specification. Where the requirements of this section differ from Division 26, the requirements of Division 26 shall take precedence.
- B. NEC Class 1 (line voltage) wiring shall be UL listed in approved raceway according to NEC and Division 26 requirements. Low-voltage wiring shall meet NEC Class 2 requirements. Low-voltage power circuits shall be sub-fused when required to meet Class 2 current limit.
- C. Where NEC Class 2 (current-limited) wires are in concealed and accessible locations, including ceiling return air plenums, approved cables not in raceway may be used if cables are UL listed for the intended application.
- D. Do not install Class 2 wiring in raceways containing Class 1 wiring. Boxes and panels containing high-voltage wiring and equipment may not be used for low-voltage wiring except for the purpose of interfacing the two (e.g., relays and transformers).
- E. Where Class 2 wiring is run exposed, wiring is to be run parallel along a surface or perpendicular to it and neatly tied at 10 ft intervals.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- F. Where plenum cables are used without raceway, they shall be supported from or anchored to structural members. Cables shall not be supported by or anchored to ductwork, electrical raceways, piping, or ceiling suspension systems.
- G. All wire-to-device connections shall be made at a terminal block or terminal strip. All wire-to-wire connections shall be at a terminal block.
- H. All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- I. Maximum allowable voltage for control wiring shall be 120 V. If only higher voltages are available, the contractor shall provide step-down transformers.
- J. All wiring shall be installed as continuous lengths, with no splices permitted between termination points.
- K. Install plenum wiring in sleeves where it passes through walls and floors. Maintain fire rating at all penetrations.
- L. Size of raceway and size and type of wire type shall be the responsibility of the contractor in keeping with the manufacturer's recommendations and NEC requirements, except as noted elsewhere.
- M. Include one pull string in each raceway in 1-inch or larger.
- N. Use color-coded conductors throughout with conductors of different colors.
- O. Control and status relays shall be in designated enclosures only. These enclosures include packaged equipment control panel enclosures unless they also contain Class 1 starters.
- P. Conceal all raceways except within mechanical, electrical, or service rooms.
- Q. Secure raceways with raceway clamps fastened to the structure and spaced according to code requirements. Raceways and pull boxes may not be hung on flexible duct strap or tie rods. Raceways may not be run on or attached to ductwork.
- R. Adhere to this specification's Division 26 requirements where raceway crosses building expansion joints.
- S. Install insulated bushings on all raceway ends and openings to enclosures. Seal top end of vertical raceways.
- T. The contractor shall terminate all control and/or interlock wiring and shall maintain updated (as-built) wiring diagrams with terminations identified at the job site.
- U. Flexible metal raceways and liquid-tight flexible metal raceways shall not exceed 3-feet in length and shall be supported at each end. Flexible metal raceway less than ½ in. electrical trade size

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal raceways shall be used.

- V. Raceway must be rigidly installed, adequately supported, properly reamed at both ends, and left clean and free of obstructions. Raceway sections shall be joined with couplings (according to code). Terminations must be made with fittings at boxes. Ends not terminating in boxes shall have bushings installed.

3.4 COMMUNICATION WIRING

- A. The contractor shall adhere to the items listed in the "Wiring" article in Part 3 of the specification. All cabling shall be installed in a neat and workmanlike manner. Follow manufacturer's installation recommendations for all communication cabling.
- B. Do not install communication wiring in raceways and enclosures containing Class 1 or other Class 2 wiring.
- C. Maximum pulling, tension, and bend radius for the cable installation, as specified by the cable manufacturer, shall not be exceeded during installation.
- D. Contractor shall verify the integrity of the entire network following cable installation. Use appropriate test measures for each cable.
- E. When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to manufacturer's instructions.
- F. All runs of communication wiring shall be unspliced length when that length is commercially available.
- G. All communication wiring shall be labeled to indicate origination and destination data.
- H. Grounding of coaxial cable shall be in accordance with NEC regulations article on "Communications Circuits, Cable, and Protector Grounding."
- I. BACnet MS/TP communications wiring shall be installed in accordance with ASHRAE/ANSI Standard 135.
- J. Fiber Optic Cable: Maximum pulling tensions as specified by the cable manufacturer shall not be exceeded during installation. Post-installation residual cable tension shall be within cable manufacturer's specifications. All cabling and associated components shall be installed in accordance with manufacturers' instructions. Minimum cable and unjacketed fiber bend radii, as specified by cable manufacturer, shall be maintained.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Report results in writing.
1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 2. Test and adjust controls and safeties.
 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.
 6. Test each system for compliance with sequence of operation.
 7. Test software and hardware interlocks.
- B. DDC Verification:
1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
 2. Check instruments for proper location and accessibility.
 3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
 4. Check flow instruments. Inspect tag number and line and bore size and verify that inlet side is identified and that meters are installed correctly.
 5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
 6. Check temperature instruments and material and length of sensing elements.
 7. Check control valves. Verify that they are in correct direction.
 8. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.
- C. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.6 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.
5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Outdoor Air Dampers. Prior to occupancy, each ventilation system shall be tested to demonstrate that outdoor air dampers operate in accordance with the system design.
11. Provide diagnostic and test instruments for calibration and adjustment of system.
12. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

- B. Adjust initial temperature and humidity set points.
- C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Section 017900 "Demonstration and Training."
- B. Provide a qualified instructor (or instructors) with five years minimum field experience with the installation and programming of similar BACnet DDC systems. Orient training to the specific systems installed. Coordinate training times with the Owner. Training shall take place at the job site.
- C. This training shall last a minimum of four (4) hours and shall be conducted at the DDC system workstation, at a notebook computer connected to the DDC system in the field, and at other site locations as necessary. Upon completion of the Training, each trainee should fully understand the project's DDC system operation. The training session shall include the following:
 - 1. This project's list of control system components
 - 2. This project's list of points and objects
 - 3. This project's device and network communication architecture
 - 4. This project's sequences of control, and:
 - 5. Alarm capabilities
 - 6. Trending capabilities
 - 7. Troubleshooting communication errors
 - 8. Troubleshooting hardware errors
- D. Provide basic control system fundamentals training.
 - 1. This project's list of control system components
 - 2. This project's list of points and objects
 - 3. This project's device and network communication architecture
 - 4. This project's sequences of control, and:
 - 5. Alarm capabilities
 - 6. Trending capabilities
 - 7. Troubleshooting communication errors
 - 8. Troubleshooting hardware errors
- E. Provide additional project-specific training:
 - 1. A walk-through tour of the mechanical system and the installed DDC components (controllers, valves, dampers, surge protection, switches, thermostats, sensors, etc.)
 - 2. A discussion of the components and functions at each DDC panel
 - 3. Logging-in and navigating at each operator interface type.
 - 4. Using each operator interface to find, read, and write to specific controllers and objects.
 - 5. Modifying and downloading control program changes
 - 6. Modifying setpoints
 - 7. Creating, editing, and viewing trends
 - 8. Creating, editing, and viewing alarms
 - 9. Creating, editing, and viewing operating schedules and schedule objects
 - 10. Backing-up and restoring programming and data bases
 - 11. Modifying graphic text, backgrounds, dynamic data displays, and links to other graphics

12. Creating new graphics and adding new dynamic data displays and links.
13. Alarm and Event management
14. Adding and removing network devices

3.8 TEST AND BALANCE SUPPORT

- A. The controls contractor shall coordinate with and provide on-site support to the test and balance (TAB) personnel. This support shall include:
1. On-site operation and manipulation of control systems during the testing and balancing.
 2. Control setpoint adjustments for balancing all relevant mechanical systems.
 3. Tuning control loops with setpoints and adjustments determined by TAB personnel.

3.9 CONTROLS SYSTEM OPERATOR'S MANUALS

- A. Provide three electronic and printed copies of a Controls System Operators Manual. The manual shall be specific to the project, written to actual project conditions, and provide a complete and concise depiction of the installed work. Provide information in detail to clearly explain all operation requirements for the control system.
- B. Provide with each manual: CDs of the project's control system drawings, control programs, data bases, graphics, and all items listed below. Include gateway back-up data and configuration tools where applicable.
- C. Provide printed manuals in sturdy 3-ring binders with a title sheet on the outside of each binder indicating the project title, project location, contract number, and the controls contractor name, address, and telephone number. Each binder shall include a table of contents and tabbed dividers, with all material neatly organized. Manuals shall include the following:
1. A copy of the as-built control system (shop) drawings set, with all items specified under the paragraph "Submittals." Indicate all field changes and modifications.
 2. A copy of the project's mechanical design drawings, including any official modifications and revisions.
 3. A copy of the project's approved Product Data submittals provided under the paragraph "Submittals."
 4. A copy of the project's approved Performance Verification Testing Plan and Report.
 5. A copy of the project's approved final TAB Report.
 6. Printouts of all control system programs, including controller setup pages if used. Include plain-English narratives of application programs, flowcharts, and source code.
 7. Printouts of all physical input and output object properties, including tuning values, alarm limits, calibration factors, and set points.
 8. A table entitled "AC Power Table" listing the electrical power source for each controller. Include the building electrical panel number, panel location, and circuit breaker number.
 9. The DDC manufacturer's hardware and software manuals in both print and CD format with printed project-specific labels. Include installation and technical manuals for all controller hardware, operator manuals for all controllers, programming manuals for all controllers,

operator manuals for all workstation software, installation and technical manuals for the workstation and notebook, and programming manuals for the workstation and notebook software.

10. A list of qualified control system service organizations for the work provided under this contract. Include their addresses and telephone numbers.
11. A written statement entitled "Software Upgrades" stating software and firmware patches and updates will be provided upon request at no additional cost to the Owner for a minimum of two years from contract acceptance. Include a table of all DDC system software and firmware provided under this contract, listing the original release dates, version numbers, part numbers, and serial numbers.

3.10 CLEANING

- A. The contractor shall clean up all debris resulting from his/her activities daily. The contractor shall remove all cartons, containers, crates, etc., under his/her control as soon as their contents have been removed. Waste shall be collected and placed in a designated location.
- B. At the completion of work in any area, the contractor shall clean all work, equipment, etc., keeping it free from dust, dirt, and debris, etc.
- C. At the completion of work, all equipment furnished under this section shall be checked for paint damage, and any factory-finished paint that has been damaged shall be required to match the adjacent areas. Any cabinet or enclosure that has been deformed shall be replaced with new material and repainted to match the adjacent areas.

END OF SECTION 230900

SECTION 230993 - SEQUENCE OF OPERATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 1
 - 2. Division 23 Section - Common Work Results
 - 3. Division 23 Section – Direct Digital Control (DDC) System
 - 4. Other Sections – Equipment with built in DDC controllers.
 - 5. Division 23 Section - Testing, Adjusting, and Balancing
 - 6. Division 26 - Electrical

1.2 GENERAL

- A. Control sequences are intended to be performance based. Implementations that provide the same functional result using different underlying detailed logic will be acceptable. As noted, control sequences shall be in accordance with ASHRAE Guideline 36-2021.
- B. All points shown in the points list or described in the sequence shall be shown on the graphics.
- C. All setpoints including setpoints internal to control algorithms shall be adjustable from all BAS operator interfaces. All commands shall be overridable from all BAS operator interfaces. All control points shall be adjustable or overridable from the same graphic page that displays the points.
- D. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be adjustable by the user with appropriate access level whether indicated as adjustable in sequences or not. Software points shall be used for these variables. Fixed scalar numbers shall not be embedded in programs except for physical constants and conversion factors.
- E. All points required by the sequence of operation including, but not limited to, the points listed in the sequences of operation below, as well as all the points' associated values, shall be connected to the BAS and available to the BAS operators on all operator workstations and all operator interface devices as part of a graphical display that depicts the mechanical system controlled.
- F. Unless otherwise indicated, control loops shall be enabled and disabled based on the status of the system being controlled to prevent windup.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- G. When a control loop is enabled or reenabled, it and all its constituents (such as the proportional and integral terms) shall be set initially to a neutral value.
- H. A control loop in neutral shall correspond to a condition that applies the minimum control effect, i.e., valves/dampers closed, VFDs at minimum speed, etc.
- I. When there are multiple OA temperature sensors, the system shall use the valid sensor that most accurately represents the OA conditions at the equipment being controlled.
- J. The term “control loop” or “loop” is used generically for all control loops. These will typically be PID loops, but proportional plus integral plus derivative gains are not required on all loops. Unless specifically indicated otherwise, the guidelines in the following subsections shall be followed.
 - 1. Use proportional only (P-only) loops for limiting loops (such as zone CO2 control loops, etc.). Limiting loops are used to prevent controlled variables from rising above or dropping below setpoint (depending on the application) by defining a fixed threshold at which the loop output reaches 100%. Limiting loops shall use proportional-only control to prevent integral windup from causing the controlled sensor to overshoot setpoint due to the sensor generally being far from setpoint.
 - 2. Do not use the derivative (D) term on any loops unless field tuning is not possible without it. Use of the derivative term makes loop tuning difficult in practice. It can make loops unstable because it increases as the rate of change of the error increases, amplifying the error signal. It is used in industrial process controls and systems that must react quickly but is rarely if ever needed in HVAC system.
 - 3. Limit PID maximum change to 25%, make this a user modifiable variable.
- K. When HVAC equipment or a sequence is specified to be started and stopped by a temperature, humidity, pressure setpoint or any other controlled variable, there shall be an adjustable differential setpoint that shall be set to prevent short cycling of the systems and equipment due to minor changes in the controlled variable. Temperature differential setpoints shall be set at 2°F and non-temperature setpoints shall be set at 10% of the controlled range unless otherwise specified. Setpoints shall indicate at when the process should be turned ON. Heating and cooling differentials shall be set for above setpoint and will be used to turn the process OFF. For example, an economizer sequence called to switch at 68°F, would turn ON at 68°F and OFF at 70°F since it is a cooling function. A heating lockout setpoint of 50 °F would turn ON heating control at 50°F and OFF at 52°F Non-temperature differentials shall be set above setpoint if the setpoint is indicating a minimum value or below setpoint if the setpoint is indicating a maximum value. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Unless otherwise specified in the individual control sequences, fans and pumps shall have a minimum runtime ON timers of 15 minutes (adj.) and OFF timers of 5 minutes (adj.). Safeties shall override runtime timers.
- L. To avoid abrupt changes in equipment operation, the output of every control loop shall be capable of being limited by a user adjustable maximum rate of change, with a default of 25% per minute.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- M. Provide minimum runtime timers for loads that are cycled to prevent over-cycling. Timers shall be set as specified or as needed to prevent damage or excessive wear to the equipment. Safeties shall override runtime timers.
- N. All setpoints, timers, deadbands, PID gains, etc. listed in sequences shall be adjustable by the user with appropriate access level whether indicated as adjustable in sequences or not. Software points shall be used for these variables. Fixed scalar numbers shall not be embedded in programs except for physical constants and conversion factors.
- O. The BAS contractor is responsible for utilizing the functional performance test procedures developed by the commissioning agent in accordance with the procedures defined for functional performance test procedures.
- P. Values for all points, including real (hardware) points used in control sequences shall be capable of being overridden by the user with appropriate access level (e.g., for testing and commissioning). If hardware design prevents this for hardware points, they shall be equated to a software point, and the software point shall be used in all sequences. Exceptions shall be made for machine or life safety.
 - 1. All hardware points, not just inputs, shall be capable of being overridden for purposes of testing and commissioning. For example, the commissioning agent shall be able to command damper positions, valve positions, fan speeds, etc. directly through BAS overrides.
 - 2. The requirement to equate hardware points to software points is necessary for systems that do not allow overriding real input points.
 - 3. The user interface shall allow the user to set an expiration period that automatically releases the override after the period has expired. The system shall also keep track of who initiates each override and when.
- Q. Provide Sequenced starting of HVAC equipment at initial startup, whether specifically mentioned in each Sequence of Operation.
- R. All setpoints indicated in the control specification are to be adjustable. The setpoints indicated herein are only specified as a calculated starting point (or initial system operation). It is expected that setpoint adjustments and control loop tuning shall be required to provide optimum system operation based on the requirements of the building. The control contractor shall work with the TAB contractor (230593) and the Owner to provide the final system setpoint adjustments and control loop tuning after the system is in operation and building is in use.
- S. BACnet
 - 1. All controllers with BACnet cards shall be integrated into the DDC system via BACnet. Provide DDC programming to define input and output information available through the boiler manufacturer's integration data port.
 - 2. All hardwired points and any setpoints, timers, or other control elements that are specified to be adjustable (adj.) shall be mapped as BACnet objects and be available on the user interface to be adjusted.

- T. Trends shall be provided for all hardware I/O points and integrated points listed as having trending and for analog and binary data points mapped to the user interface. Interval trending with sample intervals of 10 minutes shall be provided on analog process variables (this includes both analog inputs and calculated process variables) and process outputs. Data shall be stored at the supervisory controller or in the field controller and uploaded to the DDC system server when archiving is desired. Consult with the Owner to determine which trends should be archived. Trending shall be in place for a minimum of 24 hours prior to functional testing by the commissioning provider. The BAS shall sample and store trend data and shall be able to archive data to the hard disk.
- U. Variable Frequency Drives (VFD) Speed Points per ASHRAE Guideline 36-2021:
1. The speed AO sent to VFDs shall be configured such that 0% speed corresponds to 0 Hz, and 100% speed corresponds to maximum speed configured in the VFD.
 2. For each piece of equipment, the minimum speed shall be stored in a single software point; in the case of a hard-wired VFD interface, the minimum speed shall be the lowest speed command sent to the drive by the BAS. The active minimum speed parameter shall be read every 60 minutes via the drive's network interface. When a mismatch between the drive's active minimum speed and the minimum speed stored in the software point is detected, the minimum speed stored in the software point shall be written to the VFD via the network interface to restore the active minimum speed parameter to its default value and generate a Level 4 alarm.
 3. The VFD start-up technician shall work with the BAS Contractor to determine the minimum speed required for the motor controlled by the VFD to provide cooling of the motor as installed to prevent heat related problems. This minimum speed shall be set in the VFD controller.
- V. Point Types
1. AO = analog output
 2. DO = digital output (also, BO = binary output)
 3. AI = analog input
 4. DI = digital input (aka BI = Binary Input)

1.3 ALARMS

- A. Provide alarms per ASHRAE Guideline 36, Paragraph 5.1.12: "Alarms".
- B. Provide at least the following requirements in the specification for the BAS graphical user interface:
1. All alarms shall include a time/date stamp using the standalone control module time and date.
 2. Each alarm can be configured in terms of level, latching (Requires Acknowledgment of a Return to Normal/Does Not Require Acknowledgment of a Return to Normal), entry delay, exit deadband, and post-suppression period.

4. An operator shall be able to sort alarms based on level, time/date, and current status. Alarms should be reported with the following information:
 - a. Date and time of the alarm
 - b. Level of the alarm
 - c. Description of the alarm
 - d. Equipment tags for the units in alarm.
 - e. Possible causes of the alarm if provided by the fault detection routines.
 - f. The source that serves the equipment in alarm, per ASHRAE Guideline 36, Paragraph 5.1.19 “Hierarchical Alarm Suppression”.
 - C. As per ASHRAE Guideline 36, there shall be 4 levels of alarm:
 1. Level 1: Life-safety message
 2. Level 2: Critical equipment message
 3. Level 3: Urgent message
 4. Level 4: Normal message
 - D. Alarms shall be reset during a power failure; the controls shall be programmed to ignore alarms that will occur upon loss of power. For example, a pump status alarm is not necessary, since it’s obvious that the pump will fail upon loss of power.
 - E. Alarms associated with equipment that is disabled shall be inhibited.
 - F. Current status-switches shall prove the operation of fans and pumps. Level 2 Alarm, Fans & pumps: Status point not matching it’s ON/OFF point for 3 seconds after a time delay of 15 seconds while the equipment is commanded ON. The term “proven” (i.e., “prove ON”/ “prove OFF”) shall mean that the equipment’s DI status point (current switch) matches the state set by the equipment’s DO command point.
 - G. If an operating equipment has any fault condition, a Level 2 alarm shall be generated, and a response shall be triggered as defined in ASHRAE Guideline 36.
- 1.4 TRIM & RESPOND (T&R) SET-POINT RESET LOGIC
- A. Provide T&R logic per ASHRAE Guideline 36, Paragraph 5.1.14: “Trim & Respond Set-Point Reset Logic”.
 - B. Trim & Respond logic shall reset the setpoint within the range minimum (SPmin) to maximum (SPmax) setpoint. When the associated device is OFF, the setpoint shall be SP0.
 - C. T&R logic resets a setpoint for pressure, temperature, or other variables. It reduces the setpoint at a fixed rate until a downstream zone is no longer satisfied and generates a request. When enough requests are present, the setpoint is increased in response. The importance of each zone’s requests can be adjusted to ensure that critical zones are always satisfied. When enough requests no longer exist, the setpoint resumes decreasing at its fixed rate. A running total of the requests generated by each zone is kept identifying zones that are driving the reset logic.

- D. Damper/Valve Position: Knowledge of damper and valve position are required for proper generation of T&R reset requests. The following are acceptable methods for determining position:
1. Analog actuator. Position may be assumed to be equal to analog signal to actuator.
 2. Floating actuator. Provide either:
 - a. Position feedback AI
 - b. Position estimated by timing pulse-open and pulse-closed commands with autozeroing whenever zone is in Unoccupied Mode and damper is driven full closed. This option is not acceptable for 24/7 applications.

1.5 EQUIPMENT STAGING AND ROTATION

- A. All parallel equipment shall be lead/lag or lead/standby rotated to maintain even wear.
- B. Provide per ASHRAE Guideline 36, Paragraph 5.1.15: “Equipment Staging and Rotation”.
- C. Two runtime points shall be defined for each equipment:
1. Lifetime Runtime: The cumulative runtime of the equipment since equipment start-up. This point shall not be readily resettable by operators. Lifetime Runtime shall be stored to a software point on the control system server, so the recorded value is not lost due to controller reset, loss of power, programming file update, etc.
 2. Staging Runtime: An operator resettable runtime point that stores cumulative runtime since the last operator reset. Staging Runtime provides a resettable runtime counter, which allows for reset of the staging runtime hours used for lead/lag or lead/standby rotation between maintenance intervals or equipment replacement while maintaining a separate log of the Lifetime Runtime.
- D. Lead/lag equipment: Unless otherwise noted, identical parallel staged equipment (e.g., pumps) shall be lead/lag alternated when more than one is OFF or more than one is ON so that the equipment with the most operating hours as determined by Staging Runtime is made the last stage equipment and the one with the least number of hours is made the lead stage equipment. This strategy effectively makes it such that equipment are not “hot swapped”, e.g., a pump would not be started and another stopped during operation just for runtime equalization.
- E. Lead/standby equipment:
1. Unless equipment runs continuously, parallel equipment that are 100% redundant shall be lead/standby alternated when more than one of the equipment is off so that the equipment with the most operating hours as determined by Staging Runtime is made the last stage equipment and the one with the least number of hours is made the earlier stage equipment.
 2. If equipment runs continuously, lead/standby positions shall switch at an adjustable day of the week and time (e.g., every Tuesday at 10:00 am) based on Staging Runtime; standby equipment shall first be started and proven on before former lead equipment is changed to standby and shut off.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

3. Variable speed fans and pumps shall have a deceleration rate of 1 Hz/second or slower set in BAS logic when disabled to prevent nuisance trips of operating equipment (e.g., chillers).

F. Exceptions to Lead/lag and Lead/standby rotation

1. Operators with appropriate access level shall be able to manually command staging order via software points but not overriding the In-Alarm or Hand-Operation logic in the following subsections.
 - a. Staging order changes initiated via operator override shall be instituted as part of normal staging events.
 - b. Staging order shall remain overridden until released by operators.
2. Faulted Equipment:
 - a. A faulted equipment is any equipment commanded to run that is either not running or unable to perform its required duty. If an operating equipment has any fault condition described subsequently, a Level 2 alarm shall be generated, and a response shall be triggered.
 - b. Fans and Pumps: Status point not matching its on/off point for 3 seconds after a time delay of 15 seconds while the equipment is commanded on.
3. Upon identification of a fault condition:
4. For fans, pumps, and cooling towers:
 - a. The next commanded off equipment in the staging order, Equipment “B”, shall be commanded on while alarming Equipment “A” remains commanded on.
 - b. If Equipment “B” fails to prove status (i.e., it also goes into alarm), it shall remain commanded on and the preceding step shall be repeated until the quantity of equipment called for by the current stage has proven on, or there are no more available equipment.
 - c. Set alarming equipment to the last positions in the lead/lag or lead/standby staging order sequenced reverse chronologically (i.e., the equipment that alarmed most recently is sent to last position).
 - d. Staging order of non-alarming equipment shall follow the even wear logic. Equipment in alarm can only automatically move up on the staging order if another equipment goes into alarm.
 - e. Equipment in alarm shall run if so called for by the lead/lag or lead/standby staging order and present stage.
5. Hand Operation. If a piece of equipment is on-in-hand (e.g., via an HOA switch or local control of VFD), the equipment shall be set to the lead device, and a Level 4 alarm shall be generated. The equipment will remain as lead until. Hand operation is determined by the following:
 - a. Fans and Pumps: Status point not matching its on/off point for 15 seconds after a time delay of 60 seconds when the equipment is commanded off.

PART 2 - SEQUENCES

2.1 CHILLER PLANT

A. Provide per ASHRAE Guideline 36-2021:

1. Provide Setpoints per 3.1.7. Chilled Water Plant.
 - a. CHWSTminX, the lowest chilled water supply temperature setpoint for Chiller X.
 - b. CHWSTmax, the maximum chilled water supply temperature setpoint used in plant reset logic.
 - c. CH-LOT, the outdoor air lockout temperature below which the chiller plant is prevented from operating.
 - d. CHW-MinFlowX, the minimum chiller chilled water flowrate per manufacturer's recommendations for Chiller X, in GPM.
 - e. CHW-DesFlowX, the design chiller chilled water flowrate for Chiller X, in GPM.
2. Guideline 36 Paragraph 5.20.2 Plant Enable/Disable. When OA temperature is greater than 57 °F (adj.), the chiller shall be enabled. The minimum chiller runtime shall be 30 minutes (adj.).
3. Guideline 36 Paragraph 5.20.3 Waterside Economizer Control.
4. Chiller Failure: Level 2 Alarm.
5. Guideline 36 Paragraph 5.20.5 Chilled Water Plant Reset. Chilled water supply temperature setpoint shall be reset using T&R logic.
6. Guideline 36 Paragraph 5.20.6 Primary Chilled Water Pumps. Primary pumps shall be started to serve their respective chiller when it is requested to run per the chiller start and stop sequence. Pumps shall run continuously when the respective chiller is requested. BAS shall prove operation of the pump. **Under Alternate #1**, pump speed shall modulate to maintain building chilled water loop pressure differential at setpoint. Evaporator and condenser barrel isolation valves shall power open on call for chiller operation. **Under the base bid**, the existing chilled water pumps shall operate at constant speed and the system DP shall be maintained by the existing chilled water bypass valve.
7. Guideline 36 Paragraph 5.20.8. Chilled Water Minimum Flow Bypass Valve. **Under Alternate #1** the minimum flow bypass valve shall modulate to maintain DP across the evaporator barrel to ensure minimum flow rate per chiller requirements-set by TAB Contractor. **Under the base bid**, chilled water flow through the evaporator barrel shall be constant flow.
8. Guideline 36 Paragraph 5.20.9. Condenser Water Pumps. Condenser water pumps shall run at constant speed as set by the TAB contractor on call for chiller operation. **Under the base bid** the existing pumps shall operate as existing. **Under Alternate #2** provide control for the new condenser pumps, to operate at constant speed as exists, enabled when either the new chiller or the existing Clean Room chiller are enabled.
9. Guideline 36 Paragraph 5.20.10. Head Pressure Control.
10. Guideline 36 Paragraph 5.20.11. Water Treatment Override.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

11. Guideline 36 Paragraph 5.20.12. Cooling Towers. Tower fan shall modulate to maintain condenser water temperature. Tower water bypass valve shall modulate to maintain minimum temperature condenser water loop temperature at setpoint. **Under the base bid** the existing controls shall remain as exist. **Under Alternate #2** the new tower controller shall be integrated to the existing BAS via Bacnet integration.
12. Guideline 36 Paragraph 5.20.13. Tower Make-up Water **Existing to Remain..**
13. Paragraph 5.20.15. Freeze Protection.
14. Guideline 36 Paragraph 5.20.16. Performance Monitoring. ASHRAE 90.1-2016 Chiller Plant Monitoring: The electrical energy use efficiency shall be trended every 15 minutes and graphically displayed and include hourly, daily, monthly, and annual data. The system shall maintain all data collected for a minimum of 36 months.
15. Guideline 36 Paragraph 5.20.17 Alarms.

B. Guideline 36-2021 Paragraph 5.21.10. Alarms

1. Chiller fault, Level 2.
2. Low leaving CHW temperature (more than 5°F above setpoint) for more than 15 minutes when chiller plant has been enabled for longer than 15 minutes: Level 3.
3. Provide pump fault alarms per Paragraph 1.3 “Alarms”.
4. Valve alarm is indicated by the end switch status being different from the output command for 90 seconds.

END OF SECTION 230993

SECTION 232113 – HYDRONIC HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division 23 Section "Common Work Results"
 - 2. Division 23 Section "Hydronic Pumps" for pumps, motors, and accessories.
 - 3. Division 23 controls section for temperature-control valves and sensors.

1.2 SUMMARY

- A. This Section includes piping and specialties for hydronic HVAC piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Piping
 - 2. Hydronic specialties
 - 3. Chemical treatment.
- B. Delegated-Design Submittal: Braided Expansion Loops
 - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
 - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.

1.4 INFORMATIONAL SUBMITTALS

- A. Water Analysis: Submit a copy of the water analysis to illustrate water quality available at Project site.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air-control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Welding: Qualify processes and operators according to the ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- B. Qualify soldering processes, procedures, and solderers for copper and copper alloy pipe and tube in accordance with ASTM B 828.
- C. Qualify brazing processes for copper and copper alloy pipe and tube according to ANSI/AWS C3.4.
- D. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
- E. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.

1.7 COORDINATION

- A. Drawings show the general layout of piping and accessories but do not show all required fittings and offsets that may be necessary to connect piping to equipment and to coordinate with other trades. Fabricate piping based on field measurements. Provide all necessary fittings and offsets.
- B. Coordinate layout and installation of hydronic piping and suspension system components with other construction.
- C. Coordinate pipe sleeve installations and penetrations with other trades.
- D. Coordinate pipe fitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

1. Grooved Mechanical-Joint Fittings and Couplings:
 - a. Victaulic Company of America.
 - b. Anvil
 - c. Grinnell Corporation.

2. Balancing Valves:
 - a. Griswold Controls.
 - b. ITT Bell & Gossett
 - c. Taco, Inc.
 - d. Tour & Anderson
 - e. IMI Flow Design
 - f. Griswold Controls
 - g. Watts Industries Inc.
 - h. Caleffi
 - i. Nexus

3. Hydronic Pressure-Reducing Valves:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Conbraco Industries, Inc.
 - d. ITT Bell & Gossett
 - e. Spence
 - f. Caleffi
 - g. Watts Industries, Inc.

4. Safety Valves:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Conbraco Industries, Inc.
 - d. ITT McDonnell & Miller.
 - e. Kunkle Valve Division.
 - f. Spence
 - g. Caleffi
 - h. Watts Industries Inc.

5. Expansion Tanks, Air Separators, and Hydronic Specialties:
 - a. Spirovent
 - b. ITT Bell & Gossett
 - c. Taco, Inc.
 - d. Spirax Sarco
 - e. Watts Industries Inc.
 - f. Wessels
 - g. Patterson
 - h. Thrush

- i. Armstrong
- j. Flamco

6. Air Vents and Vacuum Breakers:

- a. Armstrong International, Inc.
- b. Barnes & Jones, Inc.
- c. ITT Hoffman
- d. Caleffi
- e. Spirotherm
- f. Spirax Sarco, Inc.

2.2 PIPING MATERIALS

- A. General: Refer to Part 3 "Piping Applications" Article for applications of pipe and fitting materials.

2.3 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. DWV Copper Tubing: ASTM B 306, Type DWV.
- C. Fitting Standard: Copper fittings shall conform to ASME B16.18, ASME B16.22 or ASME B16.26.
- D. Press Fitting: Viega Pro Press - Copper and copper alloy press fittings shall conform to material requirements of ASME B16.18 or ASME B16.22 and performance criteria of IAPMO PS 117. Sealing elements for press fittings shall be EPDM. Sealing elements shall be factory installed, or an alternative supplied by fitting manufacturer. Press ends shall have SC (Smart Connect) feature design (leakage path). Provide a smart connect feature to assure leakage of liquids and/or gases from inside the system past the sealing element of an un-pressed connection. The function of this feature shall be to provide the installer quick and easy identification of connections which have not been pressed prior to putting the system into operation.
- E. Wrought-Copper Unions: ASME B16.22.
- F. Solder Filler Metals: ASTM B 32, 95-5 tin antimony.
- G. Brazing Filler Metals: AWS A5.8, Classification BAg-1 (silver).

2.4 STEEL PIPE AND FITTINGS

- A. Steel Pipe, NPS 2 and Smaller: ASTM A-53, Type S (seamless) or Type F (furnace-butt welded), Grade B, Schedule 40 and 80, black steel, plain ends.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- B. Steel Pipe, NPS 2-1/2 and larger: ASTM A-53, Type E (electric-resistance welded), Grade B, Schedule 40 and 80, black steel, plain ends.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced.
- F. Wrought-Steel Fittings: ASTM A-234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings: Material Group: 1.1. End Connections: Butt-welding. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Victaulic or approved equal.
 - 2. Grooved Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron, ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 234, Grade WPB forged steel fittings with grooves or shoulders constructed to accept Victaulic grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - 3. Couplings: Ductile-iron housing and synthetic rubber gasket of central cavity pressure-responsive design (Grade “E” EPDM for water services –30°F to 230°F or Grade “EHP” EPDM for water services rated –30°F to 250°F); with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.
 - a. Rigid Type: Housings shall be cast with offsetting, angle-pattern bolt pads to provide system rigidity and support and hanging in accordance with ASME B31.1 and B31.9; Victaulic Style 07 (Zero-Flex®) or Style 107 Quick-Vic® Installation-Ready design.
 - b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Victaulic Style 75 or 77.
 - c. Flange Adapters: Ductile iron housing, flat face, for use with grooved end pipe and fittings, for mating directly with ANSI Class 125, 150, and 300 flanges. Victaulic Style 741 or 743.
- I. Mechanically formed copper or steel tee connections are not acceptable.
- J. Welded Branch and Tap Connections: Forged steel weldolets, or branchlets and threadolets may be used for branch connections up to one pipe size smaller than the main. Forged steel half-couplings, ANSI B16.11 may be used for drain, vent and gage connections.
- K. Welding Materials: Comply with Section II, Part C, of the ASME Boiler and Pressure Vessel Code for welding materials appropriate for wall thickness and for chemical analysis of pipe being welded.

- L. Gasket Material: Thickness, material, and type suitable for fluid to be handled; and design temperatures and pressures.

2.5 HYDRONIC VALVES

A. Normally use Ball valves for shut off duty: Gate Valves

1. Threaded Ends 2" and Smaller: Class 125, bronze body, union bonnet, rising-stem, solid wedge: Hammond IB617, Nibco T-124/134, Stockham B105, Milwaukee 1152 or equal.
2. Flanged Ends 2-1/2" and Larger: Class 125, iron body, bronze mounted, bolted bonnet, rising stem, OS&Y, solid wedge: Hammond IR1140, Nibco F617-0, Stockham G623, Milwaukee F2885 or equal.
3. Solder Ends 2" and Smaller: Class 125, bronze body, union bonnet, rising-stem, solid wedge: Hammond IB648, Nibco S134, Stockham B115, Milwaukee 1169 or equal.
4. Comply with the following standards: Cast Iron Valves: MSS SP – 70; Bronze Valves: MSS SP – 80.

B. Ball Valves

1. Threaded Ends 4" and Smaller: 150 psi WP and 600 psi non-shock CWP, forged brass full-port or cast bronze two-piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Watts FBV-3C series/B6080 series, Hammond 8501, Nibco T-585-70, Milwaukee BA100, Apollo 70-Series, or approved equal.
2. Soldered Ends 3" and Smaller: 150 psi WP and 600psi non-shock CWP, full-port cast bronze or forged brass two-piece body, hard chrome plated forged brass ball, true adjustable packing nut ("O"-ring only type stem seal not acceptable), blow-out proof stem: Watts FBVS-3C series/B6081 series, Hammond 8511, Nibco S-585-70, Milwaukee BA150, Apollo 70-Series, approved or equal.
3. Comply with MSS SP-110.

C. Butterfly Valves

1. Basis of Design: Center Line Series 200; Lug Type, cast iron, drilled and tapped lug body, ductile iron disc, 416SS shaft, bronze bushing, EPDM seat.
2. Valve bodies shall have extended necks to provide for 2-1/4" insulation as needed.
3. Comply with MSS SP-67.
4. Compatible with ANSI 125/150 flanges. Dead-end capacity to 200 psi.
5. Operators: 6" and smaller: handle with infinite adjustment; 8" and larger: gear w/balance-stop hand wheel. Valves located 7 feet or higher: provide gear/chain wheel.
6. Approved Manufacturers: Watts, Hammond, Nibco, Milwaukee, or approved equal.

D. Bronze Globe Valves, Class 125:

1. Description:

- a. Standard: MSS SP-80, Type 1.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and screw-in bonnet.
- d. Ends: Threaded or solder joint.
- e. Stem and Disc: Bronze.
- f. Packing: Asbestos free.
- g. Handwheel: Malleable iron.

E. Bronze Globe Valves, Class 150:

1. Description:

- a. Standard: MSS SP-80, Type 2.
- b. CWP Rating: 300 psig.
- c. Body Material: ASTM B 62, bronze with integral seat and union-ring bonnet.
- d. Ends: Threaded.
- e. Stem: Bronze.
- f. Disc: Bronze.
- g. Packing: Asbestos free.
- h. Handwheel: Malleable iron.

F. Iron Globe Valves, Class 125:

1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 200 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.
- g. Operator: Handwheel or chainwheel.

G. Iron Globe Valves, Class 250:

1. Description:

- a. Standard: MSS SP-85, Type I.
- b. CWP Rating: 500 psig.
- c. Body Material: ASTM A 126, gray iron with bolted bonnet.
- d. Ends: Flanged.
- e. Trim: Bronze.
- f. Packing and Gasket: Asbestos free.
- g. Operator: Handwheel or chainwheel.

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BARROWS HALL
UNIVERSITY OF MAINE
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- H. Wafer Check valves: Provide wafer style, butterfly type, spring actuated check valves designed to be installed with gaskets between two standard Class 125 flanges. Construct iron body valves with pressure containing parts of valves with materials conforming to ANSI/ASTM A 126, Grade B. Support hanger pin by removable side plug; Class 125, cast iron body, stainless steel trim, bronze disc, Buna-N seal; Watts BF/DBF series, Metraflex 700 Series, Nibco W920-W, Stockham WG970, Hammond 9253, Milwaukee 1400, or approved or equal.
- I. Swing check valves:
1. Construct pressure containing parts of Valves as follows: Bronze Valves: 125 or 150 psi: ANSI/ASTM B 62; Iron Body Valves: ANSI/ASTM A-126, Grade B. Comply with the following standards for design, workmanship, material and testing: Bronze Valves: MSS SP – 80; Cast Iron Valves: MSS SP – 71.
 2. Construct valves of pressure casting free of any impregnating materials. Construct disc and hanger as one piece. Support hanger pins by removable side plug.
 3. Threaded Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc: Hammond IB904, Nibco T-413Y, Stockham B320T, Milwaukee 509 or approved equal.
 4. Soldered Ends 2" and Smaller: Class 125, bronze body, screwed cap, Teflon disc: Hammond IB912, Nibco S-413-Y, Stockham B310T, Milwaukee 511 or approved equal.
 5. Flanged Ends 2-1/2" and Larger: Class 125, iron body, bronze mounted, horizontal swing, cast-iron disc: Hammond IR1124, Nibco F918-B, Stockham G931, Milwaukee F2974 or approved equal.
- J. Pressure-Reducing Valves: Diaphragm-operated, bronze or brass body with low inlet pressure check valve, inlet strainer removable without system shutdown, and non-corrosive valve seat and stem. Select valve size, capacity, and operating pressure to suit system. Valve shall be factory set at operating pressure and have capability for field adjustment.
- K. ASME Safety Relief Valves: Bell & Gossett A-434D, or equal; diaphragm-operated, bronze or brass body with brass and rubber, wetted, internal working parts; shall suit system pressure and heat capacity and shall comply with the ASME Boiler and Pressure Vessel Code, Section IV. The fluid shall not discharge into the spring chamber. The valve shall have a low blow-down differential. The valve seat and all moving parts exposed to the fluid shall be of non-ferrous material.

2.6 HYDRONIC SPECIALTIES

- A. Manual Air Vent: Bronze body and nonferrous internal parts; 150-psig working pressure; 225 deg F operating temperature; manually operated with screwdriver or thumbscrew; with NPS 1/8 discharge connection and NPS 1/2 inlet connection.
- B. Automatic Air Vent: Spirotherm Spirotop, or equal; maintenance-free, designed to vent automatically with float principle; solid-brass body and nonferrous internal parts; 150-psig working pressure; 270°F maximum temperature; NPS 1/2 inlet connection; 1/2" male thread at vent point for pressure-testing or remote venting of unwanted gases. The Spirotop has a unique "dry" vent design that helps prevent the system fluid from reaching the spring actuated Viton

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BARROWS HALL
UNIVERSITY OF MAINE
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seat and seal assembly, which is the cause of most conventional air vent failures. Air vent shall be dry: release air, not water.

1. The unique valve mechanism is guaranteed not to leak and cannot be shut off.
 2. Specially constructed air chamber to protect the valve mechanism from dirt.
 3. Sufficient volume to handle pressure fluctuations.
 4. A reliable vacuum breaker for system draining.
 5. Leak and dirt resistant.
- C. Inline Air-Dirt-Magnet Separator: Spirotherm Spirocombi air & dirt separator with magnet. Eliminates air and system from dirt and debris.
1. Horizontal or vertical pipe installation (360°).
 2. Shell: Brass
 3. Vent Head: Brass
 4. Float: Non-Ferrous
 5. Seal: Viton
 6. O Ring: Viton/EPDM
 7. Coalescing Medium: Copper; Eliminates 100% of the free air, 100% of the entrained air, and up to 99.6% of the dissolved air in the system.
 8. Magnet: Neodymium; separates dirt particles and ferrous material using powerful magnets around flow path.
 9. Max. Working Pressure: 150 psig
 10. Max. Operating Temperature: 270°
- D. In-Line Air Separators: Taco Air Scoop, Spirotherm, or equal; enlarged design with internal baffles slows the water velocity to separate the air from solution. One-piece cast iron with an integral weir designed to decelerate system flow to maximize air separation at a working pressure up to 125 psig and liquid temperature up to 300 deg F. Each Air Scoop shall have a 1/8" vent connection on top for the installation of a Taco 400-3 or 416-1 Hy-Vent, and a 1/2" bottom tapping for a diaphragm expansion tank.
- E. Y-Pattern Strainers: Strainers shall be Y-type with removable basket. Body shall have cast-in arrows to indicate direction of flow. Strainer screens shall have finished ends fitted to machined screen chamber surfaces to preclude bypass flow. Strainer element material shall be AISI Type 304 corrosion-resistant steel. Provide fine-mesh start-up strainers. Strainers in sizes 3-inch and smaller shall have screwed ends; Hammond 3010 or approved equal. Body material shall be cast bronze conforming to ASTM B584-C84400. Strainer bodies fitted with screwed screen retainers shall have straight threads and shall be gasketed with nonferrous metal. Strainer screens shall have perforations not to exceed 1/32". In sizes 4 and larger, strainers shall have flanged ends; Hammond 3030 or approved equal. Body material shall be cast iron conforming to ASTM A126 Class B. Strainer bodies fitted with bolted-on screen retainers shall have offset blowdown holes. Strainer screens shall have perforations not to exceed 1/16" (4" size); 1/8" (5" size and larger).

F. Differential Pressure Bypass Valve

1. Basis-of-Design Product: Subject to compliance with requirements, provide products by Caleffi North America; 519 Series or comparable product by one of the following:
 - a. Bell & Gossett (Xylem).
 - b. Taco Comfort Solutions.
2. Description: Used in systems with a fixed-speed circulating pump supplying several zones controlled by two-way zone valves. Ensures that the head pressure of the pump is proportional to the number of two-way valves being closed. It will bypass the differential pressure created by the pump as the zone valves close, thus eliminating water hammer noise.
3. Body Material: Brass.
4. Valve Plug: Brass.
5. Valve Plug Gasket and O-ring Seals: Peroxide-cured EPDM.
6. Union Seals: Asbestos free nitrile, butadiene rubber.
7. Control Knob: ABS.
8. Spring: Stainless steel.
9. Maximum Working Pressure: 150 psig.
11. Connections: Union.
12. Temperature Range: 32 to 23°F.
13. Flow Rates:
 - a. Size: NPS 3/4 up to 9 GPM.
 - b. Size: NPS 1 up to 40 GPM.
 - c. Size: NPS 1-1/4 up to 45 GPM.

G. Chilled water buffer tanks shall be as manufactured by Cemline Corporation or approved equal.

2.7 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Peterson Equipment Co., Inc.
 2. Flow Design, Inc.
 3. Trerice, H. O. Co.
 4. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 5. Weiss Instruments, Inc.
- B. Description: "Pete's Plug II", a 1/4" fitting to receive either a temperature or pressure probe 1.8" OD.
- C. Body: Solid brass with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping. Core Inserts: Nordel, an ethylene-propylene based synthetic rubber.

- D. Minimum Pressure and Temperature Rating: 500 PSIG at 275 deg F.

2.8 WATER TREATMENT FOR CLOSED LOOP HYDRONIC SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Sentinel
2. Anderson Chemical Company.
3. Aqua-Chem, Inc.
4. Barclay Water Management, Inc.
5. General Electric Company; GE Water & Process Technologies.
6. H-O-H Water Technology, Inc.
7. Metro Group, Inc. (The); Metropolitan Refining Div.
8. Nalco; an Ecolab company.
9. Watcon, Inc.

- B. Performance Requirements

1. Provide water treatment for closed-loop hydronic systems.
2. Water quality for hydronic systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of hydronic equipment without creating a hazard to operating personnel or the environment.
3. Base HVAC water treatment on quality of water available at Project site, hydronic system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
4. Closed hydronic systems, including shall have the following water qualities:
 - a. pH: Maintain a value within 8.2 to 9.5.
 - b. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 - c. Total Hardness : <150 ppm as CaCO_3 .
 - d. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - e. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - f. TSS: Maintain a maximum value of 10 ppm.
 - g. Ammonia: Maintain a maximum value of 20 ppm.
 - h. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 - i. Microbiological Limits:
 - 1) Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/mL.
 - 2) Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/mL.
 - 3) Nitrate Reducers: Maintain a maximum value of 100 organisms/mL.
 - 4) Sulfate Reducers: Maintain a maximum value of zero organisms/mL.
 - 5) Iron Bacteria: Maintain a maximum value of zero organisms/mL.

2.9 GLYCOL

- A. DuPont Dowfrost HD or approved equal; the propylene glycol fluid to be used in such a system shall meet the following requirements: The fluid shall be industrially inhibited propylene glycol (phosphate-based). The fluid shall be easily analyzed for glycol concentration and inhibitor level. The fluid shall be easily re-inhibited using inhibitors readily available from the fluid manufacturer. The fluid shall pass ASTM D1384 (less than 0.5 mils penetration per year for all system metals). The fluid shall be dyed bright yellow to aid in leak detection

PART 3 - EXECUTION

3.1 HYDRONIC PIPING APPLICATIONS – ABOVE GROUND

- A. Chilled Water, NPS 4 and Larger: Schedule 40 steel pipe with welded or flanged joints; or grooved mechanical-joint couplings.
- B. Makeup water piping: Type L copper.
- C. Condenser Water, NPS 4 and Larger Schedule 40 steel pipe with welded, flanged, or grooved mechanical-joint couplings.
- D. Chemical Feed Piping for Condenser Water Treatment: Chlorinated polyvinyl chloride (CPVC), Schedule 80, ASTM F441.

3.2 HYDRONIC PIPING INSTALLATIONS

- A. Refer to Division 23 Section "Common Work Results" for installation of:
 - 1. Basic piping requirements.
 - 2. Joint construction requirements.
 - 3. Hanger, support, and anchor devices.
 - 4. Firestopping
 - 5. Sleeves and Escutcheons
 - 6. Dielectric fittings
 - 7. Valves
 - 8. Mechanical Identification
- B. Hydronic piping systems shall be provided to permit the system to be drained. Provide drains, consisting of a tee fitting, NPS 3/4 ball valve, and hose-end fitting with cap, at low points in piping system mains and elsewhere as required for system drainage.
- C. Provide piping at a uniform grade of 0.2 percent upward in direction of flow. Pipe size at connections to equipment shall be distribution main size, not connection size. Reduce pipe sizes using eccentric reducer fitting installed with level side up. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out

the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.

- D. Provide safety valves on hot-water generators and elsewhere as required by the ASME Boiler and Pressure Vessel Code. Provide safety-valve discharge piping, without valves, to floor. Comply with the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, for installation requirements. Check the settings and operation of each safety valve, including valves furnished by heater manufacturer. Record settings.
- E. Swing Connections for Expansion: Connect risers and branch connections to mains with at least five pipe fittings, including tee in main. Connect mains and branch connections to terminal units with flexible hoses at least four pipe fittings, including tee in main.
- F. Terminal Equipment Connections
 - 1. Size for supply and return piping connections shall be same as for equipment connections.
 - 2. Provide control valves in accessible locations close to connected equipment.
 - 3. Arrange piping with offsets to allow for expansion, as well as terminal unit removal.

3.3 HYDRONIC SPECIALTIES INSTALLATION

- A. Provide air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.
- B. Air separator and expansion tank to be provided on the suction side of the system pumps. Expansion tank shall be tied into system piping near air separator and system fill line. Provide piping to compression tank with a 2 percent upward slope toward tank.
- C. Expansion tanks: Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.
- D. Air eliminator, dirt separators and hydraulic separators shall be mounted in a straight run of horizontal piping in a perfectly upright position to allow the vent to operate freely and/or dirt to settle.
- E. Hydraulic Separators: The primary loop shall be purged of air with the secondary terminal loop shutoff valves closed. The primary loop shall be cleaned of debris by starting the primary pumps and continuously circulating water in the primary loop. The system shall be cleaned by frequently cleaning the start-up screens in the primary pump suction diffusers until the screens do not collect any more debris. Once the suction diffuser start-up screens are clean then the shutoff valves to the secondary terminal loops can be opened. The secondary terminal loops shall be purged of air by opening the air vents on the terminal units. When the secondary terminal unit piping is purged of air then the circulators can be started.

3.4 CONTROL VALVE INSTALLATION

- A. Perform the following as directed by the BAS contractor:
 - 1. Provide modulating control valves with minimum of 10 pipe diameters straight pipe at inlet and 5 pipe diameters straight pipe at outlet.
 - 2. Installation of immersion wells and pressure tapplings, along with associated shut-off cocks.
 - 3. Installation of flow switches.
 - 4. Setting of automatic control valves or other control devices.
- B. Valve submittals shall be coordinated for type, quantity, size, and piping configuration to ensure compatibility with pipe design.
- C. Slip-stem control valves shall be installed so that the stem position is not more than 60 degrees from the vertical up position. Ball type control valves shall be installed with the stem in the horizontal position.

3.5 CHEMICAL TREATMENT

- A. Perform an analysis of makeup water to determine type and quantities of chemical treatment needed to keep system free of scale, corrosion, and fouling, and to sustain the water characteristics described in Part 2.
- B. Provide bypass chemical feeders in each hydronic system.
 - 1. Provide in upright position with top of funnel not more than 48 inches above the floor.
 - 2. Provide feeder in minimum NPS 3/4 bypass line, from main with full-size, full-port, ball valve in the main between bypass connections.
 - 3. Provide NPS 3/4 pipe from chemical feeder drain to nearest equipment drain and include a full-size, full-port, ball valve.
- C. Initial flushing: Remove loose dirt, mill scale, metal chips, weld beads, rust, and like deleterious substances without damage to any system component. Provide temporary piping or hose to bypass coils, control valves, exchangers and other factory cleaned equipment unless acceptable means of protection are provided, and subsequent inspection of hide-out areas takes place. Isolate or protect clean system components, including pumps and pressure vessels, and remove any component which may be damaged. Open all valves, drains, vents and strainers at all system levels. Remove plugs, caps, spool pieces, and components to facilitate early debris discharge from system. Sectionalize system to obtain debris carrying velocity of 6 feet per second, if possible. Connect dead-end supply and return headers as necessary. Flush bottoms of risers. Provide temporary strainers where necessary to protect down-stream equipment. Supply and remove flushing water and drainage by various type hose, temporary and permanent piping and Contractor's booster pumps. Flush until clean as approved by the commissioning agent.
- D. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a

minimum of 24 hours, drain, clean strainer screens, and refill with fresh water. Circulate systems at normal temperature to remove adherent organic soil, hydrocarbons, flux, pipe mill varnish, pipe joint compounds, iron oxide, and like deleterious substances not removed by flushing, without chemical or mechanical damage to any system component. Removal of tightly adherent mill scale is not required. Keep isolated equipment which is "clean" and where dead-end debris accumulation cannot occur. Sectionalize system, if possible, to circulate at velocities not less than 6 feet per second. Circulate each section for not less than four hours. Blow-down all strainers or remove and clean as frequently as necessary. Drain and prepare for final flushing.

- E. Final Flushing: Return systems to conditions required by initial flushing after all cleaning solution has been displaced by clean make-up. Flush all dead ends and isolated clean equipment. Gently operate all valves to dislodge any debris in valve body by throttling velocity. Flush for not less than one hour.
- F. Close and fill system as soon as possible after final flushing to minimize corrosion. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.
- G. Fill systems that glycol solutions to the concentrations indicated in the equipment schedules.

3.6 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
 - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
 - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
 - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
 - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Provide blinds in flanged joints to isolate equipment.
 - 5. Provide safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
 - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
 - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
 - 3. Isolate expansion tanks and determine that hydronic system is full of water.
 - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum

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BARROWS HALL
UNIVERSITY OF MAINE
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yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
6. Prepare written report of testing.

C. Perform the following before operating the system:

1. Open manual valves fully.
2. Inspect pumps for proper rotation.
3. Set makeup pressure-reducing valves for required system pressure.
4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
5. Set temperature controls so all coils are calling for full flow.
6. Inspect and set operating temperatures of hydronic equipment to specified values.
7. Adjust & commission the pressure differential bypass valve.
8. Verify lubrication of motors and bearings.

END OF SECTION 232113

SECTION 232123 - HYDRONIC PUMPS-ALTERNATES #1 AND #2 AS SCHEDULED

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Related Sections include the following:
 - 1. Division Section: "Common Work Results"

1.2 SUMMARY

- A. This Section includes hydronic pumps and accessories.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pump.
 - 1. Include certified performance curves and rated capacities, operating characteristics, furnished specialties, final impeller dimensions, and accessories for each type of product indicated.
 - 2. Indicate pump's operating point on curves.
 - 3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For pumps to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. UL Compliance: Fabricate and label pumps to comply with UL 778, "Motor-Operated Water Pumps," for construction requirements.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Manufacturer's Preparation for Shipping: Clean flanges and exposed machined metal surfaces and treat with anticorrosion compound after assembly and testing. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.
- B. Store pumps in dry location.
- C. Retain protective covers for flanges and protective coatings during storage.
- D. Protect bearings and couplings against damage from sand, grit, and other foreign matter.
- E. Comply with pump manufacturer's written rigging instructions.

1.7 COORDINATION

- A. Coordinate electrical power with Division 26.
- B. [Concrete Bases: Refer to Section 230500.]
- C. [Inertia Bases: Refer to Section 230548.]

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Grundfos
 - 2. Armstrong
 - 3. Bell & Gossett ITT
 - 4. PACO
 - 5. Taco
 - 6. Patterson
 - 7. Wilo

2.2 GENERAL PUMP REQUIREMENTS

- A. Pump Units: Factory assembled and tested.
- B. Motors: Include built-in, thermal-overload protection and grease-lubricated ball bearings. Select each motor to be non-overloading over full range of pump performance curve. Comply with NEMA MG 1 requirements for thermally protected motors.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- C. Motors Indicated to be premium efficiency and shall meet or exceed all NEMA Standards Publication MG1 requirements and comply with NEMA premium efficiency levels Class B temperature rise, Class F insulation.
- D. Motors used with VFD's: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - 1. Provide AEGIS® Shaft Grounding Ring (SGR) on either DE or NDE of motor to divert current away from the bearings and protect bearings in attached equipment.
 - 2. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.

2.3 BASE MOUNTED FLEX COUPLED PUMPS WITH VARIABLE SPEED DRIVE - MANUFACTURED UNITS

- A. The self-sensing product shall consist of a factory supplied base mounted flex-coupled pump with motor and preprogrammed drive with integral controls package.
- B. The drive shall be separate and apart to the pump and motor. The mounting of the drive shall be done in a manner consistent with the manufacturer's instructions and all applicable codes.
- C. The performance speed of the pump and VFD combination shall be 1750 RPM nominal as standard. Exceptions for 1150 RPM and 3600 RPM shall be noted in the schedules. 3600 RPM shall NOT be an allowable substitution for a specified 1750 RPM or 1150 RPM package. 1750 RPM shall not be an allowable substitution for a specified 1150 RPM or 3600 RPM package. Alternative RPM products might be considered as a substitution for the Specified RPM products only if that manufacturer provides a spare motor, drive, and seal for each pumping unit.
- D. Pump logic controller, variable frequency drives, sensor/transmitters and related equipment shall be installed by the mechanical contractor as shown on the plans.

2.4 COMPONENTS

- A. Pump Logic Controller.
 - 1. The controller operation shall operate the system using a tested and proven program that safeguards against undesirable or damaging conditions including:
 - a. Motor overload
 - b. Pump flow surges
 - c. Hydraulic cycling (hunting).
 - d. End of curve unstable operation: The pump logic controller, through a factory pre-programmed algorithm, shall be capable of protecting the pumps from hydraulic damage due to operation beyond their published end-of-curve. This

feature requires a flow meter for activation. The operator interface shall include an owner adjustable flow set point to set the parameters for this routine.

2. The pump logic controller shall be capable of starting, unloading, and stopping pumps based on a system performance program that will minimize energy consumption , provide reliable performance and bumpless transitions.
3. The pump logic controller shall be capable of running four different hydronic optimization sub-routines
 - a. Setup one: This subroutine shall allow the pump package to track a quadratic system curve and will optimize a secondary distribution loop. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.
 - 1) Setup two: This subroutine shall allow two pumps to run as backup for each other and shall alternate the pumps based on a real time clock.
 - 2) Setup three: This subroutine shall allow the package to run in a customer defined flow rate. The package will always seek to run at the user defined flow even with fouling causing system changes. It shall use a technology that allows the pump, drive, and motor package to translate the hydronic data from both a pump and system curve and translate it to electrical data. This allows the drive to know exactly where it is in the hydronic world.
 - 3) Setup four: This subroutine shall allow the use of a Modulating Pump Controller and shall allow for up to 4 self-sensing pumps to operate in a parallel self-sensing mode.
4. The control platform shall include a subroutine equal to the Taco Self-Sensing Series with ProBalance™. This subroutine shall allow for the automatic balancing of secondary system distribution pumps. The package shall automatically run system distribution pumps to a user defined duty point and will recognize that duty point and hold the pumps at a speed that matches the actual installed system quadratic system curve. The package will then use this data to set up a new duty point as the max point for the quadratic control curve. Use of external balancing devices or contractors will not be needed.
5. The package shall serve as a flow metering device and will display pump flow at the user interface.

2.5 PUMP SPECIALTY FITTINGS

- A. Pump Suction Diffuser: Taco RSP; full length straightening vane assembly ensures uniform flow to the suction inlet of the pump; oversized body cylinder ensures minimal pressure drop; metering port allows for the monitoring of system conditions; disposable fine mesh start-up strainer promotes cleaner, more trouble-free system; removable cover plate and reusable “O” ring allows for easy access and maintenance of permanent strainer; blow down port allows for routine maintenance and removal of sediment and debris; ductile iron body; provide the

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
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optional magnetic insert to trap small metallic particles; Class 125 flanges or grooved connections.

- B. Pumps with ECM/VFD shall have a check valve and shutoff valve instead of the multi-purpose valve.
- C. Base mounted pumps and inline pumps 5HP and larger: Provide the Flex-Hose Co.'s Flexzorber NND molded double arch spherical connector/expansion joints at the pump suction and discharge. The molded spherical body shall be manufactured using multiple plies of nylon tire cord fabric bonded within the neoprene elastomer (to avoid exposure to atmosphere or media) and must be reinforced with a spring steel wire. Floating/rotatable flanges shall be zinc-coated plate steel and must have drilled bolt holes in accordance with ANSI 150# standard. Exterior galvanized ductile iron reinforcing ring between sphere arches to maintain double profile. The rated design pressure of the molded body must have a minimum 3:1 safety factor (burst to operating pressure) based on a maximum operating temperature of 220°F and must also be capable of 26" Hg vacuum.
- D. Any pump used on an open cooling tower system shall be furnished with a seal flush line and a U.S. Seal Mfg. Co., or approved equal, Model KY-1 abrasive separator. Connected to the discharge side of the pump, the separator shall take the abrasive-laden fluid and removes foreign bodies completely. The clean fluid shall then be injected into the gland housing over the seal faces.
 - 1. Provide shut-off isolation valve installed in the seal flushing line.
 - 2. Material: Nylon
 - 3. Temperature Range: 0°F to +240°F

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine equipment foundations for compliance with requirements for installation. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PUMP INSTALLATION

- A. Pumps and equipment shall be provided per manufacturer's recommendations and according to the standards of the Hydraulics Institute.
- B. Provide pumps to provide access for periodic maintenance, including removing motors, impellers, couplings, and accessories.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- C. Pipe connections to pumps shall be made in such a manner so as not to exert any stress on pump housings. If necessary to meet this requirement, provide additional pipe supports and flex connectors.
- D. Reduction from line size to pump connection size shall be made with eccentric reducers attached to the pump with tops flat to allow continuity of flow and to avoid air pockets.
- E. Provide connector/expansion joints at the pump suction and discharge as indicated.
- F. Pumps shall **NOT** be run dry to check rotation.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Division 23 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Provide piping adjacent to machine to allow service and maintenance.
- C. Connect piping to pumps. Provide valves that are the same size as piping connected to pumps.
- D. Provide suction and discharge pipe sizes equal to or greater than diameter of pump nozzles. Provide fittings and specialties as detailed on the plans.
- E. Provide a single gage with three-input selector valve; locate at pump suction and discharge tappings, also strainer.
- F. Connect wiring and provide grounding in accordance with Division 26. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1. Install control and electrical power wiring to field-mounted control devices.

3.4 COMMISSIONING

- A. Verify that pumps are installed and connected according to the Contract Documents. Verify that electrical wiring installation complies with manufacturer's written instructions and the Contract Documents. Complete installation and startup-checks according to manufacturer's written instructions.
- B. Provide start-up of the pumping systems. This start-up shall include verification of proper installation, system initiation, adjustment, and fine tuning. Start-up shall not be considered complete until the sequence of operation, including all alarms, has been sufficiently demonstrated to the Owner or Owner's designated representative. This jobsite visit shall occur only after all hook-ups, tie-ins, and terminations have been completed and signed-off on the manufacturer's start-up request form.
- C. Check piping connections for tightness.

- D. Clean strainers on suction piping.
- E. Perform the following startup checks for each pump before starting:
 - 1. Verify bearing lubrication.
 - 2. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - 3. Verify that pump is rotating in the correct direction.
- F. Prime pump by opening suction valves and closing drains, prepare pump for operation. Start motor. Open discharge valve slowly.
- G. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for detailed requirements for testing, adjusting, and balancing hydronic systems.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps as specified below:
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining pumps.
 - 2. Review data in maintenance manuals.

END OF SECTION 232123

SECTION 236416 - CENTRIFUGAL WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal water chillers.
2. Packaged refrigerant-recovery unit.
3. Heat-exchanger, brush-cleaning system.

1.2 DEFINITIONS

- A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input, using consistent units for any given set of rating conditions.
- B. DDC: Direct digital control.
- C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
- D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit for a single chiller calculated according to the method defined by [AHRI 550/590](#) ([AHRI 551/591](#)) and referenced to AHRI standard rating conditions.
- E. kVAR: Kilovolt-ampere reactive.
- F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit for a single chiller calculated according to the method defined by [AHRI 550/590](#) ([AHRI 551/591](#)) and intended for operating conditions other than the AHRI standard rating conditions.
- G. SCCR: Short-circuit current rating.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
2. Performance at AHRI standard conditions and at conditions indicated.
3. Performance at AHRI standard unloading conditions.
4. Minimum evaporator flow rate.
5. Minimum condenser flow rate.

6. Refrigerant capacity of chiller.
7. Oil capacity of chiller.
8. Fluid capacity of evaporator, condenser.
9. Characteristics of safety relief valves.
10. Minimum entering condenser-fluid temperature.
11. Performance at varying capacities with constant design condenser-fluid temperature. Repeat performance at varying capacities for different condenser-fluid temperatures from design to minimum in [5 deg F (3 deg C)] increments.
12. Force and moment capacity of each piping connection.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans and elevations, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.
- B. Seismic Qualification Certificates: For chillers, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Source Quality-Control Certifications: For chillers.
- D. Field quality-control reports.
- E. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each chiller to include in emergency, operation, and maintenance manuals.
- B. Instructional Videos: Including those that are pre-recorded and those that are recorded during training.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Tool Kit:
 1. A tool kit specially designed by chiller manufacturer for use in servicing chiller(s) furnished.

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2. Special tools required to service chiller components not readily available to Owner service personnel in performing routine maintenance.
 3. Lockable case with hinged cover, marked with large and permanent text to indicate the special purpose of tool kit, such as "Chiller Tool Kit." Text size must be at least **1 inch (25 mm)** high.
 4. A list of each tool furnished. Permanently attach the list to underside of case cover. Text size must be at least **1/2 inch (13 mm)** high.
- B. Touch-up Paint: [**32-oz. (1-L)**] container of paint used for finish coat. Label outside of container with detailed description of paint to allow for procurement of a matching paint in the future.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Ship chillers from the factory fully charged with refrigerant.
- B. Ship each chiller with a full charge of refrigerant. Charge each chiller with nitrogen if refrigerant is shipped in containers separate from chiller.
- C. Ship each oil-lubricated chiller with a full charge of oil.
 1. Ship oil factory installed in chiller.
- D. Package chiller for export shipping in totally enclosed crate with bagging.

1.8 WARRANTY

- A. When warranties are required, verify with Owner's counsel that special warranties stated in this article are not less than remedies available to Owner under prevailing local laws.
- B. Provide manufacturer's warranty for 18 months from the date of shipment from the factory or 12 months from commissioning; whichever comes first. Warranty shall cover parts and labor required to remedy defects in materials or workmanship for the entire chiller. Perform warranty work with manufacturer's factory-trained and factory-employed service technician.
- C. Provide manufacturer's warranty for 18 months from the date of shipment from the factory or 12 months from commissioning; whichever comes first. Warranty shall cover parts and labor required to remedy defects in materials or workmanship for the entire chiller. Perform warranty work with manufacturer's factory-trained and factory-employed service technician.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. York YMC2 (Basis of Design)
- B. Trane
- C. Daikin

2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Centrifugal chillers are to withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 - 2. Component Importance Factor: 1.0.
- B. Condenser-Fluid Temperature Performance:
 - 1. Startup Condenser-Fluid Temperature: Chiller is to be capable of starting with an entering condenser-fluid temperature of **55 deg F (13 deg C)**.
 - 2. Minimum Operating Condenser-Fluid Temperature: Chiller is to be capable of continuous operation over the entire capacity range indicated with an entering condenser-fluid temperature of **65 deg F (18 deg C)**.
 - 3. Make factory modifications to standard chiller design if necessary to comply with performance indicated.
- C. Site Altitude: Chiller is to be suitable for altitude at which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.
- D. ASHRAE Compliance:
 - 1. ASHRAE 15 for safety code for mechanical refrigeration.
 - 2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
 - 3. ASHRAE/IES 90.1.
- E. ASME Compliance: Fabricate and label chillers to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, as applicable to chiller design. For chillers charged with R-513A, refrigerant, include an ASME U-stamp and nameplate certifying compliance.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
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- G. Comply with requirements of Underwriters Laboratories, and include label by a qualified testing agency showing compliance.
- H. Operation Following Loss of Normal Power:
 - 1. Equipment, associated factory- and field-installed controls, and associated electrical equipment and power supply connected to backup power system are to automatically return equipment and associated controls to the operating state occurring immediately before loss of normal power without need for manual intervention by an operator when power is restored either through a backup power source, or through normal power if restored before backup power is brought online.
 - 2. Refer to Drawings for equipment served by back-up power systems.
 - 3. Provide means and methods required to satisfy requirement, even if not explicitly indicated.
- I. Outdoor Installations:
 - 1. Chiller must be suitable for outdoor installation indicated. Provide adequate weather protection to ensure reliable service life over a 25-year period, with minimal degradation due to exposure to outdoor ambient conditions.
 - 2. Chillers are equipped to provide safe and stable operation while achieving performance indicated when operating at extreme outdoor temperatures. Review historical weather database and provide equipment that can operate at extreme outdoor temperatures recorded over past 30-year period.

2.3 GENERAL DESCRIPTION

- A. Packaged centrifugal chiller including the following: evaporator, motor and compressor, capacity control device, condenser with integral sub cooler, refrigerant metering device, lubrication system, motor starter, control panel with user interface, and – if required – a refrigerant purge system.
- B. Provide chiller utilizing an HFC refrigerant that has an Ozone Depletion Potential (ODP) of ZERO, and that has no refrigerant production phase-out date and no phase out date for equipment that uses that refrigerant.
- C. Provide chiller to meet or exceed the scheduled performance within the limits of the scheduled parameters.
- D. Vibration Isolation:
 - 1. Chiller manufacturer is to furnish vibration isolation for each chiller.

2. Spring Isolator:

- a. Stable in operation and designed for not less than 30 percent reserve deflection beyond actual operating conditions.
- b. Design isolators so that the K_x/K_y ratio will be 1.0 or more for stability.
- c. Provide PVC or neoprene-coated springs and hot-dip, galvanized-steel components. Provide aluminum components that are etched and painted. Provide nuts, bolts, and washers that are zinc electroplated.
- d. Isolators are to be adjustable and with an open spring, having one or more coil springs attached to a top compression plate and a baseplate.
- e. An elastomeric pad with a minimum thickness of 0.25 inch (6 mm) is to be bonded to the baseplate.
- f. Spring assembly is to be removable and fit within a welded-steel enclosure consisting of a top plate and rigid lower housing, which serves as a blocking device during installation.
- g. Isolated restraining bolts are to not be engaged during normal operation and are to connect the top plate and lower housing to prevent the isolated equipment from rising when drained of fluid.
- h. Select isolators for a nominal 1-inch (25-mm) deflection.
- i. Integrate seismic restraints in applications that require seismic requirements.

- E. Refrigerant isolation valves: two butterfly valves, one on the compressor discharge line and one on the liquid line.

2.4 HEAT EXCHANGERS

A. General requirements: evaporator and condenser

1. Heat exchanger type:
 - a. Evaporator: Shell and tube, hybrid falling film design
 - b. Condenser: Shell and tube, flooded design
2. Construct in accordance with the current ANSI/ASHRAE-15 Safety Code for Mechanical Refrigeration and ASME Pressure Vessels Code and shall bare the ASME stamped nameplate.
3. Shells: Carbon steel with fusion welded seams
4. Tubes: Internally rifled, externally enhanced, individually cleanable and individually replaceable from either chiller end, and roller expanded into tube sheets.
5. Tube supports: Carbon steel, 3/8" thick minimum, no more than 4 feet apart, self-supporting and welded to the shell.
6. End sheets: Carbon steel, 1" thick minimum.
7. Water boxes: Steel, bolted to end sheet, cover plate bolted to box, taps for vent and drain.
8. Pressure Relief: automatically reseating relief valves. Rupture discs are not acceptable.

B. Evaporator

1. Waterside working pressure: 150 psig or 300 psig
2. Water boxes: Compact (end nozzle locations) or marine (side nozzle connections) with flanged connections.
3. Provide water box hinges on both ends of the heat exchanger.
4. Tubes: Copper, removable from either end, minimum tube wall thickness of 0.035" at the plain lands contacting the intermediate tube supports and end sheets.
5. Suction baffle: Installed along the entire length of the evaporator.
6. Sight glass: Located such that the proper refrigerant charge is near the center of the glass when the machine is off.

C. Condenser

1. Waterside working pressure: 150 psig or 300 psig
2. Water boxes: Compact (end nozzle locations) or marine (side nozzle connections) with flanged connections.
3. Provide water box hinges on both ends of the heat exchanger
4. Tubes: Copper, removable from either end, minimum tube wall thickness of 0.035" at the plain lands contacting the intermediate tube supports and end sheets.

2.5 REFRIGERANT FLOW CONTROL

A. Variable orifice

- B. Refrigerant level sensing: Monitor refrigerant level in the condenser; report refrigerant level back to unit control panel and control chiller accordingly.
- C. Refrigerant level control: Adjust valve position via control panel to optimize refrigerant level.

2.6 COMPRESSOR

A. Single stage or multi stage

B. Fully accessible housing with vertical circular joints.

C. Direct driven

D. Magnetic bearings

1. Levitated shaft position shall be actively controlled and monitored by an X-, Y-, and Z-axis digital position sensor.

2. The compressor shall be capable of coming to a controlled, safe stop in the event of a power failure by diverting stored power from the DC bus to the magnetic bearing control system.
- E. Mechanical linkage system that continuously monitors compressor-discharge gas characteristics and optimizes diffuser spacing to minimize impeller gas-flow disruptions.
- F. The driveline (compressor and motor) and chiller starter shall be individual unit assemblies allowing for independent inspection, service, and repair/replacement. If an integrated driveline and starter package is utilized which is not fully field repairable, the supplier must provide one spare package with the unit.
- G. The chiller shall utilize a single compressor that delivers the specified performance at all load and lift conditions.

2.7 MOTOR

- A. Semi-hermetic permanent magnet motor or semi-hermetic induction motor. Semi-hermetic motors must include motor winding temperature RTDs, one per phase.
- B. Electrical connection: Steel terminal box with gasketed front access cover; overload and overcurrent transformers.

2.8 REFRIGERANT PURGE SYSTEM (NEGATIVE PRESSURE MACHINES)

- A. Refrigerant purge system is required if refrigerants with an Ozone Depletion Potential (ODP) greater than ZERO are provided.
- B. Operates automatically at all load and head pressure conditions. Does not operate when the machine is idle.
- C. Efficiency: Maximum of .002 pounds of refrigerant per pound of air at design conditions, not to exceed .007 at any operating condition in a 90°F room.
- D. Provide a plot of purge efficiency from 100% load to 10% load, using AHRI schedule condenser water relief (4 °F per 10% reduction in load).
- E. If separate canisters are required to meet these efficiencies, then provide disposal to an EPA-approved disposal site for the life of the chiller. To maintain purge efficiency, provide the virgin refrigerant and labor required to replace the lost refrigerant.
- F. If a refrigerant purge system is required, it shall be inspected and adjusted by the manufacturer at the end of each year for the first ten years of operation to ensure that the release of ozone depleting substances is minimized. A written report shall be forwarded to the owner each year to confirm completion.

2.9 POSITIVE PRESSURE SYSTEM (NEGATIVE PRESSURE MACHINES)

- A. Operates automatically when chiller is idle to prevent non condensables from entering the system.
- B. Factory install pressurization unit, including heater, wiring, pump, piping, valves, and controls.
- C. Heater: Of sufficient capacity to pressurize machine above atmospheric pressure within 2 hours.
- D. Controls: On / off / auto switch to automatically maintain positive pressure during idle periods.
- E. Valves: Check valves and balancing valve

2.10 SOURCE QUALITY CONTROL: TESTS AND INSPECTIONS

- A. Heat Exchangers (evaporator and condenser):
 - 1. Design and test in full conformance to the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1.
 - 2. Hydrostatically test evaporator and condenser refrigerant side at 1.3 times design working pressure AFTER tubing using LIQUID REFRIGERANT.
 - 3. Alternately to item '2' above, test at 1.1 times design working pressure AFTER tubing, using an approved air/gas mixture.
- B. Compressor Components:
 - 1. Leak tested at design working pressure using air under water.
 - 2. Hydrostatic strength test at 1.5 times design working pressure
 - 3. To ensure UL label qualification, manufacturer shall perform a hydrostatic strength test at 3 times design working pressure every year on the compressor castings.
 - 4. Statically and dynamically balance each impeller.
 - 5. Overspeed test each impeller at 120% of its maximum design RPM.
- C. Motor
 - 1. Balance rotor in accordance with ISO 1940 G2.5 (performed by motor manufacturer).
 - 2. High-potential test stator for dielectric strength for 60 seconds per UL1995 and 984 and the following formula: $2 * \text{RATED VOLTAGE} + 1000$ (performed by chiller manufacturer).
- D. Chiller air run test for 30 minutes:
 - 1. Measure current and voltage across each phase.
 - 2. Operate control panel, test functionality and log instrument readings at 10-minute intervals.
 - 3. Operate oil pump motor and search lubrication system for leaks (if applicable)

4. Check compressor oil pressure (if applicable).
 5. Vibration readings on driveline assembly in the horizontal, vertical and axial planes.
 6. After the test, remove and replace oil filter (if applicable).
- E. Chiller leak integrity testing: Pressurize entire system to design working pressure. Leak test using soap and water. Repair any leaks and repeat test until leak tight.
- F. Vacuum hold testing: Evacuate system to 500 microns and hold for one hour. Ensure that pressure does not rise more than 150 microns during the hour. Repair and repeat until passes.

2.11 CONTROL PANEL

- A. Type: Microprocessor based, stand alone
- B. Provide integration with the existing campus Building Automation System (Johnson Controls, Inc) for operation as specified in Section 230993.
- C. Scope: Chiller operation, monitoring of chiller sensors, actuators, relays and switches, and display of all operating parameters.
- D. Capability: Stable chiller operation at 36 °F leaving chilled water temperature without warnings or shutdowns; no freezing or slushing of chilled water.
- E. Enclosure: Lockable, NEMA 1
- F. Information Display: 10.4" (minimum) color liquid crystal display (LCD) mounted on control panel enclosure door. Access to the screen shall be controlled by the YORK Chiller Access Manager feature.
- G. User interface: Operating parameters displayed in a user-friendly, color and graphical format.
- H. Keypad: Universal type with soft-keys
- I. Height: Eye level and readable and operable without the need for ladder or stool.
- J. Temperature rating: 0 to 40 °C
- K. System status information: Displayed on screen at all times, including the following as a minimum:
 1. System status
 2. System details
 3. Control source (remote or local)
 4. User access level
 5. Date and time
 6. Startup sequence timer
 7. Shutdown sequence timer

- L. Status messages: In color according to importance, indicate the following as a minimum:
1. Ready to start
 2. Cycling shutdown – chiller will automatically restart
 3. Safety shutdown – chiller requires manual restart
 4. Soft shutdown – chiller requires manual restart
 5. System run (with countdown timers)
 6. Systems coast down (with countdown timers)
 7. Start inhibit and inhibit mode (anti-recycle, vane motor switch open (if applicable), excess motor current)
 8. Vanes closing before shutdown (if applicable)
- M. System operating information, including the following as a minimum:
1. Return and leaving chilled water and condenser water
 2. Evaporator and condenser refrigerant saturation temperatures
 3. Sub-cooling refrigerant temperature
 4. Evaporator and condenser pressure
 5. Evaporator tube and condenser tube small temperature difference
 6. Compressor discharge temperature
 7. Oil sump temperature (if applicable)
 8. Oil pump pressure differential (if applicable)
 9. Percent of motor full load current
 10. Input power
 11. Kilowatt hours
 12. Operating hours
 13. Prerotation vane position (if applicable)
 14. Refrigerant level position (condenser)
 15. Motor winding temperature (each phase)
 16. Average motor winding temperature
 17. VSD – Output frequency
 18. VSD – Output voltage (each phase)
 19. VSD – Current (each phase)
 20. VSD – Input current limit setpoint
 21. VSD – Total supply KVA
 22. VSD – Total power factor
 23. VSD - Voltage total harmonic distortion (each phase)
 24. VSD – Current total demand distortion (each phase)
 25. VSD – DC bus voltage
 26. VSD – DC bus current
 27. VSD – Input and output Peak and RMS voltages and currents (each phase)
 28. VSD – Internal ambient temperature
 29. UPS Battery voltage
 30. VGD Position
 31. Discharge Pressure
 32. Motor Housing and Winding Temperatures
 33. MBC – Positions

34. MBC – Currents
 35. MBC – Temperatures
 36. MBC – Rotor Elongation
 37. MBC – Motor Speed
- N. Programmable setpoints including the following, as a minimum:
1. Chilled liquid temperature (setpoint and range)
 2. Chilled liquid temperature cycling offset (shutdown and restart)
 3. Motor current limit (%)
 4. Pull-down demand (limit and time)
- O. Schedule function: Programmable six week schedule for starting and stopping the chiller, pumps and cooling tower.17
- P. Regional functionality: System language and units selection
- Q. Warning messages including the following, as a minimum:
1. Real time clock failure
 2. Condenser or evaporator transducer error
 3. Setpoint override
 4. Condenser high pressure limit
 5. Evaporator low pressure limit
 6. MBC – Vibration
 7. MBC – Landing counter high
 8. Excess Surge Detection
 9. Motor – High Housing, Rotor, and Winding Temperatures
 10. Motor – High Current Limit
 11. VSD – DC Bus Active
 12. Liquid Level Setpoint Not Achieved
 13. Loss of Subcooler Liquid Seal
 14. Condenser – Freeze Threat From Low Pressure
- R. Safety Shutdowns: Trigger a safety shutdown for any of the following, as a minimum:
1. Evaporator – low pressure
 2. Condenser – high pressure
 3. Condenser – high pressure contacts open
 4. Auxiliary safety – contacts closed
 5. Compressor discharge – high or low refrigerant temperature
 6. Oil – high temperature (if applicable)
 7. Oil – high or low differential pressure (if applicable)
 8. Oil – pump pressure setpoint not achieved (if applicable)
 9. Control panel – power failure
 10. Motor or starter – current imbalance
 11. Motor – high housing, winding, and rotor temperatures

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12. Watchdog – software reboot
13. Sensor – failure or out of range
14. Transducer – failure or out of range
15. Surge Protection – Excess Surge
16. MBC – internal fault
17. MBC – high bearing temperature or current
18. MBC – startup failure
19. MBC – speed signal fault
20. MBC – overspeed fault
21. MBC – communication
22. MBC – rotor elongation
23. MBC – oscillator fault
24. MBC – rotor contraction
25. MBC – unauthorized rotation
26. MBC – high and low voltage
27. VSD – shutdown, requesting fault data
28. VSD – stop contacts open
29. VSD – 105% motor current overload
30. VSD – input current overload
31. VSD – high phase input and motor baseplate temperatures (each phase)
32. VSD – precharge lockout
33. VSD – ground fault
34. VSD – motor current total harmonic distortion (THD) fault
35. VSD – inverter or rectifier program fault
36. VSD – phase motor and input DCCT (each phase)
37. VSD – high total demand distortion
38. VSD – high phase input and motor current (each phase)
39. VSD – line voltage phase rotation
40. VGD Actuator Fault
41. VGD Positioning Fault
42. Safety Stop

S. Safety Shutdowns: For each safety shutdown, indicate the following, as a minimum:

1. System status and details
2. Day and time of shutdown
3. Cause of shutdown
4. Type of restart required

T. Cycling Shutdowns: For each cycling shutdown, indicate the following, as a minimum:

1. Multiunit cycling – contacts open
2. System cycling – contacts open
3. Oil – low temperature (if applicable)
4. Oil – low temperature differential (if applicable)
5. Control panel – power failure
6. Leaving chilled liquid – low temperature
7. Leaving chilled liquid – flow switch open

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

8. Condenser – flow switch open
9. Control panel – schedule
10. VGD Actuator – serial communications
11. Evaporator – low pressure
12. Condenser – freeze threat – flow switch open
13. Control Panel – loss of control voltage
14. MBC - position
15. MBC – low frequency displacement
16. MBC – vibration
17. MBC – speed signal fault
18. MBC – startup failure
19. MBC – serial communications fault
20. VSD shutdown – requesting fault data
21. VSD – fault contacts open
22. VSD – initialization failed
23. VSD – gate driver (indicate phase)
24. VSD – single phase input power
25. VSD – high or low DC bus voltage
26. VSD – pre charge: low DC bus voltage
27. VSD – pre charge: DC bus voltage imbalance
28. VSD – high internal ambient temperature
29. VSD – logic board power supply
30. VSD – low phase input and motor baseplate temperatures (each phase)
31. VSD – logic board processor
32. VSD – run signal
33. VSD – high phase input and motor current (each phase)
34. VSD – DC bus pre-regulation
35. VSD – input DCCT offset (each phase)

U. Security Access: controlled through YORK Chiller Access Manager which will provide users dynamic access codes so that changes in the control panel can be traced back to a specific user. Users will need to set up an account at www.yorkchilleraccessmanager.com in order to be able to generate access codes.

1. Access Levels are defined by different levels of user capability:
 - a. View: open to anyone; view set points, but no changes can be made
 - b. Standard: comes with the purchase of the chiller; provides access to items for daily operation, allows local or remote control of chillers, and changing of set points
 - c. Enhanced: can be accessed by qualified service personnel who have a subscription; in the event that maintenance or service is necessary
 - d. JCI Service: generally reserved for Johnson Controls Service personnel only with access to proprietary advanced diagnostic features and tools
2. For details of what is available in the Standard and Enhanced access levels, please refer to the Operating Manual.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- V. Chiller information screen including on-screen display of the following, as a minimum:
1. Model number
 2. Chiller serial number
 3. Control panel serial number
 4. Manufacturer contract number
 5. Design voltage
 6. Refrigerant type
 7. Starter type
 8. Original factory chiller rating information
- W. Data tracking and trend display including on-screen graphical display of the following, as a minimum:
1. Parameters selected from a list of a minimum of 140 possibilities
 2. Data collected once per second up to once per hour for each parameter
 3. Data trend lines displayed for a minimum of 5 parameters at once
- X. History: Store last ten shutdowns and display all system parameters at the time of shutdown.
- Y. Memory: Non-volatile type containing operating program and setpoints, capable of retention for 10 years without memory loss, despite AC or backup battery power loss.
- Z. Terminal strip has be clearly numbered to accept field interlock wiring.
- AA. Remote communications: Via electrical contacts, control panel capability to indicate the following as a minimum:
1. Ready to start contacts
 2. Safety shutdown contacts
 3. Cycling shutdown contacts
 4. Running contacts
- BB. Remote communications: Via 4-20 mA or 0-10V analog signals, control panel capability to adjust the fol-lowing as a minimum:
1. Leaving chilled liquid setpoint
 2. Current limit setpoint
 3. Chiller start and stop
- CC. Data logging and printing: Via RS-232 or similar, control panel capability for exporting at user-program-mable intervals:
1. All system operating data
 2. Shutdown and cycling messages
 3. Operating details of last 10 cycling or safety shutdowns

- DD. Optionally send data to the cloud for:
1. Remote servicing and inspection
 2. Fault detection and diagnostics
 3. Data dashboarding and health reporting

2.12 COMPRESSOR MOTOR STARTER: VARIABLE SPEED DRIVE

- A. General: Variable Speed Drive (VSD) compressor motor starter to start motor and control motor speed by controlling the frequency and voltage of the electrical power supplied to the motor.
- B. Drive type: Pulse width modulated (PWM) utilizing insulated gate bipolar transistors (IGBTs).
- C. Control Logic: Independently control motor speed and pre rotation vane (PRV) position for optimum efficiency and operational stability. Base motor speed and PRV position on a minimum of 4 inputs: leaving chilled water temperature, return chilled water temperature, evaporator refrigerant pressure, condenser refrigerant pressure; Verify motor speed and PRV position and also use as inputs to the control logic.
- D. Power Factor: At all loads and speeds, provide a minimum of a .97 power factor.
- E. Capacitors shall not require scheduled replacement. If capacitors do not meet this requirement, the chiller manufacturer shall provide three spare sets of capacitors per compressor for the building owner's stock.
- F. Enclosure: NEMA-1 type with hinged access door with door interlock, lock and keys, and padlockable
- G. Packaging: Factory mounted on chiller, piped to cooling circuit; wired to control panel and compressor motor; entire package (including active harmonic filter) shall be UL listed
- H. Cooling: Cool drive pole assembly components and internal ambient air via fluid-cooled, closed loop; all starter components accessible for service and replacement without opening the chiller's main refrigerant circuit.
- I. Factory run test: Perform an electrical and mechanical run test of VSD starter prior to shipment to verify proper wiring and phasing.
- J. Factory settings: Set starting design current and current overload settings prior to shipment.
- K. Harmonic Distortion: Provide a drive and chiller system with an integrated active harmonic filter mounted inside the starter cabinet. System must generate harmonic distortion levels less than the following, measured at the input side of the drive:
1. Current: 5% maximum current total demand distortion
- L. Inrush amperage: Limited to the design full load amperage of the chiller.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- M. Protective devices: provide the following, as a minimum:
1. Electronic current-sensing overloads (1 per phase) – with indicating message on the control panel and reset button; shut down chiller upon detection of operating current exceeding 105% full load amperage.
 2. High instantaneous current overload – with indicating message on the control panel and reset button; shut down chiller upon detection of starting current exceeding 115% of design inrush starting current for 1 second.
 3. Phase rotation insensitivity
 4. Single phase failure protection circuit with indicating light – shut unit down if power loss occurs in any phase at startup.
 5. High temperature safety protection system on IGBTs with indicating light and reset button; via thermistors embedded on IGBT heat sinks – shut unit down if IGBT temperature exceeds acceptable limits.
 6. Power fault protection for momentary power interruptions – interrupt power to the compressor motor within 4 line cycles upon detection of power interruptions longer than $\frac{3}{4}$ of a line cycle.
 7. High and low line voltage protection.
- N. Features: Factory mount and wire the following as a minimum:
1. Control transformer: 115volt and sized to power control panel and all unit controls.
 2. Electrical lugs: Sized to accept the copper power lines required by the chiller.
 3. Single point power: From electrical lugs at starter, power all powered devices on the chiller including control panel, control devices, oil pump (if applicable) and refrigerant purge.
 4. Circuit-breaker disconnect: Door interlocked; ground fault protection; minimum 65,000A short circuit withstand capacity per UL 508.
- O. Control panel readouts: Display on the control panel and provide to BAS via communication port the following as a minimum:
1. Output frequency
 2. Output voltage
 3. Output current (each phase)
 4. Input power (kW)
 5. Energy consumption (kWh)
 6. Elapsed running time
 7. Three phase voltage total harmonic distortion (THD)
 8. Three phase current total demand distortion (TDD)
 9. Total unit power factor
 10. Total supply KVA

2.13 FINISHES

- A. Dry chiller components for shipment, including inside of water boxes and tubes.
- B. Blast and clean chiller surfaces thoroughly. Apply prime coat for painting.
- C. Paint all exposed surfaces with alkyd-modified, vinyl enamel machinery paint, including all factory-applied insulation for consistent color matching. If not painted in the factory, paint over insulation in the field with manufacturer's standard paint and color.

2.14 OPTIONS

- A. Insulation package (available on units shipping in a single piece): factory insulate evaporator, end sheets, suction line, liquid line and other cold surfaces with 3/4" or 1-1/2" closed-cell neoprene foam insulation. Adhere with vapor-proof cement. (Water boxes and nozzles must be field insulated with removable covers over bolts).
- B. Flow Sensors: thermal type: Factory installed in chilled and condenser water nozzles and factory wired to chiller control panel.
- C. Flow Switches: Differential pressure type and shipped loose for field installation and field wiring to chiller control panel in chilled and condenser water nozzles.
- D. Eddy Current Testing: Heat exchanger tube testing shall be performed at the chiller manufacturing facility to ensure tube quality and longevity. A test report shall be provided and will include the following as a minimum:
 - 1. List of test equipment used and equipment settings.
 - 2. Test data reports and accompanying strip charts of calibrations and tubes with significant defect and typical indications.
 - 3. Statistical summary of defect indications.
 - 4. Recommendations concerning tube condition, tube replacement, tube removal for evaluation and future frequency of testing.
 - 5. Approval by an ASNT Level III eddy current technician.
- E. Control System Interface: DDC type and shall provide the following, as a minimum:
 - 1. Export system operating data.
 - 2. Accept setpoint adjustments for chilled water setpoint and demand limit.
 - 3. RS-232 communication: BACNet MS/TP is the default communication protocol unless otherwise noted.
 - 4. Field commissioning assistance by manufacturer's technician.

F. Seismic Certification:

1. Available seismic certification in accordance with IBC 2009 based on shake table testing performed in accordance with AC-156.

2.15 ACCESSORIES

A. Refrigerant recovery unit consisting of the following as a minimum:

1. Portable, self-contained package, lawn mower configuration
2. Refrigerant compressor
3. Water-cooled condenser
4. Refrigerant filter drier
5. Suction and discharge pressure gauges
6. Refrigerant isolation valves
7. Relief valves
8. Two 8-foot long hoses
9. Controls: Permanent circuit with all safety devices
10. Wheels and swivel casters with lock brakes
11. Warranty: 1 year parts, starting from date of shipment
12. AHRI certified

B. Refrigerant receiving tank consisting of the following as a minimum:

1. Self contained package
2. Receiving tank: Horizontal, pitched toward tank drain
3. Capacity: Hold the charge of largest chiller with 20% capacity remaining at 90°F
4. Two sight glasses
5. Pressure gauge
6. Refrigerant isolation valves
7. Relief valves
8. Float cutoff switch
9. Oil heater (if applicable)
10. Warranty: 1 year parts, starting from date of shipment
11. ASME stamped

C. Refrigerant storage and recycling system:

1. Self contained package
2. Receiving tank: Horizontal, pitched toward tank drain
3. Capacity: Hold the charge of largest chiller with 20% capacity remaining at 90°F
4. Two sight glasses
5. Refrigerant compressor
6. Oil separator and heater (if applicable)
7. Water-cooled condenser
8. Refrigerant filter drier

9. Suction and discharge pressure gauges
10. Refrigerant isolation valves
11. Relief valves
12. Two 8-foot long hoses
13. Float cutoff switch
14. Controls: permanent circuit with all safety devices
15. AHRI certified and ASME stamped
16. Warranty: 1 year parts, starting from date of shipment

- D. Spring vibration isolators (for above-grade floor installations): Provide four spring-type, level-adjusting, 1" deflection vibration isolators with non-skid pads for each support point.

2.16 VERIFICATION OF PERFORMANCE:

- A. Execute test per AHRI Standard 550/590.
- B. One representative from both the owner and the engineer shall witness test. Manufacturer shall pay food, lodging and transportation expenses for two witnesses.
- C. AHRI Points Test: Factory test each chiller for capacity and efficiency at the four standard AHRI rating points:
1. 100% load and 85 °F entering condenser water temperature (ECWT) and design flow rates
 2. 75% load and 75 °F ECWT and design flow rates
 3. 50% load and 65 °F ECWT and design flow rates
 4. 25% load and 65 °F ECWT and design flow rates
 5. 25% load and 55 °F ECWT and design flow rates
- D. Cold Condenser Water Test: Factory test each chiller for capacity and efficiency at the four standard AHRI rating points:
1. 100% load and 55 °F entering condenser water temperature (ECWT) and design flow rates
 2. 75% load and 55 °F ECWT and design flow rates
 3. 50% load and 55 °F ECWT and design flow rates
 4. 25% load and 55 °F ECWT and design flow rates
- E. Extended Duration Test: Factory test each chiller for capacity and efficiency at the four standard AHRI rating points for four hours:
1. 100% load and 85 °F entering condenser water temperature (ECWT) and design flow rates
 2. 75% load and 75 °F ECWT and design flow rates
 3. 50% load and 65 °F ECWT and design flow rates
 4. 25% load and 65 °F ECWT and design flow rates
 5. 25% load and 55 °F ECWT and design flow rates

- F. Should a unit fail any test, treat unit with a permanent remedy at manufacturer's expense until the test is successfully passed.
- G. Provide test data and results in a report to the owner.
- H. After the test and prior to shipment, perform the following:
- I. Check / change oil filter (if applicable).
 - 1. Drain oil from sump (if applicable).
 - 2. Drain water from boxes and heat exchangers and dry thoroughly.
 - 3. Remove refrigerant and pressurize refrigerant side to 5 psig with dry nitrogen unless shipping with refrigerant in unit.
 - 4. Follow procedures in PART 1, Section 1.07 (SHIPMENT).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine chillers before installation. Reject chillers that are damaged.
- B. Examine roughing-in for equipment support, anchor-bolt sizes and locations, piping, control and electrical connections to verify actual locations, sizes, and other conditions affecting chiller performance, maintenance, and operations before equipment installation.
 - 1. Chiller locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and control and electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CENTRIFUGAL WATER CHILLERS

- A. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases.
- B. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.
- C. Install chillers on support structure indicated.
- D. Equipment Mounting:
 - 1. Install chillers on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Maintain manufacturer's recommended clearances for service and maintenance.
- F. Maintain clearances required by governing code.
- G. Chiller manufacturer's factory-trained service personnel are to charge chiller with refrigerant and fill with oil if not factory installed.
- H. Install separate devices furnished by manufacturer and not factory installed.
 1. Chillers shipped in multiple major assemblies are to be field assembled by chiller manufacturer's factory-trained service personnel.

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping," Section 232116 Hydronic Piping Specialties," and Section 232300 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to chillers, allow space for service and maintenance.
- C. Evaporator-Fluid Connections:
 1. Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gauge.
 2. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, thermometer, plugged tee with shutoff valve and pressure gauge, flow meter, and drain connection with valve.
 3. Make connections to chiller with a flange.
- D. Condenser-Fluid Connections:
 1. Connect to condenser inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gauge.
 2. Connect to condenser outlet with shutoff valve, balancing valve, flexible connector, thermometer, plugged tee with shutoff valve and pressure gauge, flow meter, and drain connection with valve.
 3. Make connections to chiller with a flange.
- E. Refrigerant-Pressure Relief Device Connections:
 1. For chillers installed indoors, extend vent piping to the outdoors without valves or restrictions.
 2. Comply with ASHRAE 15.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
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3. Connect to chiller pressure relief device with flexible connector and dirt leg with drain valve.
- F. For chillers equipped with a purge system, extend purge vent piping to the outdoors. Comply with ASHRAE 15 and ASHRAE 147.
- G. Connect each chiller drain connection with a drain valve, which is full size of drain connection. Connect drain pipe to drain valve with union, and extend drain pipe to terminate over floor drain.
- H. Connect each chiller water box vent connection with a manual vent, which is full size of vent connection.

3.4 ELECTRICAL POWER CONNECTIONS

- A. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection. Nameplate is to be laminated phenolic layers of black with engraved white letters at least **1/2 inch (13 mm)** high. Locate nameplate where easily visible.

3.5 CONTROLS CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring between chillers and other equipment to interlock operation as required to provide a complete and functioning system.
- C. Connect control wiring between chiller control interface and DDC control system for remote monitoring and control of chillers. Comply with requirements in Section 230993 "Sequence of Operation for HVAC."
- D. Install nameplate on face of chiller control panel indicating the control equipment designation serving chiller and the I/O point designation for each control connection. Nameplate is to be laminated phenolic layers of black with engraved white letters at least **0.5 inch (12.7 mm)** high.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.
 - 3. Verify that pumps are installed and functional.
 - 4. Verify that thermometers and gauges are installed.
 - 5. Operate chiller for run-in period.
 - 6. Check bearing lubrication and oil levels.
 - 7. Verify that refrigerant pressure relief device is vented outside.
 - 8. Verify proper motor rotation.
 - 9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 - 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 - 11. Verify and record performance of chiller protection devices.
 - 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, piping, controls and electrical connections for proper assembly, installation, and connection.
- C. Visually inspect chiller for damage before starting. Repair or replace damaged components, including insulation. Do not start chiller until damage that is detrimental to operation has been corrected.
- D. Prepare test and inspection startup reports.

3.7 WARRANTY PERIOD TESTING

- A. Within one month(s) of warranty period expiration, perform testing, analysis, and reporting indicated for each chiller.
- B. Eddy Current Testing:
 - 1. Solicit services of a third-party testing agency, specializing in such analysis, to perform testing of evaporator and condenser tubes, to ensure tube quality and longevity.
 - 2. Submit test report to Owner, including, at a minimum:
 - a. List of equipment used and equipment settings.

- b. Test data reports and accompanying strip charts of calibrations.
- c. Identify tubes with significant defects and typical indications.
- d. Statistical summary of defect indications.
- e. Recommendations concerning tube condition, tube replacement, tube removal for evaluation, and future frequency of testing.
- f. Approval by an American Society for Nondestructive Testing, Level III eddy current technician.

C. Oil Analysis:

1. Take oil sample and solicit services of a third-party testing agency, specializing in such analysis, to perform oil analysis.
2. Submit analysis results and recommendations to Owner.

D. Refrigerant Analysis:

1. Take refrigerant sample and solicit services of a third-party testing agency, specializing in such analysis, to perform refrigerant analysis.
2. Submit analysis results and recommendations to Owner.

E. Site Access and Scheduling:

1. Contact Owner to schedule testing at least 30 days in advance of testing.
2. Make mutually agreeable schedule adjustments to accommodate Owner's request for testing.
3. Review, with Owner, requirements for visitors in advance of testing.
4. Comply with Owner requirements for visitors while on-site.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

1. Instructor must be factory trained and certified.
2. Provide not less than eight hours of training.
3. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.
4. Provide instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
5. Obtain Owner sign-off that training is complete.
6. Owner training is to be held at Project site.

END OF SECTION 236416

SECTION 236514 – OPEN-CIRCUIT COOLING TOWERS – **ALTERNATE #2**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes factory-assembled, open-circuit, cooling towers.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, pressure drop, fan performance data, rating at selected points indicated, and furnished specialties and accessories.
 - 2. Maximum flow rate.
 - 3. Minimum flow rate.
 - 4. Pressure required at cooling tower supply piping connections.
 - 5. Pressure required at basin heater supply piping connections.
 - 6. Pressure required at collection basin sweeper supply piping connections.
 - 7. Drift loss as percent of design flow rate.
 - 8. Sound:
 - a. Sound pressure levels for operation with fan off, fan at minimum speed, and design speed. If sound requirements are indicated at a specific distance, submit performance using same distance for comparative analysis.
 - b. Sound power levels in eight octave bands for operation with fans off, fans at minimum speed, and design speed.
 - 9. Fan airflow at design conditions, brake horsepower, and drive losses (indicated in horsepower and percent of brake horsepower).
 - 10. Fan motor electrical characteristics including, but not limited to, speed, voltage, phase, hertz, amperage, efficiency, and power factor at 100, 75, 50, and 25 percent of nameplate horsepower.
 - 11. Electrical power requirements for each cooling tower component requiring power.

B. Shop Drawings:

1. Manufacturer's drawings of assembled cooling towers, control panels, sections, and elevations.
2. Assembled unit dimensions.
3. Diagram showing each separate piece requiring field assembly.
4. Shipped sub-assembly dimensions and weights for field assembly.
5. Assembled unit weight without water.
6. Operating weight and load distribution.
7. Unit vibration isolation.
8. Required clearances for maintenance and operation.
9. Sizes and dimensioned locations of piping and wiring connections.
10. Diagrams for power, signal, and control wiring.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For each cooling tower to include in emergency, operation, and maintenance manuals.
- B. Instructional Videos: Including those that are prerecorded and those that are recorded during training.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: The thermal performance shall be certified by the Cooling Technology Institute in accordance with CTI Certification Standard STD-201.
- B. The cooling towers shall comply with the energy efficiency requirements of ASHRAE Standard 90.1-2019.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Coordinate requirements for multi-piece assembly for shipment. Limit the number of separate pieces for field installation to as few as possible.
- B. If factory assembly of multiple pieces is required for testing or other reasons, disassemble cooling tower into major assemblies as required by installation before packaging for shipment. Clearly label each separate package with a unique designation and include assembly instructions for complete cooling tower.
- C. Install seals on gear-drive assemblies to eliminate oil leakage during shipment if shipped with oil.

1.7 WARRANTY

- A. One-year warranty after start-up, or eighteen months from date of shipment, whichever occurs first. Warranty to include coverage for defects in material and workmanship.
- B. Fans, fan shafts, bearings, sheaves, gearboxes, drive shafts, couplings, and mechanical equipment support must be warranted against defects in materials and workmanship for a period of five (5) years or seven (7) years, if motor space heater is properly wired.
- C. For direct drive fan system: Fans, fan shafts, bearings, sheaves, gearboxes, drive shafts, couplings, and mechanical equipment support must be warranted against defects in materials and workmanship for a period of seven (7) from date of shipment. Included VFD will have 5-year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Baltimore Aircoil
 - 2. Marley
 - 3. Evapco

2.2 MANUFACTURED UNITS

- A. Provide units suited for outdoor use, factory-assembled, induced draft with vertical discharge of air, and fan assemblies built into casing.

2.3 COMPONENTS

- A. Cold Water Basin:
 - 1. Tri-layer protection system consisting of G-235 galvanized steel, a thermosetting hybrid polymer, and a polyurethane liner factory applied to all submerged surfaces. A Removable anti-vortexing hood will be provided to prevent air entrainment. Large area lift out strainers will be provided with perforated openings sized smaller than the water distribution system nozzles. Sloped with depressed section with drain/clean-out connection. A welded Type 316 stainless steel basin is an acceptable alternative.
- B. Water Distribution System
 - 1. The hot water distribution basins will be gravity-fed and accessible from the outside of the unit for service or inspection while unit is in operation. Basins must be constructed of

corrosion-resistant pultruded fiberglass reinforced polyester (PFRP) or type 316 stainless steel. Included weir dams will accommodate a flow range of 50% to 100% of the design flow rate. Lift-off distribution covers will be constructed of Type 304 stainless steel and designed to withstand a 50 psf (244 kg/m²) live load or 200 pound (90.7 kg) concentrated load.

C. Casing Panels and Framework:

1. Casing panels will be constructed of galvanized steel protected by a thermosetting hybrid polymer. The polymer to consist of galvanized steel prepared in a four-step (clean, pre-treat, rinse, and dry) process with an electrostatically applied, thermosetting, hybrid polymer fuse-bonded to the substrate during a thermally activated curing stage and monitored by a 23-step quality assurance program. Other coatings must be submitted to the engineer for pre-approval. Approved equals must have undergone testing, resulting in the following results as a minimum:
 - a. When X-scribed to the steel substrate, unit to withstand 6000 hours of 5 percent salt spray per ASTM B117 without blistering, chipping, or loss of adhesion.
 - b. When X-scribed to the steel substrate, unit to withstand 6000 hours of exposure to acidic (pH=4.0) and alkaline (pH=11.0) water solutions at 95 degrees F (35 degrees C) without signs of chemical attack.
 - c. Unit to withstand impact of 160 in-lbs per ASTM D2794 without fracture or delamination of the polymer layer.
 - d. Unit to withstand 6000 hours of ultraviolet radiation equivalent to 120,000 hours of noontime sun exposure without loss of functional properties.
 - e. Unit to withstand 200 thermal shock cycles between minus 25 degrees F and 180 degrees F (minus 32 degrees C and 82 degrees C) without loss of adhesion or other deterioration.
 - f. Unit to withstand 6000 hours of exposure to 60 psi (42,184 kg/m²) water jet without signs of wear or erosion.
 - g. Type 304 stainless steel may be supplied as an equal to eliminate the need for passivation, minimize maintenance requirements, and prolong equipment life.

D. Air Inlet Louvers

1. Fiberglass Reinforced Polyester (FRP): Air Inlet louvers will be separate from the fill and removable to provide easy access for inspection of the air/water interface at the louver face. Louvers will prevent water splash out during fan cycling and be constructed of maintenance free, corrosion and UV resistant FRP.
2. Air Intake Screens:
 - a. A removable galvanized steel wire mesh screen with 1"x1" openings will cover air intake areas.

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- E. Fans: Multi blade, axial type. Fans must factory test-mounted, balanced, and aligned to ensure reliable operation and ease of maintenance. Fan type will be selected to meet sound ratings published on equipment schedule.
- F. Motors:
 - 1. Direct Drive Motor: See Direct Drive Fan System (2.03 G)
- G. Fan Drive System:
 - 1. Direct Drive Fan System: The motor will be directly connected to the fan shaft within the airstream, eliminating the need for couplings, right-angle gears, belts, or sheaves.
 - a. Quality Assurance
 - 1) Tower thermal performance must be certified per CTI STD-201.
 - 2) Manufactured under ISO 9001 approved quality assurance program.
 - 3) Seismic shake table tested per ICC-ES A156; must meet local Sds requirement but cannot be less than 0.50.
 - 4) Tested and certified to operate continuously at 104°F ambient wet bulb temperature.
 - 5) Compatible VFD supplied by tower manufacturer; see VFD specification for details.
 - b. Factory Test: The motor will be wired and tested prior to shipping. Testing done on-site is not acceptable. Testing will include:
 - 1) Installation of unit on a test stand for a visual/audible inspection to confirm no excess movement or unusual noises exist.
 - 2) Wiring of motor to a VFD.
 - 3) Running the motor to a specified speed/frequency and taking measurements of power draw to ensure appropriate loading is being achieved.
 - 4) Documentation of testing results supplied in the customer's documents.
 - c. General
 - 1) CSA Label and CE mark for safety compliance.
 - 2) Totally Enclosed Air Over (TEAO) IP66 rating.
 - 3) Interior permanent magnet rotor construction; synchronous design; magnets enclosed inside the rotor lamination; magnets with high temperature grade capable of 200°C conditions without loss of magnetization.
 - 4) Compliance with NEMA MG 1 part 31 standards for definite-purpose inverter-fed motors suitable for 2000 volt peak at 10,000 volt per microsecond.

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d. Components

- 1) Bearing isolator (seal) on motor shaft provided with shaft grounding device, utilizing two carbon grounding brushes to eliminate bearing currents.
- 2) Salient pole permanent magnet design rotor resulting in no I²R losses.
- 3) Stator consisting of low-loss C5a coated electrical steel.
- 4) Integral stator cooling fins, not a shaft mounted fan, for controlling rotor and stator temperatures during operation.
- 5) Class H insulation system rated at 1850 Volts peak, and thermally-rated wire when tested per ASTM D-2307 for 600,000 hours extrapolated life at 155°C minimum.
- 6) Shaft sealed by three O-rings, with two conductive O-rings to properly ground the bearing, eliminating damaging currents in the bearings.
- 7) Oversized conduit box with provisions for grounding inside.
- 8) Integral condensate drain system.
- 9) Three normally closed thermostats, one per phase.
- 10) Open ball bearings with a minimum L10 life of 100,000 hours.
- 11) Bearings sized to handle unbalanced loads based on an ISO Balance Grade of 6.3.
- 12) Re-greaseable bearing system including stainless steel inlet fitting and grease drain provided with square stainless-steel square head pipe plugs.
- 13) E-coat primer on cast iron parts prior to application of top coat.
- 14) Enhanced cooling tower duty paint that withstands 1000 hour salt fog test.

H. Fan Guard:

1. Welded steel rod and wire guard, hot dipped galvanized after fabrication. Installed over fan discharge.

I. Gravity-fed Distribution: Hot water basins will have removable covers for inspection while unit is in operation, weir dams and metering nozzles for at least 50 percent turndown capability. Gravity flow nozzles will be snap-in type for easy removal. Pressurized nozzles are not acceptable.

J. Balancing Valves: Heavy-duty butterfly valves will be provided at the hot water inlet connections. These valves will include cast iron bodies, elastomer seat and steel operating lever.

K. Single Inlet Connection: Each tower cell will be furnished with a single water inlet connection complete with the means to automatically balance flow rates to the hot water basins.
Drain Valve on EASY CONNECT: The factory-supplied internal piping will include a manual drain valve positioned to drain the piping during shutdown to reduce risk of freezing.

L. Fill:

1. The fill and integral drift eliminators will be formed from self-extinguishing (per ASTM-568) polyvinyl chloride (PVC) having a flame spread rating of 5 per ASTM E84 and will be impervious to rot, decay, fungus and biological attack. The fill is suitable for entering

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BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

water temperatures up to and including 130°F (54.4°C). The fill must be manufactured, tested and rated by the cooling tower manufacturer and are elevated above the cold water basin floor to facilitate cleaning. If louvers are attached to fill, a spare set of fill sheets are required in case of icing and scaling damage.

- M. Drift Eliminators: Three-pass design made of PVC material. Primary eliminators will be integrated into the fill media.
- N. Basin Water Level Control:
 - 1. Electric water level control with NEMA 4 enclosure, solid state controls, LED status light, and stainless steel water level sensing electrodes. Number and position of probes provided to sense the following: high water level, low water level, high water alarm level, low water alarm level, heater safety cutout, and automatic solenoid valve. Include all necessary mounting hardware.

2.4 ACCESSORIES

- A. Electric Immersion Heaters: In pan suitable to maintain temperature of water in pan at 40 degrees F (4.4 degrees C) when outside temperature is -20 degrees F (-28.9 degrees C) and wind velocity is 15 mph (25 kph); immersion thermostat and float control operate heaters on low temperature when the pan is filled. Heaters will be constructed of copper.
- B. Vibration Switch
 - 1. Provide an electronic remote reset vibration switch with contact for BAS monitoring. Wiring will be by the installing contractor. The electronic vibration cutout switch will be set to trip at a point so as not to cause damage to the cooling tower. To ensure this, the trip point will be set in a frequency range of 2 to 1000 Hertz and a trip point of 0.45 in/sec (0.0114 m/sec).
- C. Access Packages: See submittal documents for access package requirements. Platforms and ladders must ship assembled from cooling tower manufacturer.
 - 1. Plenum Access: Two hinged access doors must be provided for access into the plenum section. Include an internal walkway for inspection and maintenance. All working surfaces will be able to withstand 50 psf (244 kg/m²) live load or 200 pound (90.7 kg) concentrated load. Other components of the cooling tower, i.e. basin and fill/drift eliminators, will not be considered an internal working surface. Cooling tower designs that utilize these surfaces as working platforms will not be acceptable. Cooling tower manufacturers that promote these surfaces to be used as a working platform will provide a two-year extended warranty to the Owner to repair any damage to these surfaces caused during routine maintenance.
 - 2. Fan Deck Ladder with Handrails: A ladder with steel safety cage and safety gate will be provided for access to the fan deck. Access door or service platforms are not acceptable. 1-1/4 inch (32 mm) galvanized steel pipe handrail will be provided around the perimeter of the cooling tower cells. The handrails will be provided with knee and toe rails and will conform to OSHA requirements applicable at the time of shipment. To comply with OSHA 1910.28(b)(9), fan deck ladders exceeding 24' in total length must be designed to accept a

ladder safety system. A ladder safety cage is not an acceptable alternative to a ladder safety system and will not be provided on ladders exceeding 24' in total length.

3. Louver Face External Platforms: Easy access to the hot water basins for inspection of spray water distribution, even during tower operation, will be provided by external platforms at the louver face. Fan deck ladders and handrails, which add to the overall height of the tower, are not acceptable. Platforms and ladders must ship assembled from cooling tower manufacturer. To comply with OSHA 1910.28(b)(9), louver face external platform ladders exceeding 24' in total length must be designed to accept a ladder safety system. A ladder safety cage is not an acceptable alternative to a ladder safety system and will not be provided on ladders exceeding 24' in total length.
4. Access Door Platform: An external galvanized steel access platform at the access door of the unit(s) provides access to the spray distribution system or internal plenum. An aluminum ladder and 1-1/4 inch (32 mm) galvanized steel pipe safety railing is included with the platform. This option meets pertinent OSHA standards. Platforms and ladders must ship assembled from cooling tower manufacturer.
5. Safety Gates: All handrail access openings will be provided with a self-closing safety gate for increased safety.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine cooling towers before installation. Reject cooling towers that are damaged.
- B. Before cooling tower installation, examine roughing-in for tower support, anchor-bolt sizes and locations, piping, controls, and electrical connections to verify actual locations, sizes, and other conditions affecting cooling tower performance, maintenance, and operation.
 1. Cooling tower locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping, controls, and electrical connections.
 2. Verify sizes and locations of concrete bases and support structure with actual equipment.
 3. Verify sizes, locations, and anchoring attachments of structural-steel support structures.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Equipment Mounting: Install cooling towers on cast-in-place concrete equipment bases. Provide galvanized steel I-Beam supports.
- B. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Maintain manufacturer's recommended clearances for service and maintenance.
- D. Maintain clearances required by governing code.

- E. Loose Components: Install components, devices and accessories furnished by manufacturer, with cooling tower, that are not factory mounted. Loose components shall be installed by contractor under supervision of manufacturer's factory-trained service personnel.

3.3 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to cooling towers, allow space for service and maintenance.
- C. Install drain piping with valve at cooling tower drain connections and at low points in piping.
- D. Connect cooling tower overflows and drains, and piping drains, to sanitary sewage system.

3.4 DEELECTRICAL POWER CONNECTIONS

- A. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.
- B. Comply with requirements in Division 26 for wiring connections.
- C. Comply with requirements in Division 26 for grounding connections.
- D. Install nameplate for each electrical connection indicating electrical equipment designation and circuit number feeding connection. Nameplate shall be laminated phenolic layers of black with engraved white letters at least 1/2 inch high. Locate nameplate where easily visible.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections: Comply with CTI ATC 105.
- D. Cooling towers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
- B. Inspect field-assembled components, equipment installation, and piping; controls; and electrical connections for proper assemblies, installations, and connections.
- C. Obtain performance data from manufacturer.
 - 1. Complete installation and startup-checks according to manufacturer's written instructions and perform the following:
 - a. Clean entire unit including basins.
 - b. Verify that accessories are properly installed.
 - c. Verify clearances for airflow and for cooling tower servicing.
 - d. Check for vibration isolation and structural support.
 - e. Lubricate bearings.
 - f. Verify fan rotation for correct direction and for vibration or binding and correct problems.
 - g. Adjust belts to proper alignment and tension.
 - h. Verify proper oil level in gear-drive housing. Fill with oil to proper level.
 - i. Operate variable-speed fans through entire operating range and check for harmonic vibration imbalance. Set motor controller to skip speeds resulting in abnormal vibration.
 - j. Check vibration switch setting. Verify operation.
 - k. Verify water level in tower basin. Fill to proper startup level. Check makeup-water-level control and valve.
 - l. Verify operation of basin heater and control.
 - m. Replace defective and malfunctioning units.
- D. Start cooling tower and associated water pumps. Follow manufacturer's written starting procedures.
- E. Prepare a written startup report that records the results of tests and inspections.

3.7 ADJUSTING

- A. Set and balance water flow to each tower inlet.
- B. Adjust water-level control for proper operating level.
- C. Adjust basin heater control for proper operating set point.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain cooling towers.
1. Video record the training sessions.
 2. Instructor shall be factory trained and certified.
 3. Perform not less than 8 hours of training.
 4. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.
 5. Perform instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
 6. Obtain Owner sign-off that training is complete.
 7. Owner training shall be held at Project site.

END OF SECTION 236514

SECTION 261000 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Alternates: Refer to Division 01 to determine extent of, if any, work of this section that will be affected by any alternates if accepted.
- B. Furnish all materials, equipment, labor, and supplies and perform all operations necessary to complete the electrical work in accordance with the intent of the drawings and these specifications.
- C. Temporary Power and Lighting: Provide separate meter and service for construction area.
 - 1. Power Distribution: Provide weatherproof, grounded circuits with ground-fault interruption features, with proper power characteristics and either permanently wired or plug-in connections as appropriate for intended use. Provide overload-protected disconnect switch for each circuit at distribution panel. Space 4-gang convenience outlets (20 amp circuit) so that every portion of work can be reached with 100' extension cord.
 - 2. Temporary Lighting: Provide lighting of intensity and quality sufficient for proper and safe performance of the work and for access thereto and security thereof. (Consult OSHA requirements.)

1.3 EFFICIENCY MAINE

- A. This project intends to pursue Efficient Maine prescriptive and/or custom incentives. The contractor shall be an Efficiency Maine Qualified Partner and shall participate in the activities associated with Efficiency Maine incentive pre-approval and approval process including but not limited to; preparation and submission of required incentive application(s) and the tracking and submission of measure specific invoices to Efficiency Maine within 60 days of the completion of the work.
- B. The contractor shall also:
 - 1. Become familiar with the Efficiency Maine Business Program including available incentives and the application and review process.

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UNIVERSITY OF MAINE
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2. Review plans and specifications for any and all incentive opportunities, prescriptive and custom.
 - C. The project schedule shall reflect and accommodate the time required to achieve application preapproval from Efficiency Maine. No equipment shall be purchased until preapproval is received from Efficiency Maine.
 - D. All invoices shall be forwarded to Efficiency Maine in accordance with Efficiency Maine requirements. This deliverable shall be shown on the project schedule as a milestone date and coordinated with all contractors to assure compliance with this requirement.
- 1.4 FIRE ALARM SYSTEM
- A. Modify and add to the existing fire alarm system to provide a complete and code compliant system including but not limited to: new smoke detectors, heat detectors and notification appliances in all areas required. Fire alarm systems shall generally comply with requirements of NFPA 72 for local building systems except as modified and supplemented by this specification. All units of equipment shall be listed by Underwriters Laboratories and shall consist of a battery-backed fire alarm control station, with audio/visual and visual alarm indicating devices, heat detectors, smoke detectors, and pull stations. All equipment shall be located as shown on the plans and wired in accordance with the manufacturer's instructions to form a complete and workable emergency evacuation life safety system as hereinafter described.
- 1.5 QUALITY ASSURANCE
- A. All wiring shall be in accordance with the latest issue of the National Electrical Code.
 - B. The Contractor shall show evidence, upon request, of having successfully completed at least five similar projects. Installation of each system shall be under the supervision of a factory-authorized organization.
 - C. The Contractor shall show evidence, upon request, that he maintains a fully equipped service organization capable of furnishing adequate inspection and service to the system. The Contractor must have a service contract program for the maintenance of the system after the guarantee period.
 - D. All electrical equipment shall be listed by Underwriters Laboratories, Inc. Each system shall be products of a single manufacturer of established reputation and experience. The Contractor shall have supplied similar apparatus to comparable installations rendering satisfactory service for at least three years.
 - E. For each system, the manufacturer shall furnish "gratis" to the Owner a one-year contract effective from the date of installation for maintenance and inspection services of the manufacturer's equipment with a minimum of two inspections during the contract year.

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UNIVERSITY OF MAINE
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- F. Furnish the services of a competent instructor for not less than one four- hour period for instructing personnel in the operation and maintenance of the closed-circuit television system, on the dates requested by the Owner.

1.6 ARC-FLASH HAZARD STUDY AND IDENTIFICATION

- A. The work of this section includes updating the Owner's existing arc-flash hazard study to include equipment provided under this project. The existing study was performed using EasyPower computed software developed by ESA, Inc. The study shall be updated using computer software that is compatible with the existing study. The existing study document files shall be available for use in preparing the study specified herein.
- B. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- C. Comply with NFPA 70E and its Annex D for hazard analysis study.
- D. Provide arc-flash hazard warning labels as specified in Part 3 of this section

1.7 SUBMITTALS

- A. In accordance with Division 01, furnish the following:
 - 1. Manufacturer's descriptive literature: For each type of product indicated.
 - 2. Submit shop drawings which include engineering drawings of the system with specification sheets covering all component parts of the system and interconnection diagrams.
 - 3. Certification:
 - a. Prior to final inspection, deliver to the Owner's Representative certification that the material is in accordance with the drawings and specifications and has been properly installed.
 - b. Submit certification of system operating test.
 - 4. Manuals: Submit copies of complete set of operating instructions including circuit diagrams and other information of system components.

1.8 PROJECT CONDITIONS

- A. Regulatory Requirements:
 - 1. Conform to the requirements of all laws and regulations applicable to the work.
 - 2. Cooperate with all authorities having jurisdiction.

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BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

3. Compliance with laws and regulations governing the work on this project does not relieve the Contractor from compliance with more restrictive requirements contained in these specifications.
4. If the Contract Documents are found to be at variance with any law or regulation, the Contractor shall notify the Architect/Engineer promptly in writing. The Contractor shall assume full responsibility for any work contrary to law or regulation, and shall bear all costs for the corrections thereof.
5. Minimum Requirements: The National Electrical Code (NEC), Underwriters Laboratories, Inc. (UL), the National Fire Codes, and National Fire Protection Association (NFPA) are a minimum requirement for work under this section. Design drawings and other specification sections shall govern in those instances where requirements are greater than those required by code.

B. Permits, Fees, and Inspections:

1. Secure and pay for all permits, fees, licenses, inspections, etc., required for the work under Division 26.
2. Schedule and pay for all legally required inspections and cooperate with inspecting officers.
3. Provide Certificates of Inspection and Approval from all regulatory authorities having jurisdiction over the work in Division 26.

C. Drawings:

1. Do not scale the drawings. The general location of the apparatus and the details of the work are shown on the drawings, which form a part of this specification. Exact locations are to be determined at the building as the work progresses, and shall be subject to the Architect/Engineer's approval. Actual field conditions shall govern all dimensions.
2. Anything shown on the drawings and not mentioned in the specifications or vice versa shall be provided as if it were both shown and specified.
3. It is not intended that the drawings shall show every wire, device, fitting, conduit or appliance, but it shall be a requirement to furnish without additional expense, all material and labor necessary to complete the systems in accordance with applicable codes and the best practice of the trade.

1.9 WARRANTY

- A. The Contractor shall guarantee all equipment and wiring free from inherent mechanical or electrical defects for one year from date of acceptance.

1.10 RELATED WORK

- A. Division 23 - Mechanical

PART 2 - PRODUCTS

2.1 MATERIALS

A. Switches

1. Toggle Switches: 20A, 277V, 1-pole, ivory specification grade, mount 4'-0" above finished floor at door entrance.
2. Push-Button Switches: Modular, momentary-contact, low-voltage type connected to lighting control panels. Use for all permanently installed luminaires unless otherwise noted. Mount 4'-0" above finished floor at door entrance.

- B. Switchbox type occupancy sensors: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. Configure for manual-on/automatic-off operation.

C. Indoor Occupancy Sensors

1. General Description: Wall- or ceiling-mounting, solid-state units with a separate relay unit.
 - a. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
 - b. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
 - c. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
 - d. Mounting:
 - 1) Sensor: Suitable for mounting in any position on a standard outlet box.
 - 2) Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure.
 - 3) Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
 - e. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
 - f. Bypass Switch: Override the on function in case of sensor failure.
 - g. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc; keep lighting off when selected lighting level is present.
2. Dual-Technology Type: Ceiling mounting; detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.

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UNIVERSITY OF MAINE
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- a. Sensitivity Adjustment: Separate for each sensing technology.
 - b. Detector Sensitivity: Detect occurrences of 6-inch-minimum movement of any portion of a human body that presents a target of not less than 36 sq. in., and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an approximate speed of 12 inches/s.
 - c. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of 1000 sq. ft. when mounted on a 96-inch-high ceiling.
- D. Receptacles shall be specification grade, mounted 18" above finished floor unless otherwise noted.
1. Provide type TR tamper-resistant where required by code.
 2. Provide type WR weather-resistant where required by code.
- E. Duplex Receptacles with Ground-Fault Interrupter shall be an integral unit suitable for mounting in a standard outlet box.
1. Ground-Fault Interrupter shall consist of a differential current transformer, solid state sensing circuitry and a circuit interrupter switch. It shall be rated for operation on a 60 Hz, 120-volt, 20-ampere branch circuit. Device shall have nominal sensitivity to ground leakage current of five milliamperes and shall function to interrupt the current supply for any value of ground leakage current above five milliamperes on the load side of the device. Device shall have a minimum nominal tripping time of 1/30th of a second.
 2. Receptacle shall be rated 20 amperes, 125 volts for indoor use and shall be the standard duplex, three-wire, grounding type.
 3. Provide type WR weather-resistant where required by code.
- F. Weatherproof Receptacles shall consist of a duplex GFI receptacle, as specified, mounted in a weatherproof box with a gasketed, weatherproof, cast metal cover plate. The weatherproof integrity shall not be affected when heavy duty specification or hospital grade attachment plug caps are inserted. Cover plates on outlet boxes mounted flush in the wall shall be gasketed to the wall in a watertight manner.
- G. Plates shall be 302 stainless steel with tamper-proof screws.
- H. Boxes shall be steel minimum 2-1/2" deep.
- I. Light Fixtures: The light fixtures shall be as described on the drawings or approved equal.
- J. Disconnect Switches shall be heavy-duty type, horsepower rated.
- K. Motor Starters:
1. Manual motor starters shall be toggle-switch type with melting alloy thermal overload relay. Thermal units shall be one-piece construction and interchangeable. Starter shall be inoperative with thermal unit removed. Contacts shall be double break, silver alloy. Starters in finished areas shall be flush mounted over the light switch at 60" above finished floor. Starters shall be mounted behind stainless steel device plate and shall have adjacent

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pilot lights. Square D Class 2510 Type FS-1P-FL1 or approved equal. Starters in unfinished areas shall be surface mounted 60" above finished floor. Square D Class 2510 Type FG-5P or approved equal.

2. Magnetic motor starters shall be combination circuit breaker or fused disconnect switch type, mounted in a common enclosure. Starters shall be three-pole with three melting alloy overload relays. Overload heaters shall be coordinated with Division 23. Thermal units shall be of one-piece construction and interchangeable. Starter shall be inoperative with any thermal unit removed. The disconnect operating handle shall be position indicating.
 - a. Provide a control device and pilot light on the cover of each combination starter. Control devices for motors with remote manual or automatic control shall be "hand-off-auto" switches. Control devices for locally controlled motors shall be "start-stop" pushbuttons.
 - b. 120-volt magnetic motor starters may consist of a circuit breaker or fused disconnect switch and a magnetic starter in separate enclosures mounted next to each other.
 - c. Control circuits shall operate at a maximum of 120 volts. Provide control transformers as required.
3. Starters shall be mounted within NEMA-1 enclosures unless specified otherwise.
4. All starters shall be lockable in the "off" position.
5. Overload heaters shall be sized for the motor nameplate full-load amperes per the manufacturer's recommendations.

L. Wiring Materials:

1. Wiring shall be enclosed in electrical rigid galvanized steel, intermediate metal conduit, or electrical metallic tubing sized in accordance with code requirements for the conductors. Types MC or NM cable may be used where concealed in walls or ceilings and allowed by code.
 - a. Conduit fittings shall be steel compression type.
 - b. Terminations for all conduit shall have insulated bushings or insulated throat connectors in accordance with code requirements.
 - c. All conduits shall be substantially supported with approved clips or hangers spaced not to exceed ten feet on center. Minimum conduit size shall be 1/2".
2. Flexible Metal Conduit shall be used for all connections to motors and vibrating equipment and shall comply with Fed. Spec. WW-C-566.
3. Liquid-Tight Flexible Metal Conduit shall consist of flexible steel conduit with a liquid-tight PVC jacket over the conduit.
 - a. Fittings shall incorporate a threaded grounding cone, a steel or plastic compression ring, and a gland for tightening.
 - b. Liquid-tight flexible metal conduit shall be used in damp or wet locations when flexible metal conduit would otherwise be used.
 - c. Liquid-tight flexible metal conduit shall not penetrate the roof or exterior walls, and shall not be installed in lengths exceeding 72" except where necessary for flexibility.

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BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

4. All Wiring shall be type THW, XHHW, or THWN, UL labeled, copper conductors with 600-volt insulation, except as otherwise noted. Minimum size wire shall be No. 12 AWG.
5. Nonmetallic-Sheathed Cable (Type NM) shall be two-or three-conductor with a ground conductor and an overall covering that is flame-retardant and moisture-resistant. Minimum wire size shall be No. 12 AWG.
6. Type MC Cable shall have minimum No. 12 AWG type THWN or XHHW insulated copper conductors with an internal bare or insulated copper ground wire.

M. Fire-Stop Material:

1. Fire-stopping material shall maintain its dimension and integrity while preventing the passage of flame, smoke, and gases under conditions of installation and use when exposed to the ASTM E 119 time-temperature curve for a time period equivalent to the rating of the assembly penetrated. Cotton waste shall not ignite when placed in contact with the non-fire side during the test. Fire-stopping material shall be noncombustible as defined by ASTM E 136; and in addition for insulation materials, melt point shall be a minimum of 1700°F for one-hour protection and 1850°F for two-hour protection.
2. Seals for floor, exterior wall, and roof shall also be watertight.

N. Circuit Breakers: Circuit breakers to be added to existing panelboards shall match existing circuit breakers; manufacturer, mounting type, AIC rating, voltage rating and UL listed for operation in respective panelboard.

O. Panelboards:

1. Provide standard manufacturer products. All components of panelboards shall be the product and assembly of the same manufacturer. All similar units of all panelboards shall be of the same manufacturer.
2. All panels shall be dead front safety type.
3. All panelboards shall be completely factory assembled with molded case circuit breakers.
4. Panels shall have main breaker or main lugs, bus size, voltage, phase, and flush or surface mounting all as scheduled on the drawings. Panelboards to be used as service equipment shall be listed for such use.
5. Panelboards shall have the following features:
 - a. Non-reduced size copper or aluminum bus bars and connection straps bolted together and rigidly supported on molded insulators. Bus bar taps shall be arranged for sequence phasing of branch circuit devices.
 - b. Full size neutral bar mounted on insulated supports.
 - c. Ground bar with sufficient terminals for all grounding wires. The ground bar shall be insulated and isolated where called for on the drawings.
 - d. Buses braced for the available short-circuit current, but not less than scheduled and never less than 10,000 amperes symmetrical. All panelboards shall be fully rated. Series rated assemblies are not acceptable.
 - e. All breakers arranged so that it will be possible to substitute a two-pole breaker for two single pole breakers or a three-pole breaker for three single pole breakers when frame size is 100 amperes or less.

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UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- f. Design interior so that protective devices can be replaced without removing adjacent units, main bus connectors and without drilling or tapping.
- g. Where designated, on panel schedule as "space", include all necessary bussing, device supports and connections. Provide blank cover for each space.
- h. Provide galvanized steel cabinets to house panelboards. Cabinets for panelboards may be factory primed and suitably treated with a corrosion-resisting paint finish meeting UL standard for outdoor applications.
- i. Back and sides shall be of one-piece formed steel. Cabinets for panelboards may be of formed sheet steel with end and side panels welded, riveted or bolted as required.
- j. Provide minimum of four interior mounted studs and necessary hardware for in and out adjustment of panel interior.
- k. Fabricate trim of sheet steel consisting of frame with door attached by concealed hinges. Provide flush or surface trim as shown on the drawings.
- l. Surface trim shall have the same width and height as the box.
- m. Provide doors with flush type latch and manufacturer's standard lock.
- n. In making switching devices accessible, doors shall not uncover any live parts.
- o. Provide concealed butt hinges welded to the doors and trims.
- p. Provide keyed alike system for all panelboards.
- q. Provide a directory card, metal holder, and transparent cover. Permanently mount holders on inside of doors.

- r. Circuit breakers in panelboards shall be bolt on type on phase bus bar or branch circuit bar. Molded case circuit breakers shall have automatic, trip free, non-adjustable, inverse time, and instantaneous magnetic trips

P. Transient Voltage Surge Suppressors (TVSS):

- 1. Provide factory installed integral TVSS in panels where scheduled, listed in the specifications or indicated on the drawings. Field installed units shall not be acceptable.
- 2. UL Listed, UL1449.
- 3. Noise: less than 45 dBA at 5 feet.
- 4. 3 phase, 4 wire plus ground.
- 5. Dedication Modes:
 - a. Line to ground (L-G)
 - b. Line to Line (L-L)
 - c. Neutral to Ground (N-G)
 - d. Line to Neutral (L-N)
- 6. Category C with 8 x 20 microsecond waveform.
- 7. Joule rating shall meet or exceed ANSI/IEEE C62.41.
- 8. 5 year warranty from shipping data against part failure.
- 9. Quality Assurance
 - a. The specified system shall be thoroughly factory tested before shipment. Testing of each system shall include, but shall not be limited to, quality control checks, "Hi-Pot" tests at two times rated voltage plus 1000 volts per UL requirements, IEEE

C62.41 Category B surge tests, UL ground leakage test, and operational and calibration tests.

- b. The product shall be life cycle tested following suggested wait times as defined by ANSI/IEEE C62.45 and shall be capable of surviving 1000 sequential Category B surges of 10,000 Amps without failure.
- c. The TVSS shall be provided with computer-generated graphs or oscillograms demonstrating the TVSS clamping voltage and operability. This test shall follow procedures outlined in ANSI/IEEE C62.45 for the installation category and applicable protection modes of the TVSS

Q. Grounding Conductors:

1. Grounding conductors shall be soft-drawn bare copper.
2. Insulated grounding wires shall be UL and NEC approved types, copper, with THWN or XHHW insulation color identified green, except where otherwise shown on the drawings or specified.
3. Wire shall not be less than shown on the drawings and not less than required by the NEC.

R. Ground Clamps:

1. Ground clamps shall be cast bronze or cast copper and shall be UL listed for grounding connections.
2. Ground clamps shall be sized for the specific conductor and electrode to be clamped.

S. Equipment Grounding Connections: Connections shall be of the compression type solderless connectors.

T. Fire Alarm System Components:

1. Fire alarm system components shall be compatible and listed for use with the existing fire alarm system, and shall match existing similar devices or be the system manufacturer's current recommended replacement for existing similar devices.
2. Fire Alarm Control Panel: Provide all necessary common components, power supply, battery charger, batteries, programming, etc. as required to support the addition of components provided under this section for completion of a totally operational fire alarm panel and its respective remote annunciator when existing.
3. Intelligent Duct Smoke Detector:
 - a. The duct smoke detector housing shall accommodate an intelligent ionization detector that provides continuous analog monitoring and alarm verification from the panel.
 - b. When sufficient smoke is sensed, an alarm signal is initiated at the FACP, and appropriate action taken to change over air handling systems to help prevent the rapid distribution of toxic smoke and fire gases throughout the areas served by the duct system.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- c. Provide sampling tubes as required by the ductwork.
 - d. Provide remote test/indicator stations where indicated. Provide engraved nameplate with HVAC unit designation for each station.
 - e. The detector shall use the photoelectric principal to sense products-of-combustion and report the measured level of such products to the control panel
4. Provide addressable modules as required to monitor and control non-addressable devices such as solenoid valves, water flow switches, etc. indicated on the drawings and where required to provide a complete and operational system in accordance with the intent of the drawings and specifications. All shall be monitored separately.
 5. Sprinkler and Standpipe Valve Supervisory Switches:
 - a. Valve supervisory switches shall be furnished and installed under Div. 21 and wired and connected under this section.
 6. Conduit and Wire:
 - a. Wiring shall be in accordance with NEC Article 760, as shown on the drawings, and as recommended by the manufacturer of the fire alarm system. All wires shall be color-coded. Exposed wiring in unfinished areas shall be installed in metal conduit. Conduit fill shall not exceed 40 percent of interior cross-sectional area. Number and size of conductors shall be as recommended by the fire alarm system manufacturer. Conduit shall be 1/2" minimum. Type FPL cable shall be permitted where concealed and acceptable to the Authority Having Jurisdiction.
 - b. Wires in junction boxes and cabinets shall be permanently tagged and identified with tags.
 - c. Junction boxes shall have a volume 40 percent greater than required by the NEC. Minimum sized wire shall be considered as 14 AWG for calculation purposes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General:

1. All work shall be in accordance with the National Electrical Code's requirements as amended to date, with the local electric utility company's rules, the Fire Underwriter's requirements, and all local, state and federal laws and regulations.
2. In general, all wiring in finished areas shall be concealed in walls or above ceilings. Where wiring cannot be concealed due to existing construction, exposed wiring shall be installed in conduit or surface metal raceway as indicated on the drawings. Exposed wiring shall not be installed in finished areas without prior written authorization from the Engineer.
3. Conduits shall be of sizes required by the National Electrical Code. Exposed conduits shall be installed with runs parallel or perpendicular to walls and ceiling, with right-angle turns consisting of bends, fittings, or outlet boxes. No wire shall be installed until work that

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

might cause damage to wires or conduits has been completed. Conduits shall be thoroughly cleaned of water or other foreign matter before wire is installed.

4. Where conduits, wireways and other electrical raceways pass through fire partitions, fire walls, or floor, install a fire-stop that provides an effective barrier against the spread of fire, smoke and gases. Fire-stop material shall be packed tight and completely fill clearances between raceways and openings. Floor, exterior wall, and roof seals shall also be made watertight.
5. Where raceways puncture roof, coordinate with Division 07.
6. Raceway penetrations through roof and exterior walls shall be made with rigid metal conduit, intermediate metal conduit, or EMT with compression fittings.
7. All splices shall be mechanically and electrically perfect, using crimp type wire connectors.
8. Provide all disconnect switches required by the N.E.C.
9. Locate motor starters as shown on drawings.
10. Mount disconnect switches and starters at a height of 60" above finished floor unless otherwise noted.
11. Provide all necessary hardware for mounting motor starters.
12. Revise existing panelboard directories. Furnish new cards as needed. Directories shall be typewritten or printed using a computer.
13. Mount the distribution equipment so that maximum height of circuit breakers or operating handle above finished floor shall not exceed 78".
14. Circuit numbers indicated on the drawings are the actual numbers assigned to the circuit in the panelboard and shall not be varied without the consent of the Architect/Engineer.
15. Provide all necessary hardware for mounting distribution equipment.
16. Branch circuit wiring may be nonmetallic-sheathed cable where concealed and allowed by Code, Type NM. NOTE: All romex shall be Properly Supported. (Provide continuous ground wire.)
17. Feeder circuit wiring shall be in conduit or EMT.
18. All wiring in outside walls shall be in conduit or EMT.
19. All wiring in masonry walls shall be in conduit or EMT.
20. In general, conductors shall be the same size from the last protective device to the load and shall have an ampacity the same as or greater than the ampacity of the protective device where the wire size is not shown on the drawings. Use the 60°C ampacity rating for wire sizes No. 12 through No. 1. For 120V circuits, home runs longer than 100 feet shall be minimum No. 10 AWG, longer than 200 feet shall be minimum No. 8 AWG.

B. Fire Alarm System Installation:

1. Installation shall be in accordance with the NEC Article 760, and the Americans with Disabilities Act and as shown on the drawings.
2. Installation shall be as shown on the drawings and on the manufacturer's wiring diagrams, and shall be performed under the supervision of a factory-trained representative.
3. All wiring shall be one wire per terminal to insure supervision. Crimp-on connectors shall not be used.
4. All wiring shall be color-coded and tagged and shall be checked for continuity, short circuiting, and resistance to ground.
5. All fire alarm wiring shall be installed in raceways.
6. A factory-trained technician shall be present during testing and final inspection and shall instruct the Owner in system operation.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

7. Splices and taps: Use numbered terminal strips in junction, pull, and outlet boxes; cabinets; or equipment enclosures where circuit connections are made.
8. Mounting Heights:
 - a. Manual Stations: 48" AFF
 - b. Visual Units: 80" above the highest floor level within the space or 6 in (152 mm) below the ceiling, whichever is lower.
9. Tests:
 - a. Provide the service of a competent, factory-trained engineer or technician authorized by the manufacturer of the fire alarm equipment to technically supervise and participate during all of the adjustments and tests for the system. Make all adjustments and tests in the presence of the Owner's Representative.
 - b. When the systems have been completed and prior to the final inspection, furnish testing equipment and perform the following tests in the presence of the Owner's Representative.
 - 1) Before energizing the cables and wires, check for correct connections and test for short circuits, ground faults, continuity, and insulation.
 - 2) Test the insulation on all installed cable and wiring by standard methods as recommended by the equipment manufacturer.
 - 3) Open fire alarm detector circuits to see if trouble signal actuates.
 - 4) Check installation, supervision, operation and sensitivity of smoke detectors as recommended by the manufacturer to ascertain that they will avoid false alarm signals and will function as specified.
 - 5) Perform any other tests recommended by the equipment manufacturer.
10. Final Inspection: At the final inspection a factory-trained representative of the manufacturer of the existing equipment shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Architect/Engineer

C. Grounding:

1. The entire electrical system shall be permanently and effectively grounded in accordance with Code requirements.
2. Connections to junction boxes, equipment frames, etc., shall be bolted.
3. Conduit Systems:
 - a. Ground all metallic conduit systems.
 - b. Conduit systems shall contain a grounding conductor sized per NEC Table 250-122 or as shown on the drawings. Increase conduit size where necessary to accommodate the grounding conductor.
4. Feeders and Branch Circuits: Install green grounding conductors with all feeders and branch circuits.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

5. Lighting Fixtures: Conduits shall not be used for grounding fixtures. Green equipment grounding conductor must be bonded to all fixtures.

D. Alterations:

1. The Contractor shall study all drawings and specifications, visit the site, and acquaint himself with the existing conditions and the requirements of the plans and specifications. No claim will be recognized for extra compensation due to the failure of the Contractor to familiarize himself with the conditions and extent of the proposed work.
2. The Contractor shall execute all alterations, additions, removals, relocations or new work, etc., as indicated or required to provide a complete installation in accordance with the intent of the drawing and specifications.
3. Reconnect existing circuits to remain. Remove existing equipment to be discontinued.
4. Any existing work disturbed or damaged by the alterations or new work shall be repaired or replaced to the Engineer's satisfaction.
5. Equipment relocated or removed and reinstalled shall be cleaned and repaired to a first-class condition before reinstallation.

- E. Continuity of Services: Arrange to execute work at such times and in such locations to provide uninterrupted service to the building or any of its sections. If necessary, temporary power shall be installed to provide for this condition. Authorization for interrupting service shall be obtained in writing from the Owner. Any interruption of normal supply shall be performed during an overtime period to be scheduled with the Owner. Cost for overtime work shall be included in the bid.

F. Identification:

1. Provide tags on each end of all pulled wires giving location of other end.
2. Provide phenolic nameplates for all panelboards, motor starters, disconnect switches (except switches located at motors), and duct smoke detector remote test/alarm-indicating stations.
3. Label each receptacle faceplate using machine-printed thermal adhesive labels to indicate source panel and branch circuit. For receptacles connected to normal power, labels shall be white with black letters. For receptacles connected to circuits from operational standby (OS) panels, labels shall be red with white letters.
4. Arc-Flash Warning Labels:
 - a. Produce a 3.5-by-5-inch thermal transfer label of high-adhesion polyester for each work location included in the analysis.
 - b. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1) Location designation.
 - 2) Nominal voltage.
 - 3) Flash protection boundary.
 - 4) Hazard risk category.
 - 5) Incident energy.

CHILLER REPLACEMENT
BARROWS HALL
UNIVERSITY OF MAINE
ISSUED FOR CONSTRUCTION

- 6) Working distance.
 - 7) Engineering report number, revision number, and issue date.
 - 8) Labels shall be machine printed, with no field-applied markings.
- c. Apply one arc-flash label for 480-V ac, and 208-V ac panelboards and disconnects and for each of the following locations:
- 1) Motor-control center.
 - 2) Low-voltage switchboard.
 - 3) Switchgear.
 - 4) Medium-voltage switch.
 - 5) Control panel
- G. Record Drawings: The Contractor shall keep on the job a set of prints showing any changes to the installation. These shall be given to the Engineer at the completion of the work.
- H. Testing and Adjusting:
1. The entire installation shall be free from short-circuits and improper grounds. Tests shall be made in the presence of the Engineer or his representatives.
 2. Each individual branch circuit shall be tested at the panel; and in testing for insulation resistance to ground, the equipment shall be connected for proper operation. In no case shall the insulation resistance be less than that required by the National Electrical Code. Failures shall be corrected in a manner satisfactory to the Architect/Engineer.
 3. Each system shall be completely tested and shall be adjusted for proper operation as required by the Engineer.
 4. Final Inspection: At the final inspection, a factory-trained representative of the manufacturer of the major equipment shall demonstrate that the systems function properly in every respect. The demonstration shall be made in the presence of the Owner's Representative.

END OF SECTION 261000