

**CRESCENT HEIGHTS**

**ADDENDUM #1**

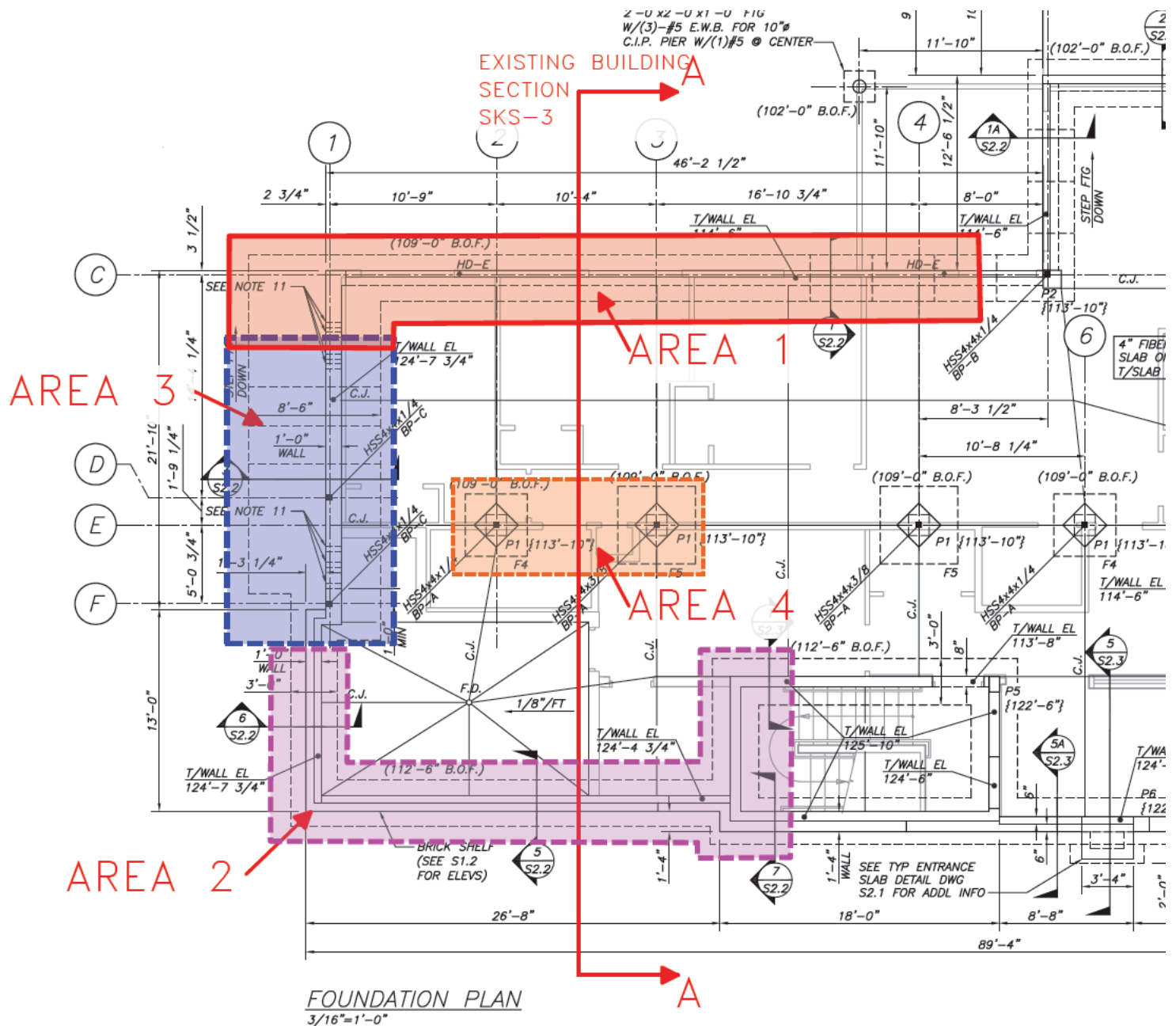
April 22, 2009

*The following items hereby amend and supersede the plans and specifications dated April 2, 2009 for the above referenced project.*

<i>Specification Section</i>	<i>Title</i>	<i>Description</i>	
1- 1	011000	Summary	Note that the project is not tax exempt.
1- 2	011000	Summary	Note that the Contractor shall verify the need for an FAA permit for a crane on the site due to the proximity of the MMC heliport.
1- 3	011000	Summary	Crescent Street is under moratorium by the city, and cannot be opened for utilities without the Contractor paying a Resurfacing Impact Fee. Todd Merkle at the City is a contact person for determining this.
1- 4	011000	Summary	Wescott Street and the portion of Crescent Street west of the intersection are the principal ambulance and fire truck access to the emergency department and Bean Wing of Maine Medical Center. These streets must be kept open for their full width 24 hours per day, 7 days per week. No traffic to the project shall back out into the street without being supervised by a flag man. The street shall be continuously kept clean, and sprayed to minimize dust.
1- 5	012100	Allowances	Add Item 3.3.A: Allowance #1 Utility Service Charge. See 260000 Item 1.13.A for this allowance to be carried for work by Central Maine Power Company.
1- 6	023200	GeoTech	Item 4.2 - Two options are discussed. Excavation of unsuitable material option is implemented by the design. Excavation to the footing depths shown on the foundation plan will remove the unsuitable soil to the approximate depth for bearing. GeoPier system option is not included in the work.
1- 7	055000	Metal Fab	Section is attached.
1- 8	055100	Metal Stairs	Section is attached.
1- 9	055213	Pipe Rails	Section is attached.
1- 10	061000	Rough Carpentry	Item 1.04.G: Note that if panelized construction is chosen by the Contractor, then the dimensions on the shop drawings of all panels shall be certified by the General Contractor. The shop drawing review by the Architect shall be for conformance with the design concept only. Panel shop drawings shall show dimensions of all panels. Panel shop drawings which have not been stamped by the General Contractor as "Dimensions Approved," will be returned without review. No extensions of time or additional cost shall be allowed as a result of the quality control process for panels.

1- 11	061000	Rough Carpentry	Item 3.01.D: Panels which do not meet criteria of structural and dimensional requirements shall be returned to the panel plant and not used. The 1/4" tolerance given in 3.04.A shall apply to all panels, and also shall apply to continuous runs of panels for their overall dimension.
1- 12	096519	VCT	Item 2.2.F: The Architect shall select up to 4 colors maximum. Laundry, Room G05 shall be a checkerboard of two of these.
1- 13	096816	Carpeting	Item 2.1.A - For apartment stretch-in carpet delete "Revive Ecoworx 60679." Add therefore "Gradient 5A513 Eco Solution Q by Shaw Contract Group."
1- 14	096816	Carpeting	Item 2.1.A - For corridor glue-down carpet delete "Pebble 60687." Add therefore "Tone 5A152 Eco Solution Q by Shaw Contract Group."
1- 15	096816	Carpeting	Item 2.2.A - For carpet cushion delete bonded polyurethane foam. Add therefore 27 ounce synthetic hair and jute.
1- 16	101400	Signs	Item 3.3.A - At Corridors delete "one for each entry." Add therefore "one for each suite entrance." Individual bedroom doors shall not have signs.
1- 17	104413	F E Cabinets	Item 2.2.B.1: Delete "1037F17."
1- 18	104413	F E Cabinets	Item 2.2.B.3: Delete "7062-A-2."
1- 19	104413	F E Cabinets	Item 2.2.B.3: Delete "SS 2409-6R." See attached sketches for the Larsen model which shall be the design standard and the locations for the fire extinguishers.
1- 20	104416	Fire Extinguishers	Item 2.1.B: Delete "UL rated 4A:60B:C, 10 lb nominal capacity." Add therefore "UL rated 3A:40B:C, 5 lb nominal capacity."
1- 21	230000	Mechanical	Section is attached.
1- 22	TOC	Part B	A bid bond is required. See Part B.
1- 23	TOC	Part B	At Part B change title to read "CONTRACT FORMS - INCORPORATED BY REFERENCE"
1- 24	TOC	Part C	At Part C change "AIA A201" to read "AIA A201 1997 EDITION - INCORPORATED BY REFERENCE"
1- 25	TOC	Part C	Supplemental General Conditions are attached.

	<i>Drawing</i>	<i>Title</i>	<i>Description</i>
1- 26	A 10.1	Windows	Window Schedule: At Window Type E delete the fiberglass IFSPD90610 9 foot wide three panel slider. Add therefore fiberglass/ wood 8 foot wide two panel french slider ISFD8068.
1- 27	A 12.1	Finish Schedule	At Laundry Room G05 delete VCT-SR. Add therefore VCT in checkerboard pattern. At abbreviations legend, delete VCT-SR.
1- 28	C 5	MMC Retaining Wall Tiebacks	Due to the proximity of the tiebacks to the bottom of the footings, the attached sketches, SK 1, outline a phased excavation and foundation construction sequence which will minimize the un-loading of the existing tiebacks. The bottom of the footing in the northwest corner of the building is estimated to be only one to two feet above the tie back. Similar conditions exist elsewhere. The Contractor shall take precautions to locate the tiebacks and monitor the condition of the existing MMC retaining wall.
1- 29	S 1.0	General Notes	The citation for design per IBC 2003 is correct. (For Structural only.)
1- 30	S 1.1	Foundation Plan	Add piers along north foundation wall. See attached sketches.
1- 31	S 1.1	Foundation Plan	Sheet S1.1 - Callout on foundation plan along grid line 1 should be changed from "SEE NOTE 10" to read "SEE NOTE 11" in (2) locations.



**CONSTRUCTION MONITORING PROTOCOL:**

The Owner shall install Deflection Monitoring Points (DMPs) at the top of the shotcrete wall above Soldier Piles #27, 29, 31 and 33 prior to starting excavation of the site. The Contractor may install additional DMPs along the length of the existing shotcrete wall at their discretion. The Contractor shall continuously monitor the movement of these DMPs during the excavation of Areas 1 to 4.

If the lateral movement of any DMP exceeds 0.5 in. the Contractor shall stop excavating immediately. The contractor must contact the Engineer of Record and Simpson, Gumpertz and Heger immediately for review before proceeding with the excavation.

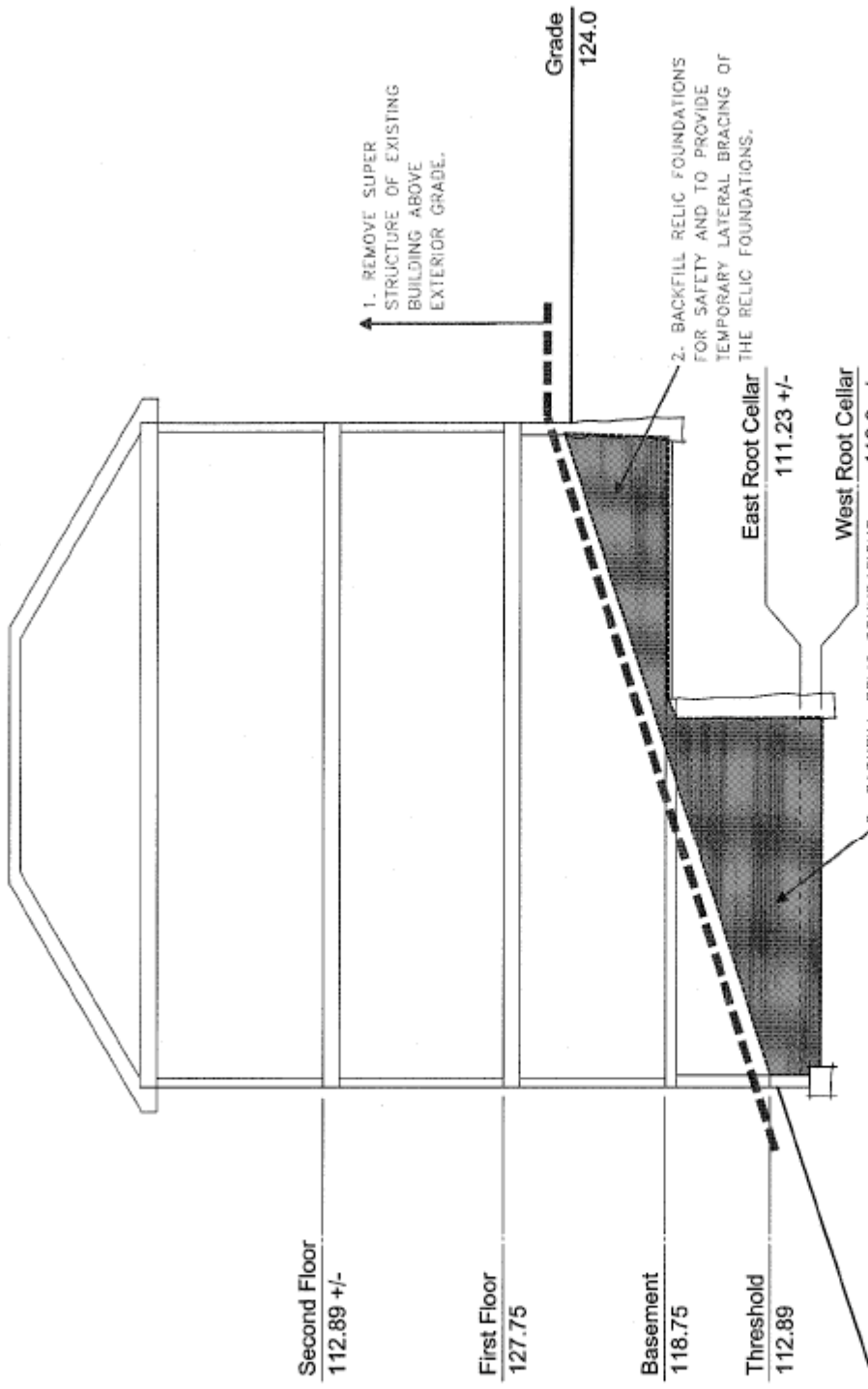
**NOTE:**

PROVIDE TEMPORARY BACKFILL AS DESCRIBED IN PHASING NARRATIVE.

PROVIDE SHORING AND BRACING FOR FOUNDATION WALLS WITH UNBALANCED BACKFILL OF 6' OR GREATER.

FOLLOWING COMPLETION OF FIRST FLOOR FRAMING, REMOVE BACKFILL AND PROVIDE WORK FOR FOOTING DRAINS AND FOUNDATION WATERPROOFING.

- PHASE #1** Area 1
- a. Excavate the minimum amount of soil required to demolish and remove the existing footing and foundation wall in Area 1. The excavation contractor shall be responsible for the means and methods of providing a safe excavation.
  - b. Do not over-excavate. The existing post-tensioned tiebacks (#32 and #33) may be as close as 1 to 2 ft. below the bottom of the new footing.
  - c. Remove the existing foundation wall and footing in Area 1.
  - d. Construct the new footing and foundation wall in Area 1 per the contract documents (see drawings by others).
  - e. Backfill the new foundation wall evenly on both sides until the soil is at the final proposed elevation on the interior and exterior of the wall. The Engineer of Record (EOR) shall verify that the wall design can resist any unbalanced lateral soil loads.
- PHASE #2** Area 2
- a. Excavate the minimum amount of soil required to demolish and remove the existing footing and foundation wall in Area 2.
  - b. Do not over-excavate. Existing post-tensioned tiebacks (#28 and #29) may be as close as 4 to 5 ft. below the bottom of the new footing.
  - c. Remove the existing foundation wall and footing in Area 2.
  - d. Construct the new footing and foundation wall in Area 2 per the contract documents (see drawings by others).
  - e. Backfill the new foundation wall to the final proposed backfill elevation on the interior and exterior of wall. The new foundation wall shall be temporarily braced to resist lateral soil pressures, or the EOR shall verify that the wall design can resist any unbalanced lateral soil loads.
- PHASE #3** Area 3
- a. Excavate the minimum amount of soil required to demolish and remove the existing footing and foundation wall in Area 3.
  - b. Do not over-excavate. Existing post-tensioned tiebacks (#30 and #31) may be as close as 2 to 3 ft. below the bottom of the new footing.
  - c. Remove the existing foundation wall and footing in Area 3.
  - d. Construct the new footing and foundation wall per the contract documents (see drawings by others).
  - e. Backfill the new foundation wall to the final proposed backfill elevation on the interior and exterior of the wall. The new foundation wall shall be temporarily braced to resist lateral soil pressures, or the EOR shall verify that the wall design can resist any unbalanced lateral soil loads.
- PHASE #4** Remove the remaining existing interior foundation walls and any excess soil from the interior area.
- PHASE #5** Area 4
- a. Excavate the minimum amount of soil required to construct the new column footings in Area 4.
  - b. Do not over-excavate. Existing post-tensioned tiebacks (#30 and #31) may be as close as 3 to 4 ft. below the bottom of the new footing.
  - c. Construct the new column footings.
  - d. Backfill around the new column footings to the final proposed backfill elevation.
- PHASE #6** Construct the new diaphragm at the top of the new foundation walls to provide lateral bracing for these walls, as necessary, to resist unbalanced lateral soil loads.
- PHASE #7** Remove any remaining excess soil from the interior of the building footprint. Cast the new concrete slab-on-grade.



**NOTE:**

THE FILLS SHOWN ON THIS SKETCH WILL BE PROVIDED BY THE OWNER UNDER SEPARATE CONTRACT PRIOR TO THE START OF CONSTRUCTION.

SKS-3  
 SECTION A-A THROUGH (E) BUILDING  
 SGH MARKUP  
 31 MARCH 2009  
 (REVISED 16 APRIL 2009)  
 Crescent Heights

1" = 10' - 0"

29 Crescent St. Building Section

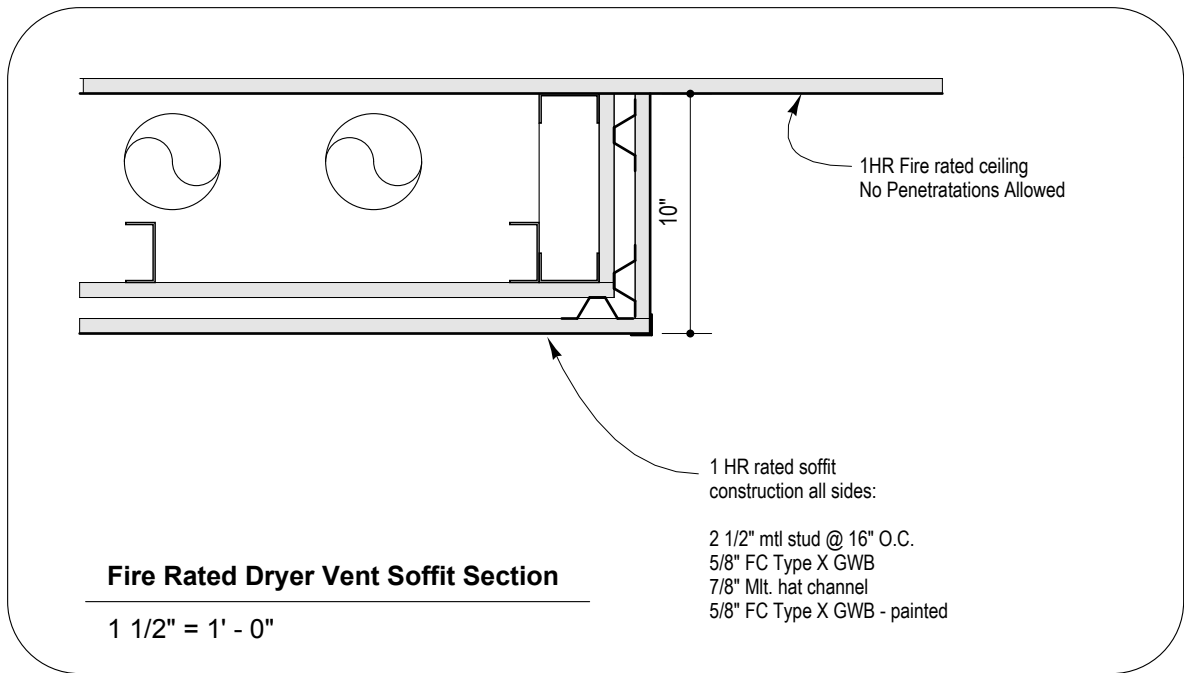
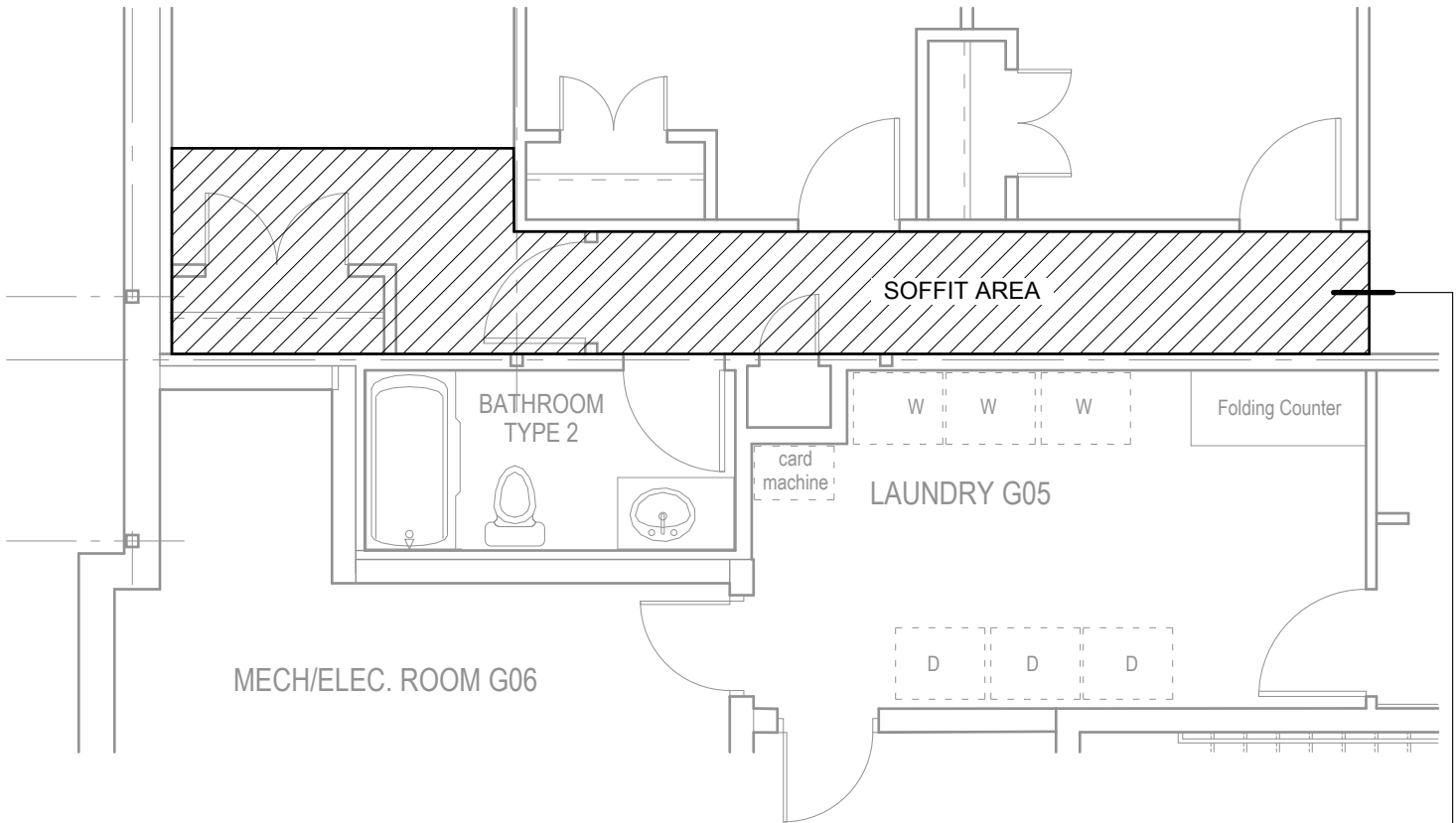
Winton Scott Architects

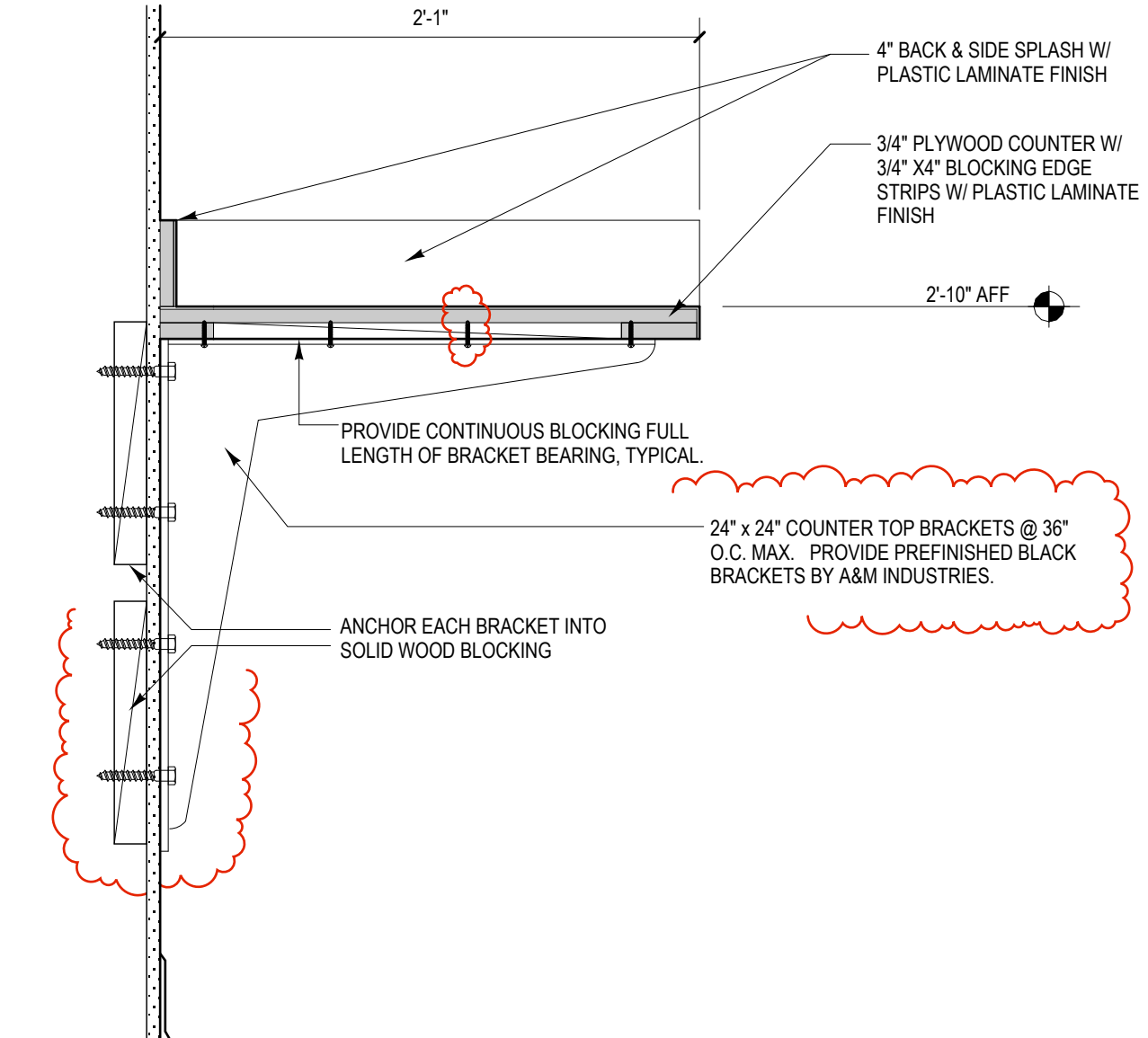
5 Milk Street Portland, Maine 04101

2008

**Fire Rated Dryer Vent Soffit Plan**

3/16" = 1' - 0"

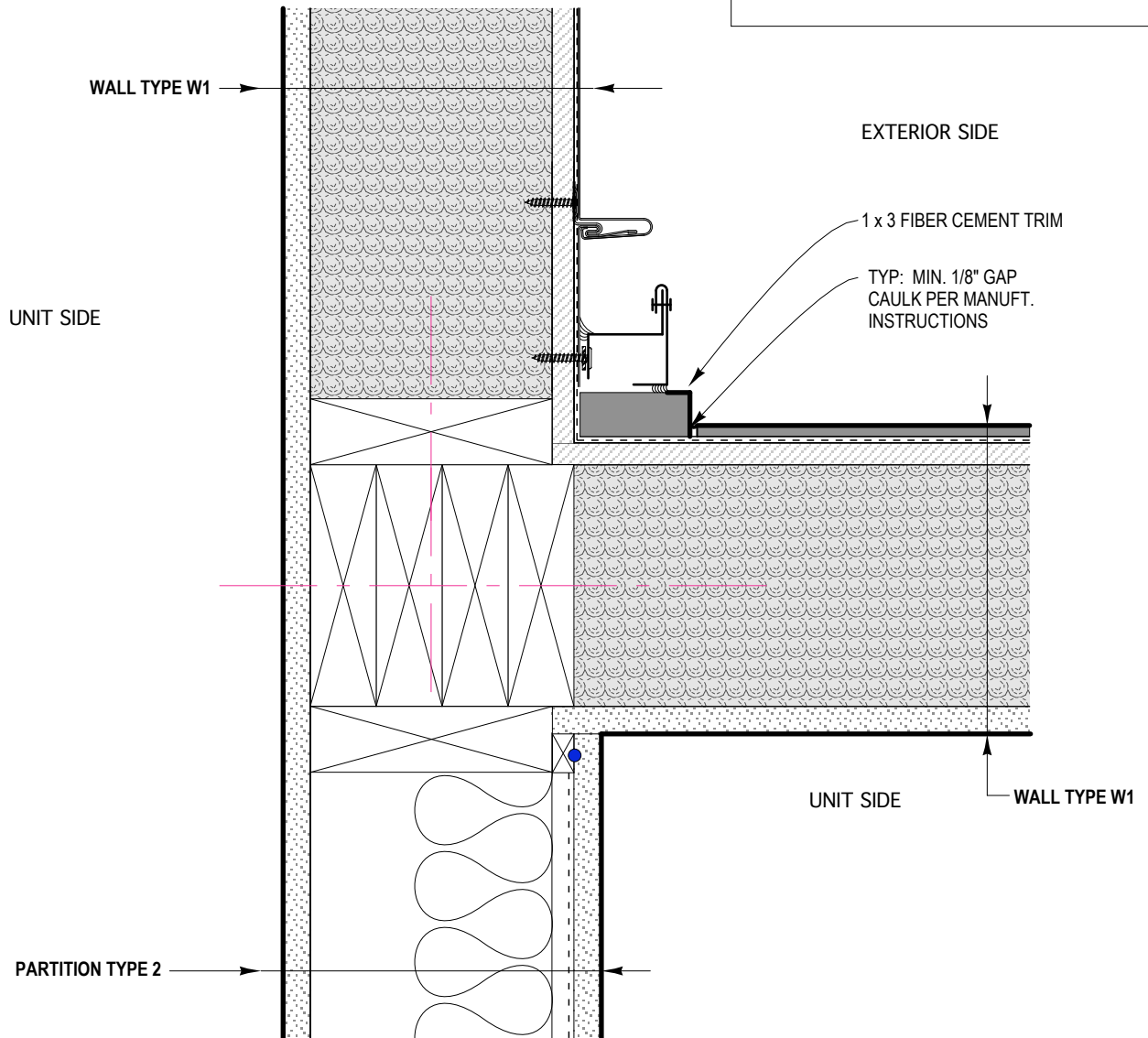




**6** **LAUNDRY COUNTERTOP DETAIL**  
SCALE: 1 1/2" = 1'-0"  
**REF DTL 6 / A 12.2**

REFER TO:

DETAIL 1/A5.1 FOR USE AT INSIDE  
CORNERS  
BETWEEN FIBER CEMENT SIDING AND  
METAL SIDING

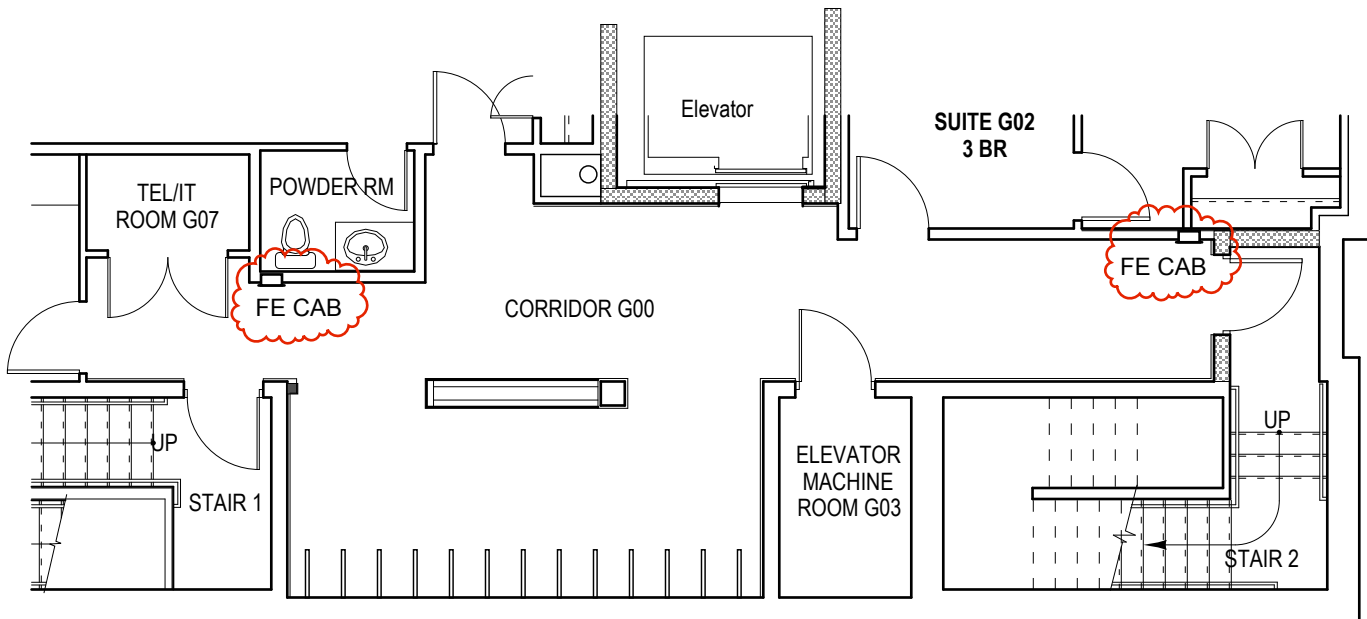


## TYPICAL SECTION OF DEMISING PARTITION TO EXTERIOR WALL

1

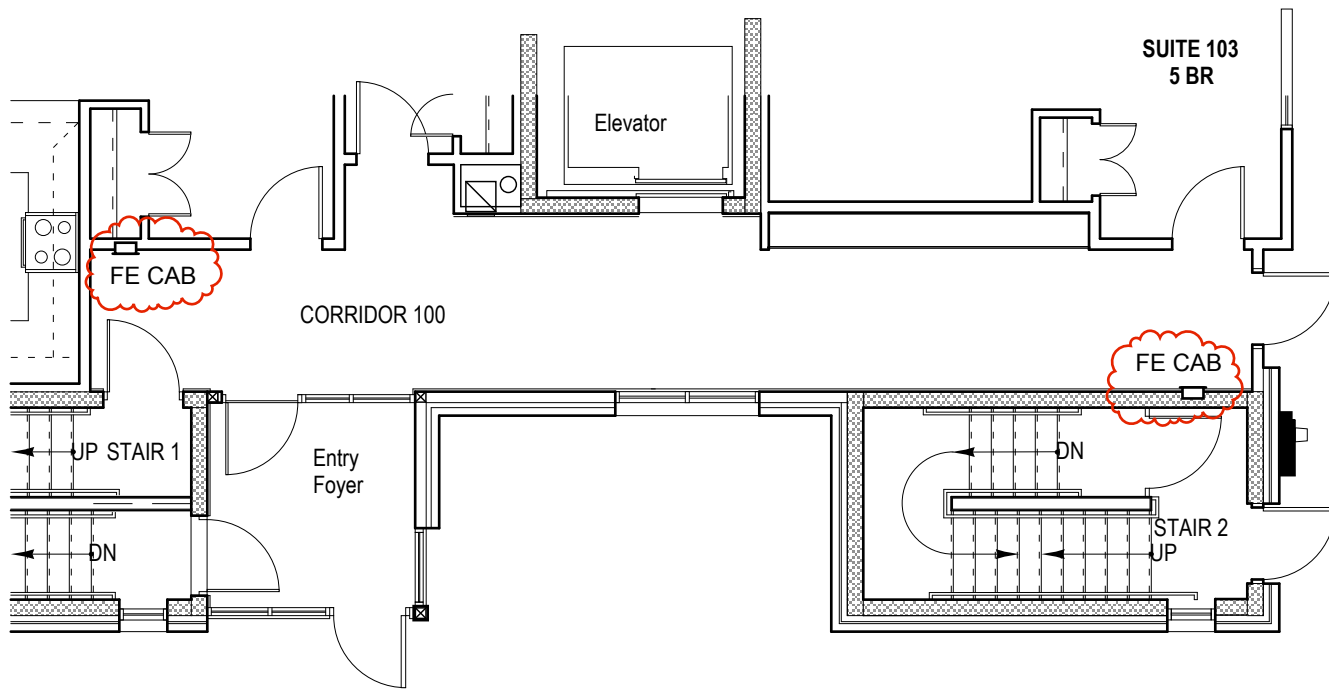
3" = 1'-0"





**GROUND FLOOR**

1/8" = 1' - 0"



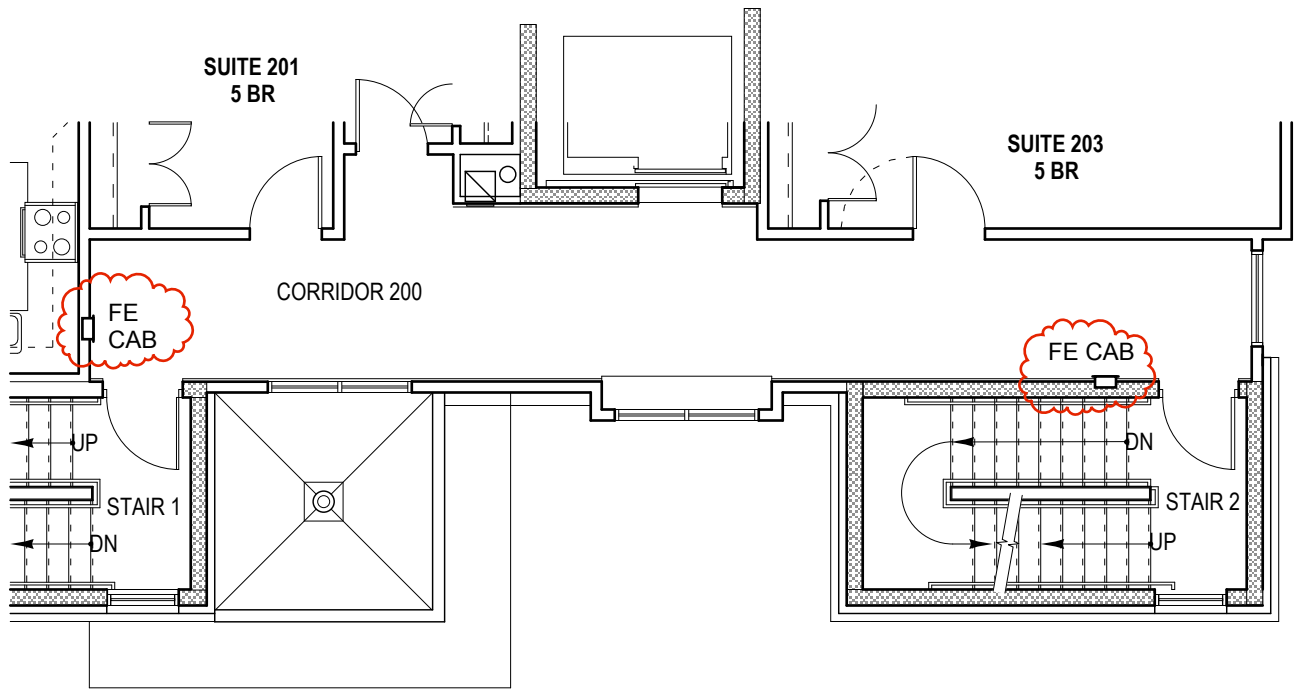
**FIRST FLOOR**

1/8" = 1' - 0"

**FIRE EXTINGUISHERS & CABS**

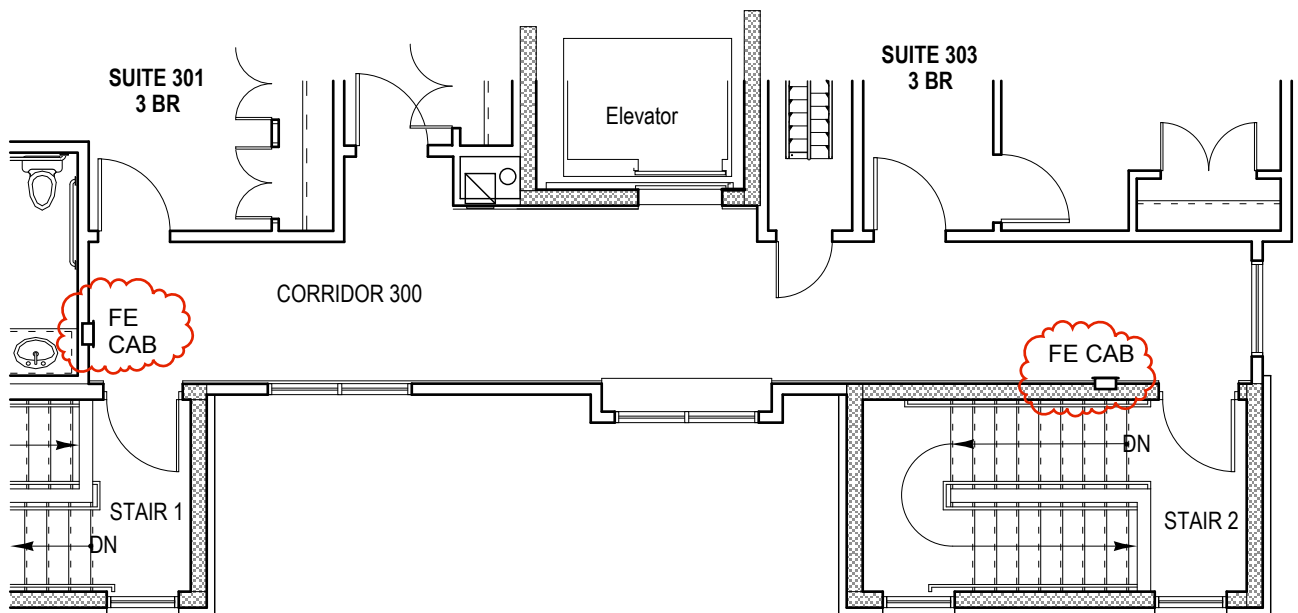
(Based on Larsen's)

- 5 LB 3A - 40B:C Dry Chemical Extinguisher
- FS SS 2409-R1 Fully Recessed Cabinet  
(26 1/8" H x 11 5/8" W x 6 1/8" D R.O.)
- Flame Shield Fire Rated Cabinet
- Stainless Steel Trim with Full Glass Door



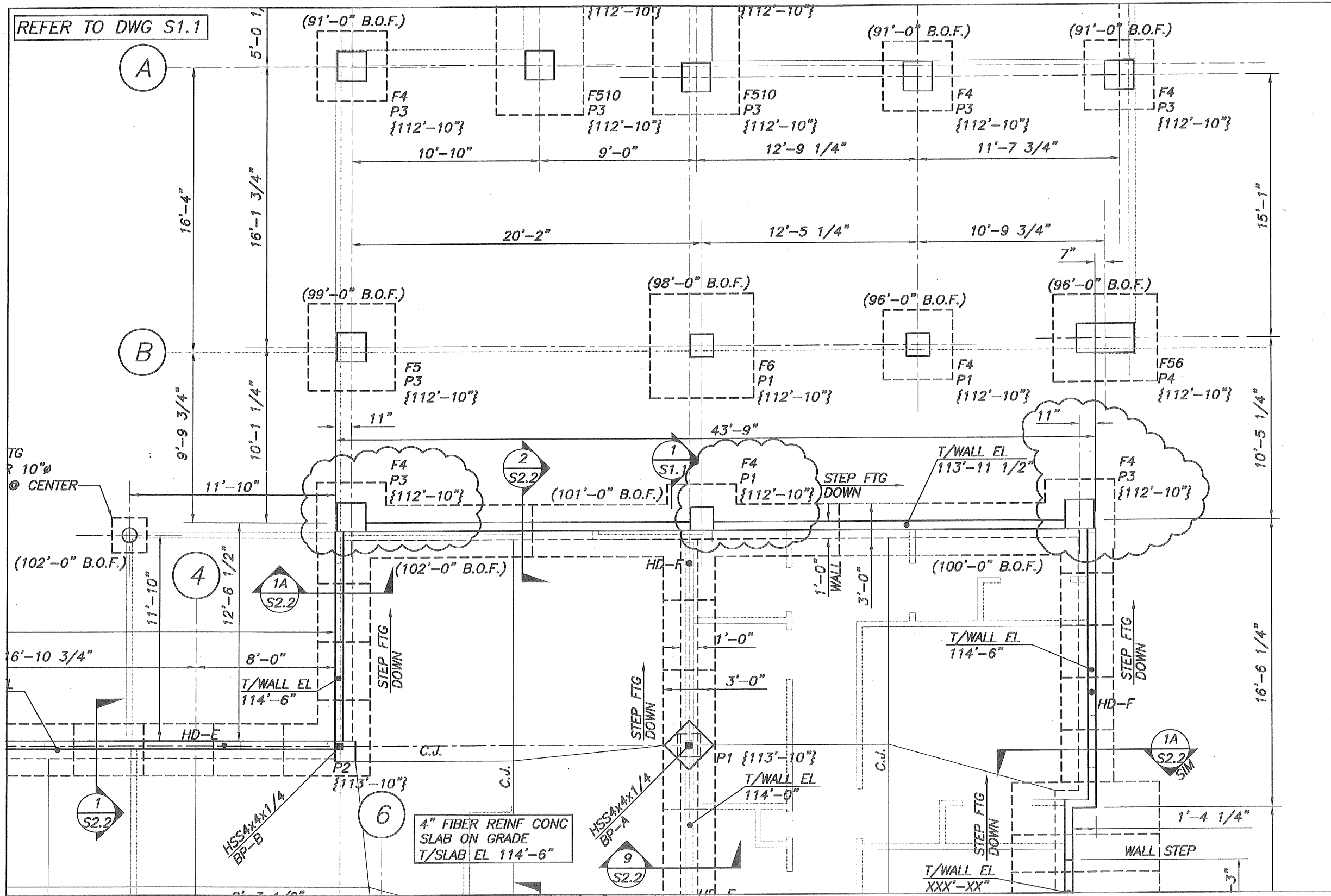
**SECOND FLOOR**

1/8" = 1' - 0"



**THIRD FLOOR**

1/8" = 1' - 0"



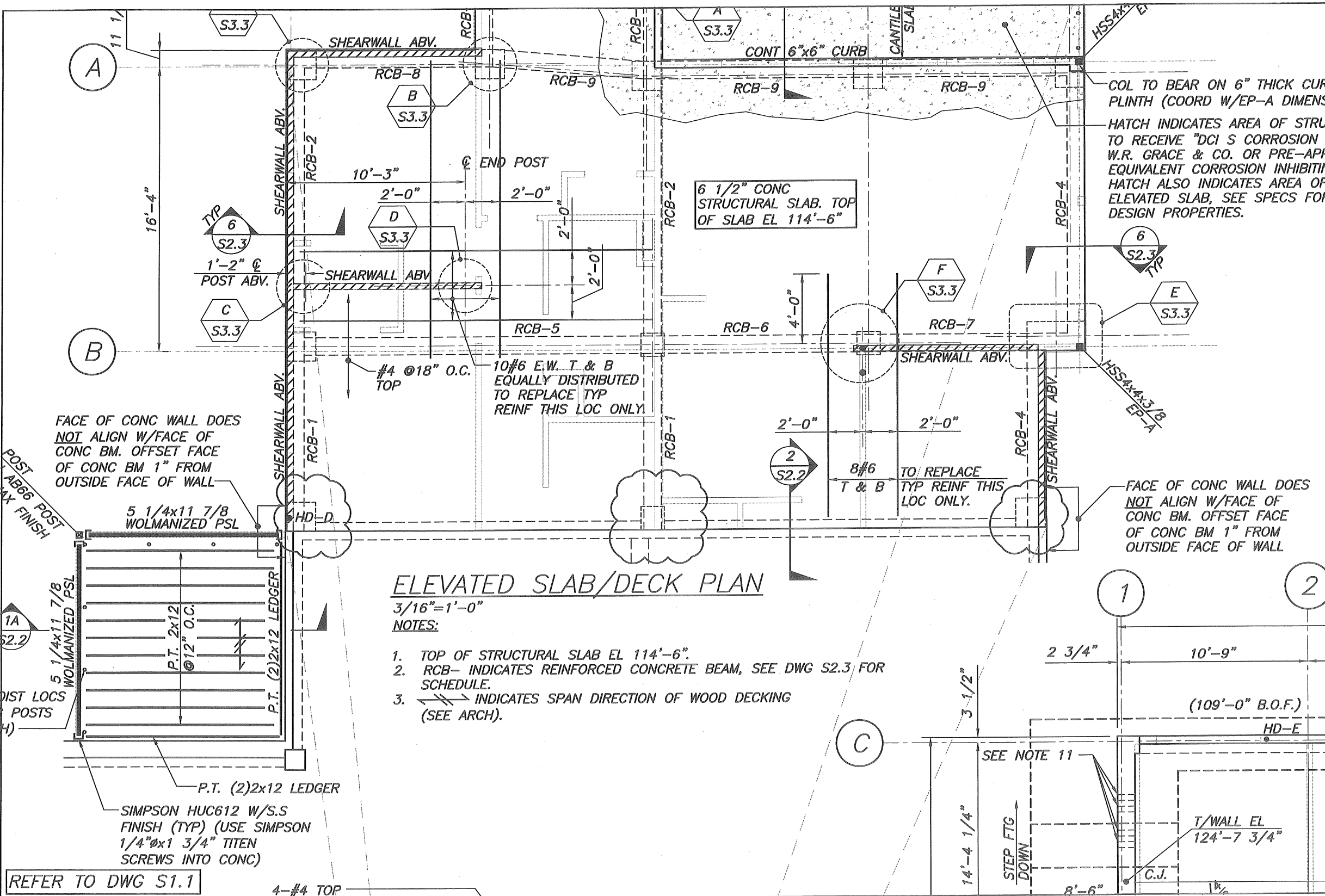
**BECKER**  
structural engineers, inc.

Tel 207-879-1838  
Fax 207-879-1822  
www.beckerstructural.com  
75 York Street  
Portland, ME 04101-4701  
info@beckerstructural.com

CRESCENT HEIGHTS  
PORTLAND, ME

Designed NRM	Scale NOTED
Drawn NRM	Date 4/20/09
Checked PBB	Becker Job Number 2035

SKS-1



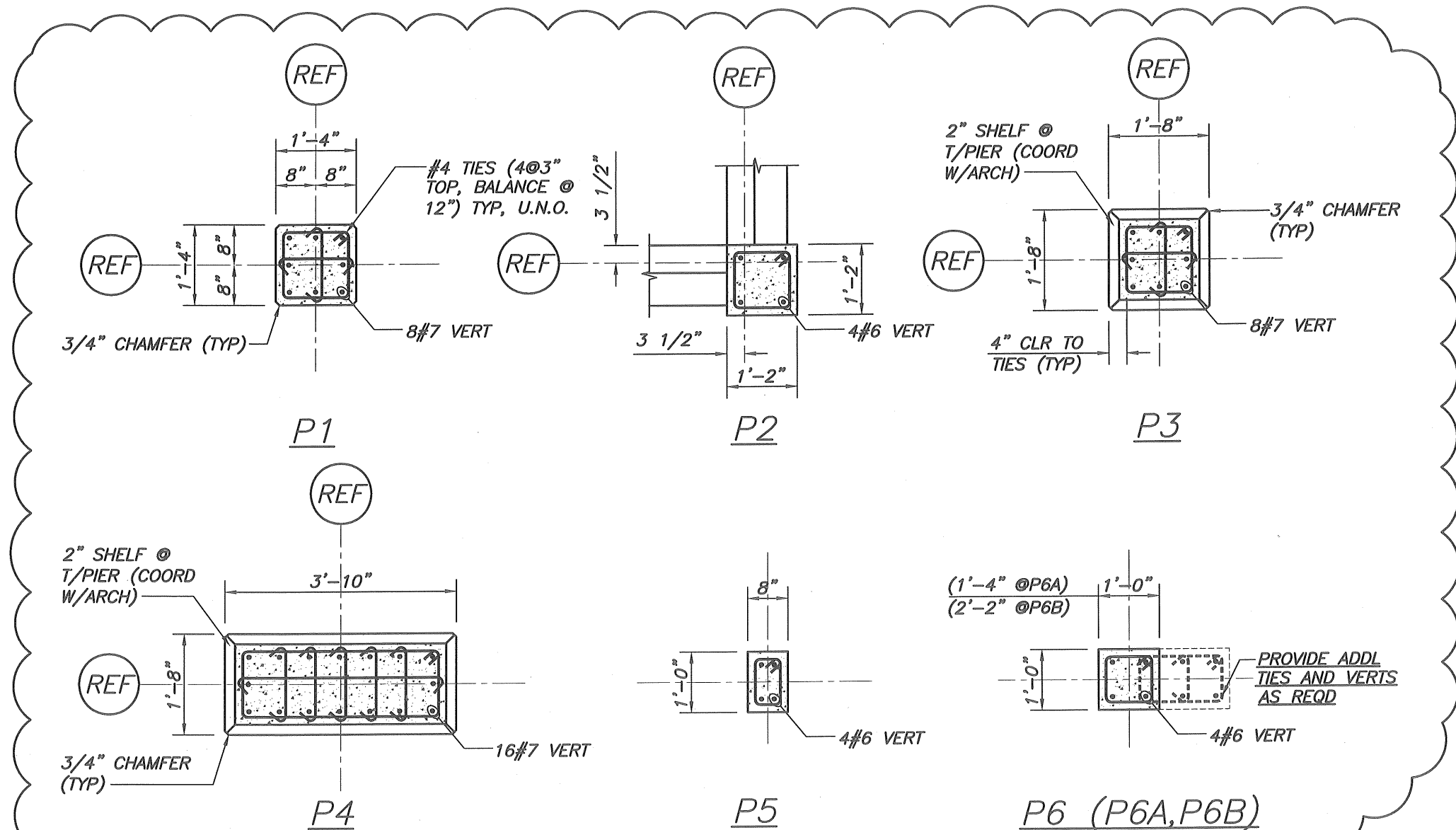
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CRESCENT HEIGHTS  
 PORTLAND, ME

Designed NRM	Scale NOTED
Drawn NRM	Date 4/20/09
Checked PBB	Becker Job Number 2035

SKS-2

REFER TO DWG S2.3



PIER DETAILS  
1/2"=1'-0"

**BECKER**  
structural engineers, inc.  
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Fax 207-879-1822  
www.beckerstructural.com  
75 York Street  
Portland, ME 04101-4701  
info@beckerstructural.com

CRESCENT HEIGHTS  
PORTLAND, ME

Designed <b>NRM</b>	Scale <b>NOTED</b>
Drawn <b>NRM</b>	Date <b>4/20/09</b>
Checked <b>PBB</b>	Becker Job Number <b>2035</b>

SKS-3



**NOTICE TO CONTRACTORS**

Sealed Proposals, in envelopes plainly marked, Proposal For:

**CRESCENT HEIGHTS**

Brief Job Description:

The Work involves the construction of the new Crescent Heights facility at location indicated on Drawings. Work includes, but is not limited to, selective site demolition, earthwork, site utilities and site improvements, paving, and landscaping. Work also includes concrete foundations and slab-on-grade, wood structure, wood trusses and decking, membrane roofing, sheet metal, masonry veneer, wood and metal stud partitions, insulation, gypsum board walls and ceilings, resilient flooring, carpeting, custom cabinets and fixtures, carpentry, painting, metal doors, wood doors, metal frames, door hardware, metal fabrications, toilet accessories, signage, fire alarm systems, security systems, electrical, and heating, ventilating, and air conditioning complete and ready for use.

Addressed to:           **Mr. Kevin Bunker**  
Developers Collaborative  
17 Chestnut St.  
Portland, ME 04101

Proposals will be received at the office of the **Developers Collaborative** located at **17 Chestnut Street, 2<sup>nd</sup> floor conference room**, at or before **2:00 P.M.** then prevailing time on **Tuesday, May 5, 2008**.

The Owner reserves the right to waive all formalities, and reject any and all Proposals or to accept any Proposal. Proposals shall be submitted upon the Form provided with the Specifications.

The Selected General Contractor will be required to furnish a 100% Contract Performance Bond and a 100% Contract Payment Bond to cover the execution of the Work which shall be in conformity with the Form of Bonds listed in the Table of Contents of the specifications and for the Contract Amount.

The Notice to Proceed is anticipated to be issued on or about **May 15, 2009**. This project shall be substantially complete on June 1, 2010.

Plans and specifications may be obtained on or about **April 6, 2009**. The procedure for obtaining documents is as follows:

The complete Bidding Documents, consisting of Instructions to Bidders, Bid Forms, General Conditions, Supplemental General Conditions, Contract Forms, Drawings, Specifications, and Addenda (if any), may be obtained from:

FMC Cadd  
75 Bishop Street  
Portland, ME 04103  
Tel: 878-8511  
Fax: 878-8515  
**Attn. Ruth Daigle**

Bidders may purchase Bid Document Full Sets ONLY for \$200.00 (non refundable), which will cover complete set of drawings, specifications, any addenda and any necessary shipping and handling. The

payment shall be by check or money order payable to **FMC Cadd**. Bidders picking up documents are advised to verify their availability beforehand.

Documents remain the property of the Architect and shall be returned on demand. Federal copyright law protects documents. Reproduction of documents without written authorization from the Architect or use of such documents for the preparation of bids subjects the bidder to having their bids disqualified.

PROJECT ARCHITECT: The Architect for this project and contact information is as follows:

**Winton Scott Architects, PA**  
5 Milk Street  
Portland, ME 04101

Project Manager: Mark Wilcox

T. (207) 774-4811 extension 2#  
F. (207) 774-3083  
E. mwilcox@wintonscott.com

PRE-BID CONFERENCE:

A General Contractor mandatory pre-bid conference will be held **at 10:00 AM on Monday, April 13, 2009, at Developers Collaborative, Second Floor Conference Room, 17 Chestnut Street, Portland, Maine.** A walk of the site will follow the meeting. The purpose of the conference will be to answer questions of prospective Bidders, and provide a walk through of the construction site area. Other interested subcontractors or suppliers are invited to attend.

INVITED BIDDERS: The following General Contractors have been invited to submit bids for this project:

- |  |  |
|--|--|
| <p><b>1. Benchmark</b><br/>34 Thomas Drive<br/>Westbrook, ME 04092<br/>Ph: 207-591-7600<br/>F: 207-591-7604<br/>Attn: Kevin Reilley</p>                                    | <p><b>2. H.L. Patten Construction</b><br/>P.O. Box 4050<br/>Kittery, ME 03904<br/>Ph: 207-439-2008<br/>F: 207-439-2068<br/>Attn: Brett Patten</p>        |
| <p><b>3. Hebert Construction Corporation</b><br/>9 Gould Road<br/>Lewiston, Maine 04240<br/>Ph: 207-783-2091<br/>F: 207-782-4938<br/>Attn: Daniel Hebert / Mike Hebert</p> | <p><b>4. Pizzagalli Construction</b><br/>131 Presumpscot St.<br/>Portland, ME 04103<br/>Ph: 207-874-2323<br/>F: 207-874-2727<br/>Attn: Kevin Freeman</p> |



**5. Portland Builders**  
85 York St. #3  
Portland, ME 04101  
Ph: 207-879-0118  
F: 207-772-8182  
Attn: Josh Cushman

**6. Wright-Ryan Construction**  
10 Danforth St.  
Portland, ME 04101  
Ph: 207-773-3625  
F: 207-773-5173  
Attn: Richard Bergeron

\*Plans and Specifications may be examined at:

FMC Planroom  
75 Bishop Street  
Portland, ME 04103

Dodge Corporation  
224 Gorham Road  
Scarborough, ME 04074

Associated Constructors of  
Maine, Inc.  
Whitten Road – P.O. Box 5519  
Augusta, ME 04332-5519

Dunlap Construction Service Bureau  
The Dunlap Agency  
31 Court Street, P O Box 40  
Auburn, ME 04210

By: Developers Collaborative

17 Chestnut Street  
Portland, ME 04101

END OF SECTION



## SUPPLEMENTAL GENERAL CONDITIONS

## GENERAL CONDITIONS:

- A. The "General Conditions of the Contract for Construction". Document A-201, Fifteenth Edition, dated 1997, as issued by the American Institute of Architects, 1735 New York Avenue, N.W., Washington, D.C. 20006; form the General Conditions for this Contract whether bound herein or not. The term "Contractor" as used herein shall have the same meaning as the term "General Contractor" as used in the Standard Form of Agreement Between Owner and General Contractor, AIA Document A-101, between the parties hereto.
- B. The provisions of the foregoing document shall apply to the work of this Contract, except as modified or supplemented hereinafter in the Supplemental Conditions. Where General Conditions Paragraphs or Subparagraphs are modified in part by the Supplemental Conditions, the portions of it, which have not been modified, shall remain in effect. In the event of discrepancy between the General and Supplemental Conditions, the Supplemental Conditions shall prevail.

## ARTICLE 1 - GENERAL PROVISIONS:

- A. Paragraph 1.1 Basic Definitions: Add the following to Subparagraph 1.1.1:
- .1 In the event of conflict or discrepancies among the Contract Documents, the Documents shall be construed according to the following priorities.
 

a.	Highest Priority	Modifications
b.	Second Priority	Agreement
c.	Third Priority	Addenda - later date to take precedence
d.	Fourth Priority	Special requirements of financing agency published in the Project Manual
e.	Fifth Priority	Supplemental General Conditions
f.	Sixth Priority	General Conditions
h.	Seventh Priority	Published Financing Requirements
j.	Eighth Priority	Division 1 of the Specifications
k.	Ninth Priority	Drawings and Div. 2-16 of the Specifications
  - .2 In the event of conflicts or discrepancies between the Drawings and Divisions 2-16 of the Specifications or within either document not clarified by Addendum, the Architect will determine which takes precedence in accordance with Section 4.2.11.

- .3 The Contract Documents executed in accordance with Section 1.5.1 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers.

- B. Paragraph 1.1 Basic Definitions: Add the following to Subparagraph 1.1.2:

Except for the special agreements in Paragraph 3.18, nothing contained in the Contract Documents shall be construed to create any contractual relationship of any kind between the Architect and the Contractor.

ARTICLE 2 - OWNER:

- A. Paragraph 2.2 Information And Services Required of The Owner: Delete subparagraph 2.2.5 and substitute the following:

The Contractor will be furnished free of charge one (1) set of drawings and project manual, complete with any Addenda. Additional sets will be furnished at the cost of reproductions, postage and handling.

- B. Paragraph 2.3.1 Delete "persistently" in line 2.

ARTICLE 3 - CONTRACTOR:

- A. Paragraph 3.2 Review of Contract Documents and Field Conditions by Contractor:

Add to the beginning of Subparagraph 3.2.1 before ".the Contractor shall..." the following: "Before starting the work, and at frequent intervals during the progress thereof,....".

Add the following Subparagraphs:

3.2.4 The Contractor shall give the Architect timely notice of any additional design drawings, specifications, or instructions required to define the work in greater detail, in order to permit the proper progress of the work.

3.2.5 The Owner shall be entitled to deduct from the Contract Sum amounts paid to the Architect for the Architect to evaluate and respond to the Contractor's requests for information, where such information was available to the Contractor from a careful study and comparison of the Contract Documents, field conditions, other Owner-provided information, Contractor-prepared coordination drawings, or prior Project correspondence or documentation.

3.2.6 Any necessary changes shall be ordered as provided in Article 7.

- B. Paragraph 3.4 Labor and Materials: Add the following Sections and clauses:

3.4.4 Not later than 15 days from the Contract date, the Contractor shall provide a list showing the name of the manufacturer proposed to be used for each of the major

products to be used in the work and, where applicable, the name of the installing Subcontractor.

- 3.4.5 The Architect shall reply in writing within seven (7) days to the Contractor stating whether the Owner or the Architect, after due investigation, has reasonable objection to any such proposal. If adequate data on any proposed manufacturer or installer is not available, the Architect may state that action will be deferred until the Contractor provides further data. Failure to object to a manufacturer shall not constitute a waiver of any of the requirements of the Contract Documents, and all products furnished by the listed manufacturer must conform to such requirements.
- .1 After the contract has been executed, the Owner and the Architect will consider a formal request for the substitution of products in place of those specified only under the conditions set forth in the Contract Documents, Section 012500 Substitution Procedures.
  - .2 By making requests for substitutions based on Clause 3.4.4.1 above, Contractor:
    - a. represents that he has personally investigated the proposed substitute products and determined that it is equal or superior in all respects to that specified;
    - b. represents that he will provide the same warranty for the substitution that he would for that specified;
    - c. certifies that the cost data presented is complete and includes all related costs under this Contract but excludes costs under separate contracts, and excludes the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
    - d. will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
  - .3 The Owner shall be entitled to deduct 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 such substitutions.

C. Paragraph 3.9 Superintendent:

Add the following clauses to the end of Section 3.9.1:

- .1 The Contractor shall assign one construction superintendent to the project and maintain the same person as superintendent, excepting acts beyond the contractors control, throughout the duration of the Contract.

.2 The Contractor shall not make any changes in project superintendent personnel without prior written approval from the Owner.

3.9.2 The superintendent or assistant to the superintendent shall also perform as a coordinator for site work and mechanical and electrical work. The coordinator shall be knowledgeable in site issues and mechanical and electrical systems and capable of reading, interpreting and coordinating Drawings, Specifications, and shop drawings pertaining to such systems. The coordinator shall assist the Subcontractors in arranging space conditions to eliminate interference between utilities and other site elements and mechanical and electrical systems and other Work and shall supervise the preparation of coordination drawings documenting the spatial arrangements for such systems within restricted spaces. The coordinator shall assist in planning and expediting the proper sequences of delivery of site related materials and mechanical and electrical equipment to the project site.

D. Paragraph 3.12 Shop Drawings, Product Data and Samples

Add the following clauses to the end of Section 3.12:

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

#### ARTICLE 4 - ADMINISTRATION OF THE CONTRACT:

A. Paragraph 4.2 Architect's Administration of the Contract

Add the following clauses to Section 4.2.2

.1 The Contractor shall reimburse the Owner for compensation paid to the Architect for additional site visits made necessary by the fault, neglect, or request of the Contractor.

B. Paragraph 4.3.4: Change the time required for notice from 21 days to 5 days in the first instance and 14 days in the second instance.

C. Paragraph 4.6 Arbitration: Delete in its entirety and wherever references to arbitration appear in the General Conditions, such reference will be replaced with litigation in the Superior Court, Cumberland County, State of Maine, unless both parties agree to an alternate means of dispute resolution.

ARTICLE 5 - SUBCONTRACTORS - No modifications.

ARTICLE 6 - CONSTRUCTION BY OWNER - No modifications.

ARTICLE 7 - CHANGES IN THE WORK:

- A. Delete the words "a reasonable allowance for overhead and profit" wherever they occur in Article 7 and substitute "an allowance for overhead and profit in accordance with the schedule set forth in subparagraph 7.1.4.
- B. Add the following subparagraph and clauses:
  - 7.1.4 The allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:
    - .1 For the Contractor, for any Work performed by the Contractor's own forces: 10 percent of the cost.
    - .2 For the Contractor, for work performed by his Subcontractor: 5 percent of the amount due the Subcontractor.
    - .3 For each Subcontractor or Sub-subcontractor involved, for any Work performed by that Subcontractor's or Sub-subcontractor's own forces: 10 percent of the cost.
    - .4 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.6.
    - .5 In order to facilitate checking for quotations of extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a 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 shall be itemized also. In no case will a change involving over \$1,000.00 be approved without such itemization.

ARTICLE 8 - TIME

- A. Paragraph 8.3 Delays and Extensions of Time:
  - 8.3.1 Delete the words "labor disputes" from line three.
- B. Add the following Subparagraphs:
  - 8.3.4 The Contractor shall achieve Substantial Completion of the entire Work no later than June 1, 2010. In the event that the Contractor does not achieve Substantial Completion of the project by this date, and the Contractor is not entitled to an extension of time to reach Substantial Completion, then liquidated damages shall be assessed at the following rates per calendar day:

PHASE	COMPLETION TIME	DAILY DAMAGES
Entire Work	June 1, 2010	\$300

In the event that the Contractor does not achieve Substantial Completion of the project on June 15, 2020, then the liquidated damages shall increase to \$3,750 per day.

- 8.3.5 In the event that the Contractor achieves Substantial Completion before June 1, 2010, an early completion bonus of \$150 per calendar day shall be awarded.

ARTICLE 9 - PAYMENTS AND COMPLETION

- A. Paragraph 9.3 Applications for Payment:

9.3.1 Add the following clauses to this Subparagraph:

9.3.1.3 Until the Work is 50 percent complete, the Owner will pay 90 percent of the undisputed amount due the Contractor on account of progress payments. After which, the Owner will pay 100% of the undisputed amount due the Contractor on account of progress payments until the work is Substantially Complete as defined in the General Conditions and amended herein. Retainage accrued up to the point of 50% completion will be held by the Owner until the work is Substantially Complete. From the point of 50% completion to Substantial Completion, project retainage will not be allowed to fall below 5% of the amount due the contractor. The Owner may reinstate retainage at any time in sufficient amount to maintain the 5% level of retainage until Substantial Completion.

9.3.1.4 The full Contract retainage in the amount of 10 % may be reinstated at any time by the Owner if the manner of completion of the work and its progress do not remain satisfactory to the Architect or the Owner, or if the Surety withholds its consent, or for other good and sufficient reasons.

9.3.1.5 The Owner shall make Progress Payments and Final Payment within 30 days of application date.

- B. Paragraph 9.5.1.7 delete “persistent”.

- C. Additional Paragraph: Insert additional Paragraphs in their proper locations as follows:

Paragraph 9.8 Substantial Completion: Add the following to the end of Subparagraph 9.8.1:

“... and only minor items, which can be corrected or completed without substantial interference with the Owner's use of the Work, remain to be corrected or completed, and a Certificate of Occupancy has been issued by the local code enforcement agency having jurisdiction for the project location.”

- D. Paragraph 9.10.2: Insert a new item (6) as follows:

“(6) Delivery of As-Built Drawings and Owner’s Operating Manuals”

- E. 9.11 Storage of Materials Off Site:



9.11.1 The Contractor, his Subcontractor and Sub-subcontractors shall obtain prior written approval from the Owner for permission to store materials to be incorporated in the Work, for which Progress Payments will be requested, at off-site locations. Any and all charges for storage, including insurance, shall be borne solely by the Contractor. Before approval, Owner will require proper proof of insurance naming the Owner as an additionally insured party, and letter in which is furnished.

1. The name of the Contractor and/or Subcontractor or Subordinate Subcontractor leasing the storage area.
2. The location of such leased space.
3. The leased area: the entire premises of certain areas of a warehouse giving the number of floors or portions thereof.
4. The date on which the material is first stored.
5. The value of the material stored.
6. A transfer of title of the material to the Owner once payment has been received by the Contractor.

9.11.2 The Contractor, his Subcontractors and Subordinate Subcontractors shall notify the Architect and the Owner to inspect, at least once each month, the materials being stored at any location.

9.11.3 The Contractor, his Subcontractors and Subordinate Subcontractors shall mark each sealed carton with the name and address of the Project and Architect.

9.11.4 A perpetual inventory shall be maintained for all materials held in storage for which payment has been requested.

9.11.5 Payment for materials stored off site shall be at the sole discretion of the Owner. Any additional costs to the Owner resulting from storage of material off site for which payment is requested, such as, but not limited to, travel expenses and time for inspectors, shall be back charged to, and paid by, the Contractor.

## ARTICLE 10 – PROTECTION OF PERSONS AND PROPERTY

### A. Paragraph 10.2 Safety of Persons and Property

Add the following clauses to Section 10.2.4:

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

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

- A. Paragraph 10.3.3 Delete “sole” in the last line.
- B. Paragraph 10.4 Add the following at the end of the paragraph: “and contractor has properly handled such materials.”

ARTICLE 11 - INSURANCE AND BONDS:

- A. Paragraph 11.1 Contractor's Liability Insurance:

11.1.1 In the first line following the work "maintain" insert the words "in a company or companies licensed to do business in the state in which the Project is located".

11.1.1.1 Delete the semicolon at the end of Section 11.1.1.1 and add:

“,including private entities performing Work at the site and exempt from the coverage on account of number of employees of occupation, which entities shall maintain voluntary compensation coverage at the same limits specified for mandatory coverage for duration of the Project.”

11.1.1.2 Delete the semicolon at the end of Section 11.1.1.2 and add:

“or persons or entities excluded by statute from the requirements of Section 11.1.1.1 but required by the Contract Documents to provide the insurance required by that section;

- B. Add the following lines and clauses to the end of Section 11.1.2:

11.1.2 “...The insurance required by Section 11.1.1 shall be written for not less than the following, or greater if required by law and all such policies shall include the Owner as an additional named insured.”

.1 Worker's Compensation:

- (a) State: Statutory
- (b) Applicable Federal Statutory

.2 Employers Liability \$500,000

.3 Comprehensive General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Contractual Liability, Personal Injury, and Broad Form Property Damage (including coverage for XCU Hazards Liability) shall be as follows:

(a) Bodily Injury:

- \$5,000,000 Each Occurrence
- \$5,000,000 Annual Aggregate

(b) Property Damage:

\$2,000,000 Each Occurrence  
 \$2,000,000 Annual Aggregate

- .4 Contractual Liability (including indemnification provisions):
  - (a) shall include coverage sufficient to meet the obligations in AIA Document A201-1997 under Section 3.18.
- .5 Products and Completed Operations:
  - (a) \$5,000,000 Aggregate
  - (b) shall be maintained for a minimum period of at least 1 year after either 90 days following Substantial Completion, or final payment, whichever is earlier.
- .6 Personal Injury, with Employment Exclusion deleted:
  - (a) \$5,000,000 Annual Aggregate
- .7 Comprehensive Automobile Liability for both owned vehicles and non-owned and hired vehicles:
  - (a) Bodily Injury:
    - \$5,000,000 Each Person
    - \$5,000,000 Each Occurrence
  - (b) Property Damage:
    - \$2,000,000 Each Occurrence
- .8 Aircraft Liability (owned and non-owned) when applicable: (Owner to approve limits proposed by Contractor.)
- .9 Watercraft Liability (owned and non-owned) when applicable: (Owner to approve limits proposed by Contractor).
- .10 All subcontractors shall carry policies with \$1,000,000.00 insurance coverage for their work on this project.

C. Add the following clause to Section 11.1.3:

- .1 The Contractor shall furnish three (3) copies each of Certificates of Insurance herein required with one copy for Architect's use, which shall specifically set forth evidence of all coverage required herein. The form of the Certificate shall be ACORD form 25-s, completed and supplemented in accordance with AIA G-715 - 1991. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage or limits.

D. Paragraph 11.4 Property Insurance.

11.4.1.4 Delete Section 11.4.1.4 and substitute the following:

11.4.1.4 The Contractor shall at the Contractor's own expense provide insurance coverage for materials stored off site after written approval of the Owner of the value established in the approval, and also for portions of the Work in transit until such materials are permanently attached to the Work.

Add the following clause to Section 11.4.1:

11.4.1.6 Insurance required by Section 11.4 is not intended to cover machinery, tools or equipment owned or rented by the Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. The Contractor shall, at the Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment, which shall be subject to the provisions of Section 11.4.7.

Add the following clause after 11.4.7:

11.4.7.1 The subrogation waiver shall not extend to rights any of the insured parties may have against another insured party for losses and damages falling within the deductible amounts of the policies of insurance pursuant to this article 11, if such losses and damages are attributable in whole or in substantial part to the negligence or breach of contractual obligations of such other insured party.

E. Paragraph 11.5 Performance Bond and Payment Bond

11.5.1 Delete Section 11.5.1 and substitute the following:

11.5.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising there under. 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.

11.5.1.1 The Contractor shall deliver the required bonds to the Owner not later than three (3) days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

11.5.1.2 The Contractor shall require the attorney in fact who executes the required bonds of behalf of the surety to affix thereto a certified and current copy of the power of attorney.

ARTICLE 13 - MISCELLANEOUS PROVISIONS:

A. Paragraph 13.2 Successors and Assigns:

13.2.1: Add the following at the end of the second sentence: “; provided, however, that consent to an assignment by Owner will not be unreasonably withheld by Contractor.”

B. Add the following Paragraph 13.8 to Article 13:

13.8 EQUAL OPPORTUNITY

13.8.1 The Contractor shall maintain polices of employment as follows:

13.8.1.1 The Contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex, national origin or sexual orientation. The Contractor shall take affirmative action to insure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex, national origin or sexual orientation. Such action shall include, but not be limited to, the following employment, upgrading, demotion or transfer, recruitment or recruitment advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices setting forth the policies of non-discrimination.

13.8.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, national origin or sexual orientation.

ARTICLE 14 - TERMINATION OR SUSPENSION OF THE CONTRACT:

A. Paragraph 14.2 Termination By The Owner For Cause:

14.2.1.1 Delete the words “persistently or repeatedly”

14.2.1.3 Delete the word “persistently”

14.2.2 Delete in the first line “upon certification by the Architect that sufficient cause exists to justify such action,”

ARTICLE 15 - OTHER CONDITIONS OF THE CONTRACT:

15.1 The Contractor acknowledges that nothing in the performance of the Services of the Architect in connection with this project implies any undertaking for the benefit of, or which may be enforced by the Contractor, its subcontractors or suppliers, or the surety of any of them, and that the obligations of the Architect run solely to the benefit of the Owner.

- 15.2 Typographical errors shall not be grounds for additional payments.
- 15.3 The Architect is not responsible for the survey, identification, or removal of any hazardous materials, including asbestos, on the project.
- 15.4 The Contractor is not responsible for the survey, identification, or removal of any hazardous materials, including asbestos, on the project unless otherwise specified.
- 15.5 In the event the Contractor encounters material reasonably believed to be asbestos or other hazardous materials, which have not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and the Architect in writing. The Work in the affected area shall not thereafter be resumed except by written agreement of the Owner and Contractor if in fact the material is asbestos or other hazardous materials and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or other hazardous materials, or when it has been rendered harmless, by written agreement of the Owner and Contractor. The Owner shall be responsible for contracting the removal of asbestos or other hazardous materials.
- 15.6 The Contractor shall not be required to perform without consent any Work relating to asbestos or other hazardous materials.
- 15.8 Access to Records
- 15.8.1 It is also agreed that the following Access to Records provision applies if Section 952 of the Omnibus Reconciliation Act of 1980 is found to apply to this contractual relationship. Until the expiration of four years after the furnishing of the services provided under this Contract, the Contractor will make available to the Secretary, U.S. Comptroller General, and their representatives, this Contract and all books, and documents and records necessary to certify the nature and extent of the costs for those services. If the Contractor carries out the duties of the Contract through a subcontract worth \$10,000.00 or more over twelve month period with a related organization, the sub period will also contain the access clause to permit access by the Secretary, Comptroller General, and their representative to the related organization's books and records.

END OF SUPPLEMENTAL GENERAL CONDITIONS

## SECTION 055000

## METAL FABRICATIONS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Steel framing and supports for mechanical and electrical equipment.
  - 2. Steel framing and supports for applications where framing and supports are not specified in other Sections.
  - 3. Elevator machine beams.
  - 4. Support angles for elevator door sills.
  - 5. Loose bearing and leveling plates.
  - 6. Metal ladder for elevator pit.
  - 7. Metal bollards.
  - 8. Understory fence by Alternate #5
- B. Products furnished, but not installed, under this Section include the following:
  - 1. Loose steel lintels.
  - 2. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
- C. Related Sections include the following:
  - 1. Division 03 Section "Cast-in-Place Concrete" for installing anchor bolts, steel pipe sleeves, wedge-type inserts and other items indicated to be cast into concrete.
  - 2. Division 04 Section "Unit Masonry" for installing loose lintels, anchor bolts, and other items indicated to be built into unit masonry.
  - 3. Division 05 Section "Structural Steel Framing."
  - 4. Division 05 Section "Pipe and Tube Railings."
  - 5. Division 06 Section "Rough Carpentry" for metal framing anchors.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Ladders: Provide ladders capable of withstanding the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
  - 1. Provide ladders meeting the OSHA requirements of 29CFR 1910.27.

- B. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
1. Nonslip aggregates and nonslip-aggregate surface finishes.
  2. Paint products.
  3. Grout.
- B. LEED Submittal:
1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.
    - a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.
    - b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material with associated documentation.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
  2. Provide templates for anchors and bolts specified for installation under other Sections.
  3. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.
- E. Qualification Data: For professional engineer.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
  2. AWS D1.3, "Structural Welding Code--Sheet Steel."



## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating metal fabrications without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
  - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- C. Fabrication of Steel Products: Provide products extracted, processed and manufactured within 500 miles of home

## 2.3 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, cold-formed steel tubing.
- C. Steel Pipe: ASTM A 53/A 53M, standard weight (Schedule 40), unless another weight is indicated or required by structural loads.
- D. Cast Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.

## 2.4 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A; with hex nuts, ASTM A 563; and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.
- D. Anchor Bolts: ASTM F 1554, Grade 36.
  - 1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Eyebolts: ASTM A 489.
- F. Machine Screws: ASME B18.6.3.
- G. Lag Bolts: ASME B18.2.1.
- H. Wood Screws: Flat head, ASME B18.6.1.
- I. Plain Washers: Round, ASME B18.22.1.
- J. Lock Washers: Helical, spring type, ASME B18.21.1.
- K. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.

- L. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
  - 1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.
  - 2. Material for Anchors in Exterior Locations: Alloy Group 1 stainless-steel bolts complying with ASTM F 593 and nuts complying with ASTM F 594.

## 2.5 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
  - 1. Available Products:
    - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
    - b. ICI Devco Coatings; Catha-Coat 313.
    - c. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
    - d. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
    - e. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
    - f. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
  - 1. Available Products:
    - a. Sealmastic, Type 1; W. R. Meadows
    - b. Hydrocide 600; Sonneborn Building Products.
    - c. Karnak 100 AF; Karnac Chemical Corp.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
  - 1. Available Products:
    - a. Five Star Grout by Five Star Products, Inc.
    - b. Masterflow 928 Grout by Master Builders Technologies.
    - c. SonogROUT 10K by Sonneborn.

- d. 14K Hy Flow by Sonneborn.
- G. Concrete: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, concrete with a minimum 28-day compressive strength of 3000 psi.

## 2.6 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.
  - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
  - 1. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

## 2.7 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.
  - 1. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.

## 2.8 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span but not less than 8 inches, unless otherwise indicated.
- C. Galvanize loose steel lintels located in exterior walls.

## 2.9 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Prime plates with zinc-rich primer.

## 2.10 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.

## 2.11 METAL LADDERS

- A. General:
  - 1. Comply with ANSI A14.3, unless otherwise indicated.
  - 2. For elevator pit ladders, comply with ASME A17.1.
- B. Fabricate ladders from materials as detailed on the drawings or if not indicated, as follows:

1. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges, spaced 18 inches .
2. Rungs: 3/4-inch- diameter steel bars, spaced 12 inches .
3. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
4. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets. Size brackets to support design loads specified in ANSI A14.3.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Available Products:
  - a. IKG Industries, a Harsco company; Mebac.
  - b. W. S. Molnar Company; SlipNOT.
7. Prime interior ladders, including brackets and fasteners, with zinc-rich primer.

## 2.12 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 40 steel pipe.

## 2.13 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish metal fabrications after assembly.

## 2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dipped process, Durogalv by Duncan Galvanizing. The galvanizing bath shall contain high grade zinc and other earthy materials. Immediately before galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The use of the wet kettle process is prohibited. Comply with ASTM A123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards.
- B. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
  1. Exteriors (SSPC Zone 1B) and Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Interiors (SSPC Zone 1A): SSPC-SP 3, "Power Tool Cleaning."
- C. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
  1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  2. Obtain fusion without undercut or overlap.
  3. Remove welding flux immediately.
  4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.

### 3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.

- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
  - 1. Use nonshrink grout, nonmetallic, in concealed and exposed locations, unless otherwise indicated.
  - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

### 3.4 INSTALLING METAL BOLLARDS

- A. Fill bollards solidly with concrete, mounding top surface to shed water.

### 3.5 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
  - 1. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION



## SECTION 055100 - METAL STAIRS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Alternating Tread Stair.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of loads and stresses within limits and under conditions specified in ICC's International Building Code.

#### 1.4 SUBMITTALS

- A. Product Data: For metal stairs and the following:
  - 1. Alternating tread stair.
- B. LEED Submittal:
  - 1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.
    - a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.
    - b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material with associated documentation.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Provide templates for anchors and bolts specified for installation under other Sections.

#### 1.5 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

## 1.6 COORDINATION

- A. Coordinate installation of anchorages for metal stairs. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate locations of hanger rods and struts with other work so that they will not encroach on required stair width and will be within the fire-resistance-rated stair enclosure.

## PART 2 - PRODUCTS

### 2.1 ALTERNATING TREAD STAIR

- A. Provide alternating tread stairs where shown on the drawings. Stairs shall conform to layout and dimensions indicated in drawings.
- B. Available Manufacturer: Lapeyre Stair, 220 Laitram Lane, LA 70123 (800 535-7631).
  1. Stair units shall be a complete assembly including stair, hand rails, platforms, supports, mounting and fastening devices.
  2. Treads: Capable of withstanding a concentrated load of 1000 lbs. Without deformation.
  3. Handrails: Capable of withstanding a concentrated load of 200 lbs. Applied in any direction and at any point on the rail.
  4. Finish: Safety yellow powder coat.

### 2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.

### 2.3 FASTENERS

- A. General: Provide zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 25 for exterior use, and Class Fe/Zn 5 where built into exterior walls. Select fasteners for type, grade, and class required.
- B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times

the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

1. Material for Anchors in Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B 633, Class Fe/Zn 5.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

#### 3.2 INSTALLING ALTERNATING TREAD STAIR

- A. Install in strict accordance with stair manufacturers printed installation instructions.

#### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.

END OF SECTION 055100



## SECTION 055213

## PIPE AND TUBE RAILINGS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:

- 1. Steel pipe and tube railings.
- 2. Steel gates.

- B. Related Sections include the following:

- 1. Division 06 Section "Rough Carpentry" for wood blocking for anchoring railings.

## 1.3 PERFORMANCE REQUIREMENTS

- A. General: In engineering railings to withstand structural loads indicated, determine allowable design working stresses of railing materials based on the following:

- 1. Steel: 72 percent of minimum yield strength.

- B. Structural Performance: Provide railings capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:

- 1. Handrails:

- a. Uniform load of 50 lbf/ ft. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

- 2. Top Rails of Guards:

- a. Uniform load of 50 lbf/ ft. applied in any direction.
- b. Concentrated load of 200 lbf applied in any direction.
- c. Uniform and concentrated loads need not be assumed to act concurrently.

- 3. Infill of Guards:

- a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..

- b. Uniform load of 25 lbf/sq. ft. applied horizontally.
  - c. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Provide exterior railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
- 1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

#### 1.4 SUBMITTALS

- A. Product Data: For the following:
- 1. Manufacturer's product lines of mechanically connected railings.
  - 2. Grout, anchoring cement, and paint products.
- B. LEED Submittal:
- 1. Product Data for Credit MR 2.2: Environmentally Preferable Materials.
    - a. Local production. Provide materials that were extracted, processed, and manufactured within 500 miles of the home. Provide documentation from manufacturer that verifies source location.
    - b. Recycled Content: Provide materials that include at least 25% postconsumer or 50% preconsumer (postindustrial) recycled material with associated documentation.
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- 1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Welding certificates.
- E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, according to ASTM E 894 and ASTM E 935.

#### 1.5 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of railing through one source from a single manufacturer.
- B. Welding: Qualify procedures and personnel according to the following:
- 1. AWS D1.1, "Structural Welding Code--Steel."

## 1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication and indicate measurements on Shop Drawings.
  - 1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating railings without field measurements. Coordinate wall and other contiguous construction to ensure that actual dimensions correspond to established dimensions.
  - 2. Provide allowance for trimming and fitting at site.

## 1.7 COORDINATION AND SCHEDULING

- A. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Schedule installation so wall attachments are made only to completed walls. Do not support railings temporarily by any means that do not satisfy structural performance requirements.

## PART 2 - PRODUCTS

## 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.
- C. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- D. Fabrication of Steel Products: Provide products extracted, processed and manufactured within 500 miles of home

## 2.2 STEEL AND IRON

- A. Tubing: ASTM A 500 (cold formed) or ASTM A 513, Type 5 (mandrel drawn).
- B. Pipe: ASTM A 53/A 53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.
  - 1. Provide galvanized finish for exterior installations and where indicated.

- C. Plates, Shapes, and Bars: ASTM A 36/A 36M.
- D. Castings: Either gray or malleable iron, unless otherwise indicated.
  - 1. Gray Iron: ASTM A 48/A 48M, Class 30, unless another class is indicated or required by structural loads.
  - 2. Malleable Iron: ASTM A 47/A 47M.

## 2.3 FASTENERS

- A. General: Provide the following:
  - 1. Steel Railings: Plated steel fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.
- B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction indicated and capable of withstanding design loads.
- C. Fasteners for Interconnecting Railing Components:
  - 1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
  - 2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
  - 3. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
- D. Anchors: Provide cast-in-place, chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
  - 1. For aluminum railings, provide type and alloy as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer.
  - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- C. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.



1. Available Products:
  - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
  - b. Carboline Company; Carbozinc 621.
  - c. ICI Devoe Coatings; Catha-Coat 313.
  - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
  - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
  - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
  - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
  
- D. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.
  
- E. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
  
- F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.
  
- G. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

1. Available Products:
  - a. Five Star Grout by Five Star Products, Inc.
  - b. Masterflow 928 Grout by Master Builders Technologies.
  - c. SonogROUT 10K by Sonneborn.
  - d. 14K Hy Flow by Sonneborn.

## 2.5 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
  
- B. Assemble railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.
  
- C. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
  
- D. Form work true to line and level with accurate angles and surfaces.
  
- E. Fabricate connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.

- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections, unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove flux immediately.
  - 4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
- I. Form changes in direction as follows:
  - 1. As detailed.
- J. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
- K. Close exposed ends of railing members with prefabricated end fittings.
- L. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
- M. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work, unless otherwise indicated.
  - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide fillers made from crush-resistant material, or other means to transfer wall loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
- N. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work. Fabricate anchorage devices capable of withstanding loads imposed by railings. Coordinate anchorage devices with supporting structure.
- O. For railing posts set in concrete, provide steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with steel plate forming bottom closure.

## 2.6 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Provide exposed fasteners with finish matching appearance, including color and texture, of railings.

## 2.7 STEEL AND IRON FINISHES

- A. Galvanizing: Provide coating for iron and steel fabrications applied by the hot-dipped process, Durogalv by Duncan Galvanizing. The galvanizing bath shall contain high grade zinc and other earthy materials. Immediately before galvanizing, the steel shall be immersed in a bath of zinc ammonium chloride. The use of the wet kettle process is prohibited. Comply with ASTM A123 for fabricated products and ASTM A 153 for hardware. Provide thickness of galvanizing specified in referenced standards.
- B. Fill vent and drain holes that will be exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.
- C. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- D. For nongalvanized steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves, except galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.
- F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed railings:
  1. Exterior Railings (SSPC Zone 1B): SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
  2. Interior Railings (SSPC Zone 1A): SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
- G. Apply shop primer to prepared surfaces of railings, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
  1. Do not apply primer to galvanized surfaces.
  2. Stripe paint corners, crevices, bolts, welds, and sharp edges.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements have been clearly marked for Installer. Locate reinforcements and mark locations if not already done.

## 3.2 INSTALLATION, GENERAL

- A. Fit exposed connections together to form tight, hairline joints.
- B. Perform cutting, drilling, and fitting required for installing railings. Set railings accurately in location, alignment, and elevation; measured from established lines and levels and free of rack.
  - 1. Do not weld, cut, or abrade surfaces of railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
  - 2. Set posts plumb within a tolerance of 1/16 inch in 3 feet.
  - 3. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.
- C. Corrosion Protection: Coat concealed surfaces of aluminum that will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.
- D. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- E. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

## 3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in Part 2 "Fabrication" Article whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to 1 side, and locate joint within 6 inches of post.

## 3.4 ANCHORING POSTS

- A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.

- B. Form or core-drill holes not less than 5 inches deep and 3/4 inch larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- C. Cover anchorage joint with flange of same metal as post, welded to post after placing anchoring material or attached to post with set screws.
- D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch buildup, sloped away from post.
- E. Anchor posts to metal surfaces with oval flanges, angle type, or floor type as required by conditions, connected to posts and to metal supporting members as follows:
  - 1. For aluminum pipe railings, attach posts using fittings designed and engineered for this purpose.
  - 2. For stainless-steel pipe railings, weld flanges to post and bolt to supporting surfaces.
  - 3. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.
- F. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

### 3.5 ANCHORING RAILING ENDS

- A. Anchor railing ends to concrete and masonry with round flanges connected to railing ends and anchored to wall construction with anchors and bolts.
- B. Anchor railing ends to metal surfaces with flanges bolted to metal surfaces and welded to railing ends or connected to railing ends using nonwelded connections.

### 3.6 ATTACHING HANDRAILS TO WALLS

- A. Attach handrails to wall with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.
  - 1. Use type of bracket with predrilled hole for exposed bolt anchorage.
- B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
- C. Secure wall brackets to building construction as follows:
  - 1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
  - 2. For hollow masonry anchorage, use toggle bolts.
  - 3. For wood stud partitions, use hanger or lag bolts set into wood backing between studs. Coordinate with carpentry work to locate backing members.

3.7 ADJUSTING AND CLEANING

- A. Clean aluminum and stainless steel by washing thoroughly with clean water and soap and rinsing with clean water.
- B. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- C. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Division 09 painting Sections.
- D. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.
- B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION

## SECTION 230000

## MECHANICAL

## PART 1 - GENERAL

## 1.01 RELATED DOCUMENTS

General Provisions of Contract, including General and Supplementary conditions and General Requirements (if any) apply to work specified in this Section.

## 1.02 ALTERNATES

There are alternates that apply to this section of the project.

## 1.03 INTENT

It is the intent of the drawings and specifications to provide for the installation of heating and ventilating systems which are safe, quiet, and economical in operation and complete in all respects. The heating system will provide a uniform temperature of 70 degrees F. in all living spaces as may be noted on the drawings, when the outside temperature is -2 degrees F. All materials and equipment necessary to accomplish the intent shall be furnished and installed by the heating (mechanical) contractor.

## 1.04 DEFINITIONS

ATC	Automatic Temperature Control
EC	Electrical Contractor (Division 16)
GC	General Contractor
HC	Heating (mechanical) Contractor
PC	Plumbing Contractor

## 1.05 DESCRIPTION OF WORK

## A. Work Included

1. Furnish all labor, materials, equipment, transportation and perform all operations required to install complete heating and ventilating systems in the buildings, in accordance with these specifications and applicable drawings.
2. All temperatures are expressed in degrees Fahrenheit.
3. Work to be performed shall include, but is not limited to, the following:
  - a. Provide and install forced hot water heating system in building areas indicated on drawings.
  - b. Provide and install exhaust systems in building areas indicated on drawings.
  - c. Pipe, valve and fittings
  - d. Hot water specialties
  - e. Circulating pumps and boiler work
  - f. Radiation

- g. Cabinet unit heaters
  - h. Insulation
  - i. Fans
  - j. Sheetmetal
  - k. Temperature control
  - l. Tests and balance
4. Specifications and accompanying drawings do not indicate every detail of pipe, valves, fittings, hangers, ductwork and equipment necessary for complete installation; but are provided to show general arrangement and extent of work to be performed.
  5. Before submitting proposal, Mechanical Contractor shall be familiar with all conditions. Failure to do so does not relieve Mechanical Contractor of responsibility regarding satisfactory installation of the system.
  6. Mechanical contractor shall be responsible for rigging to hoist his own (and his sub-contractors') materials and equipment into place.
  7. Mechanical contractor and his sub-contractors shall be responsible for start-up of all equipment provided under this section.
- B. Related Work Described Elsewhere
1. Excavation and backfill
  2. Cutting and patching
  3. Firestopping between building construction and pipe sleeves and between building construction and ductwork, Section 07900.
  4. Electrical conduit and wiring, except as noted below
  5. Roofing, curbs, curb openings and framing of openings.
  6. Setting of sleeves in masonry work (sleeves provided by Mechanical Contractor)
  7. Door louvers
  8. Finish painting, Section 09900
  9. All finish work
- C. Commissioning
1. A commissioning agent has been retained by and works directly for the Owner. The commissioning agent's responsibility shall include ensuring the mechanical systems function as designed. A full scope of the agent's duties may be provided on request.
  2. This contractor shall provide documentation on mechanical equipment that may be requested by the commissioning agent with notification provided to the Architect of such.
  3. Should the commissioning agent requested changes or alterations to the mechanical systems, said changes or alterations must be authorized by the Architect or Engineer of record prior to work. See part 1.19, "CHANGE ORDERS".
  4. The scope of the mechanical contractor's responsibility regarding commissioning shall include (but not be limited) to:
    - a. Attend commissioning meetings.



- b. Coordinate factory start up of the ATC and boiler systems to include the commissioning agent. Coordination shall include as a minimum 5 working days notice of factory start up tests.
- c. Coordinate and provide at least 5 working days notice of testing and balancing contractor being on site to allow the commissioning agent to observe the process.
- d. Complete check lists on boilers, pumps and controls.
- e. Demonstrate all sequences of operation of all mechanical equipment.

D. Mechanical Electrical Work

1. Provide and erect all motors, temperature controls, limit switches as specified.
2. Power supply to switches, fused switches, outlets, motor starters, to line terminals of equipment, and all related wiring and fuses to properly connect and operate all electrical equipment specified shall be furnished and installed under Division 16, "ELECTRICAL" (Division 16). Division 16 shall not mount electrical equipment to indoor mechanical equipment without the consent of Division 15. Division 16 shall not drill wiring holes in equipment casings but shall make use of factory wiring knockouts when present. Coordinate all wiring between Mechanical and Electrical to provide a complete and operating system.
3. All power wiring provided under this section shall be in accordance with the latest rules and regulations of the National Fire Underwriters, National Electric code, National Fuel Gas Code, and Local Codes Division 16. Install all wiring under the supervision of the Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section.
4. Automatic Temperature Control (ATC) Systems  
  
Electric wiring for ATC systems shall be furnished and installed by ATC Contractor under supervision of Division 16. Any wiring that is not installed according to these standards, and which does not match wiring installed by Division 16 in type, quality and appearance shall be corrected by Division 16 at the expense of this section. Low voltage wiring shall be plenum rated and installed in an organized manner. Conduit for low voltage wiring shall not be required.
5. Boilers  
  
Division 16 shall provide a separate circuit breaker for each boiler and wire to line terminals on unit control.
6. Fans
  - a. Division 16 to wire to unit mounted disconnect switches with overload protection provided with units.
  - b. Division 16 to provide 120 volt power from exhaust fans to motor operated dampers associated with each fan, where provided. Dampers and actuators to be provided by ATC Contractor.

## 7. Automatic Temperature Control (ATC) Panel

Division 16 shall provide a dedicated 120 volt, 15 amp circuit breaker for each temperature control panel. Wiring from circuit breaker to temperature control panels will be provided and installed by the ATC Contractor. Division 16 shall also provide a duplex convenience receptacle on a separate circuit within 6 feet of panel.

## 8. Circulating Pumps

Division 16 shall provide and wire a disconnect switch for each pump. Division 16 shall provide and wire magnetic starters for three phase units. Starters to have Hand-Off-Automatic switch and automatic re-start feature in event of power failure.

## 9. Unit Heaters

- a. Cabinet Type: Division 16 shall wire to disconnect switch provided with unit.
- b. Propeller type: Division 16 shall provide and wire service switch with overload protection.

- 11. All motors 1/3 HP and smaller shall be wired for 120 volt, 1 phase, 60 hz. Motors 1/2 HP and larger shall be wired for 208 volt, 1 phase, 60 hz, unless specifically shown otherwise.

## 1.06 PERMITS

- A. This Contractor shall be responsible for providing and filing all Plans, Specifications and other documents, pay all requisite fees and secure all permits, inspections and approvals necessary for the legal installation and operation of the systems and/or equipment furnished under this Section of the Specifications.
- B. The Contractor shall frame under glass/ clear plastic all permits, secured by him, adjacent to the respective system and/or equipment and required to be displayed by Code, law or ordinance. Those permits secured but not required to be displayed shall be laminated in plastic and included in the Owner's maintenance manual.

## 1.07 CODES, ORDINANCES AND PERMITS

- A. All work performed under this Section of the Specifications shall be done in accordance with applicable National, State and local Codes, Laws and Ordinances. The following abbreviations are used for reference to standards which are to be followed:

AABC	Associated Air Balance Council
ADA	Americans With Disabilities Act
AMCA	Air Movement & Control Association
ANSI	American National Standards Institute
ARI	Air Conditioning and Refrigeration Institute
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers

ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
NEC	National Electrical Code
NFPA	National Fire Protection Association
NEMA	National Electrical Manufacturer's Association
OSHA	Occupational Safety and Health Act
SMACNA	Sheet Metal and Air Conditioning Contractors National Association
UL	Underwriter's Laboratories

- B. The latest issue of each Code in effect at the time of bidding shall be used. Code requirements are the minimum quality and/or performance acceptable. Where the Specifications and/or Drawings indicate more stringent requirements, these requirements shall govern.

#### 1.08 QUALITY ASSURANCE

- A. Qualification of Workpersons

Use sufficient qualified workpersons and competent supervisors in execution of this portion of the work to ensure proper and adequate installation of system throughout.

- B. Work performed shall conform with all Local and State Rules and Regulations, as well as those of the National Fire Protection Association (N.F.P.A.).
- C. Piping design shall conform to ANSI, ASME B31.9 and AWS D10.9 codes.
- D. Expansion tank shall conform to ASME Section VIII Code.
- E. Air separator shall conform to ASME Boiler and Pressure Vessel Code.
- F. Welding standards shall conform to ANSI Boiler Code, Section IX, B31.1

#### 1.09 MATERIALS AND SUBSTITUTIONS

All materials and equipment shall be new and of the latest design of respective manufacturers. **All materials and equipment of the same classification shall be the product of the same manufacturer**, unless specified otherwise.

- A. Any proposal for substitution of Mechanical equipment, materials or vendors shall be made in writing **PRIOR TO OPENING OF BIDS**, see Division 1. Submit full details for consideration and obtain written approval of the Architect. The phrase "or approved equal" shall be defined to mean that the Architect, not the contractor, shall make final determination whether or not substitute materials are an equal to that which is specified. The contractor shall be responsible to certify within his submittals that any equipment to be considered as an "approved equal" meets or exceeds the requirements of this specification in all aspects and will physically fit within the space provided and still provide adequate space adjacent to the equipment for service. If requested by the Architect the contractor shall provide said certification in the form of scale drawings before review will be made. Architect will not be responsible to provide drawings for substituted materials unless the substitution is agreed upon prior to opening of bids. Architect's decision on acceptability of substitute materials shall be final.

- B. Approval by Architect for such substitution shall not relieve Mechanical Contractor from responsibility for a satisfactory installation and shall not affect his guarantee covering all parts of work
- C. Any material or equipment submitted for approval which are arranged differently or is/are of different physical size from that shown or specified shall be accompanied by shop drawings indicating different arrangements of size and method of making the various connections to equipment. Final results will be compatible with system as designed.
- D. Materials and equipment determined as an "approved equal" and/or substitutions must meet the same construction standards, capacities, code compliances, etc. as the equipment (i.e. Manufacturer, model, etc.) specified.
- E. Any additional cost(s) resulting from the substitution of equipment, regardless of acceptance by the Architect or Engineer, shall be paid by this Contractor. Additional costs may include, but not be limited to, electrical and/or structural alterations from the contract documents. Contractor shall be solely responsible to verify that substitutes will fit within the designated spaces provide while permitting adequate clearances for servicing of equipment as required by the manufacturers. Contractor shall, upon request from the Architect or Engineer of record, provide such verification of ample space and clearances in the form of drawings or any other manner requested.
- F. All materials not specified otherwise shall be manufactured within the United States and supplied locally (within the State of Maine) when available. It is preferable to obtain materials that are manufactured within 500 miles of the work site when practical.

#### 1.10 PLANS AND SPECIFICATIONS

Mechanical Contractor shall provide his sub-contractors with a copy of the ENTIRE portion of Part 1 of this specification, portions of this specification and copies of drawings which pertain to the equipment to be supplied at no cost to the sub-contractor. Provide ATC Contractor with entire set of Electrical plans and specifications. Provide Testing and Balancing sub-contractor with copies of shop drawings indicating coil gpm's, fan air volumes, etc. Failure to do so may result in the Architect providing the required materials at the Contractor's expense.

#### 1.11 ELECTRONIC DRAWINGS AND FILE SHARING

Plans and specifications may be made available in electronic format on request. Plans may be provided in either Adobe (.pdf) or CAD (.dwg or .dxf) formats and will be compressed using WinZip (.zip format). Recipient is responsible to obtain the necessary software to open the files. Note: CAD (.dwg and .dxf) files will be made available to successful bidders only after a contract is awarded.

CAD drawings are produced with AutoCAD 2006 and may be provided in either the 2000 or 2004 file formats. Upon request for CAD files a release form will be provided which must be signed and returned to the Engineer prior to transmission of electronic files. Physical mailing address, telephone numbers and e-mail address for this office are indicated on each drawing. A signed release will not be required for Adobe based files.

All contract documents are copyrighted material. No portion of materials may be reproduced or duplicated except as indicated in the release form. Where release forms are not required (Adobe based files), materials may be printed for use by the intended recipient only and may not be reproduced or copied in any other manner or for any purpose other than for use pertaining to the construction of this project unless written permission is obtained.

#### 1.12 SHOP DRAWINGS & SUBMITTALS

- A. As soon as possible after award of Contract (but not longer than 21 calendar days), before any material or equipment is purchased, Mechanical Contractor shall submit to the Architect shop drawings for approval (see Division 1 for required quantities). If shop drawings are not submitted within the allotted time frame all substitutions included in the late shop drawings will be invalid and the equipment specified must be provided. Any costs resulting from delays in the project schedule due to failure to submit shop drawings related to this section in a timely manner shall be the responsibility of the Mechanical Contractor. Shop drawings shall be properly identified and shall describe in detail the material and equipment to be provided, including all dimensional data, performance data, fan curves, pump curves, computer selection print-outs, etc. Capacities indicated are minimums. Equipment submitted with capacities below specified parameters will be refused.
- B. Corrections or comments made on the shop drawings do not relieve the contractor from compliance with requirements of the drawings and specifications. Shop drawing review is only for review of general conformance with the design concept of the project and general compliance with the information given in the contract documents. The contractor is responsible for confirming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction; coordinating his work with that of all other trades and performing his work in a safe and satisfactory manner.
- C. All related items shall be submitted as a package. Partial submission shall not be reviewed until the package is complete, as itemized in paragraph "H" below.
- D. Should any materials or products be purchased and/or installed without prior review and comment the contractor shall be required to remove or replace those products and/or materials if directed by the Architect at his the contractor's expense. If the materials are not removed (or replaced) or if the project is delayed as a result the Architect reserves the right to order the withholding of payment until the situation is resolved in a manner satisfactory to the Architect.
- E. Mechanical shop drawings shall be separate from Plumbing shop drawings. All submittals shall have a clear area on the front no less than 4inches x 3inches to be reserved exclusively for the Engineers' shop drawing stamp or they will be refused for re-submittal.
- F. Submittals must be original documents or good quality photocopies of original documents (photocopies of color samples are not acceptable). Faxed copies of submittal sheets will be refused.
- G. Review must be obtained on the following items:
  - 1. Ductwork and Accessories
    - a. Registers and grilles

- b. Duct access doors
  - c. Volume control dampers (manual and automatic)
  - d. Duct sealant
  - e. Fire dampers and sleeves
  - f. Turning vanes
  - g. Flexible duct
  - h. Kitchen range hoods and accessories
  - i. Backdraft dampers
  - j. Louvers and brick vents - provide color chips (photocopies not acceptable) – provide samples if substituting
  - k. Filters
  - l. Vents from gas heating appliances
  - m. Exterior vent hoods from dryers, range hoods and exhaust fans where applicable.
2. Mechanical Equipment (sound data must be provided with all interior motorized equipment).
- a. Full warrantee information must be included with all submittals.
  - b. Fans and accessories - provide full fan curves and computer selection printouts.
  - c. Cabinet unit heaters - provide color chips (photocopies not acceptable)
  - d. Horizontal unit heaters
  - e. Pumps and accessories - provide full pump curves and computer selection printouts.
  - f. Boilers and accessories, confirmation of start-up and State Inspection
  - g. Domestic hot water storage heaters and accessories
  - h. Equipment identification tags
3. Piping and Accessories
- a. Pipe, valves, unions and flanges
  - b. Manual balancing valves with read-out gauge and pressure tappings. Provide a schedule clearly indicating every valve, its location, GPM, size and pressure drop.
  - c. Automatic Balancing valves
  - d. Air vents (automatic and manual)
  - e. Air separator
  - f. Relief valves
  - g. Expansion tank and accessories
  - h. Pipe hangers and insulated pipe supports
  - i. Pressure gauges and thermometers
  - j. Triple duty valves
  - k. Pressure reducing valves
  - l. Pipe flexible connectors
  - m. Pipe and valve markers
  - n. Backflow preventer
  - o. Flow control valves
  - p. Underground piping system
  - q. PEX tubing, fasteners, connectors, hangers and accessories

4. Terminal Units
  - a. Finned radiation
5. Insulation
  - a. Pipe
  - b. Duct
  - c. Pipe fittings
  - d. Air separator
6. Automatic Temperature Control (ATC) System

#### 1.13 PRODUCT HANDLING

##### A. Protection

Use all means necessary to protect heating and ventilating materials before, during and after installation and to protect the installed work and materials of all other trades.

##### B. Replacements

In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect at no additional cost to the Owner.

#### 1.14 AS-BUILT DRAWINGS

Keep in good condition at the job, apart from all other prints used in actual construction, one complete set of all blueprints furnished for this job. On this special set of blueprints, record *completely and accurately* all differences between the work as actually installed and the design as shown on the drawings. These record prints must be kept up to date by recording all changes within one week of the time that the changes are authorized. At the completion of the work, this set of drawings shall be delivered to the Architect for the Owner electronically in the form of CAD drawings. If a complete record of changes is not made and electronic CAD drawings not provided by the Mechanical Contractor, a record shall be made by the Engineers, and *the cost of the record shall be paid by the Mechanical Contractor*. Copies of the mechanical CAD drawings may be made available electronically to the Mechanical Contractor if desired. Drawings shall be dated accordingly and clearly identified as "AS-BUILT". Contact the Architect directly or the Engineer via e-mail at [mechsyst@maine.rr.com](mailto:mechsyst@maine.rr.com). Specify required CAD format when requesting the files. CAD drawings were generated using AutoCAD 2006 and utilize both paper space and model space with external references to various other drawings. Files will be compressed and will require "WinZip" (<http://www.winzip.com>) for extraction. A release form will be provided which must be signed and returned to the Engineer prior to transfer of files.

## 1.15 MAINTENANCE MANUAL

- A. On completion of this portion of the work, and as a condition of its acceptance, submit for approval two copies of a manual describing the system. Mechanical equipment manuals shall be separate from plumbing manuals. All manuals shall be original copies, not photocopies or they will be refused for re-submittal. Prepare manuals in durable 3-ring binders approximately 8½ inches by 11 inches in size with at least the following:
1. Identification on the front cover and spine stating general nature of the manual.
  2. Neatly typewritten index.
  3. Complete instructions regarding operation and maintenance of all equipment involved.
  4. Complete nomenclature of all replaceable parts, their part numbers, current cost, and name, address and telephone number of nearest vendor of parts.
  5. Copy of all guarantees and warranties issued.
  6. Where contents of manuals including manufacturer's catalog pages, clearly indicate the precise item included in this installation and delete, or otherwise clearly indicate, all manufacturers' data with which this installation is not concerned.
- B. In addition to above, provide two (2) separate offset style binders properly identified, each containing a copy of all reviewed shop drawings and catalog cuts. (NOTE: May be incorporated in Maintenance Manuals, if binders are of adequate size.)

## 1.16 OBJECTIONABLE NOISE AND VIBRATION

Mechanical equipment shall operate without objectionable noise and vibration. Should objectionable noise or vibration be transmitted to any occupied part of the building by apparatus, piping or ducts, as determined by the Architect, the necessary changes eliminating the noise or vibration shall be made by this Mechanical Contractor at no extra cost to the Owner.

## 1.17 GUARANTEE

This Contractor shall guarantee all materials and workmanship furnished by him or his sub-contractors to be free from all defects for a period of no less than one (1) year from date of final acceptance of completed system and shall make good, repair or replace any defective work which may develop within that time at his own expense and without expense to the Owner. Any additional costs required to extend manufacturer's guarantee and warranty for the period specified, shall be included in Contractor's base bid.



## 1.18 MINOR DEVIATIONS AND DISCREPANCIES

- A. The drawings are intended to indicate only diagrammatically the extent, general character and approximate locations of mechanical work. Work indicated, but having minor details obviously omitted, shall be furnished complete to perform the functions intended without additional cost to the Owner. Follow the architectural, structural, plumbing and electrical drawings so that work under this section is properly installed and coordinated with other Sections.
- B. The drawings and specifications are complimentary to each other and what is called for in one, shall be as binding as if called for by both. In the event of conflicting information on the mechanical drawings, or between drawings and specifications, or between trades, that which is better, best or most stringent shall govern.
- C. Questions to the Architect or Engineers are encouraged, but any answers or advice is non-binding. Therefore, inquires about such items should be made at least 4 days prior to when bids are due to allow time for a clarifying addendum to be issued.
- D. Any conflicts arising from duplication of equipment specified in different portions of the specifications shall be brought to the attention of the Architect prior to submitting bids. Failure to do so does not relieve the Contractor from responsibility of providing said materials and equipment and a credit will be taken for the duplicated item(s).

## 1.19 CHANGE ORDERS

- A. No change shall be made from the work, equipment, or materials under this section except as directed in writing by the Architect or Engineer of record.
- B. All requests for change in contract price and scope shall be accompanied by a breakdown list of materials with unit and extended prices and labor hours with unit and extended price, plus markups that have been applied.

## 1.20 COORDINATION

- A. Contractor shall be responsible to coordinate his work with that of other trades to adjust to field conditions prior to commencing work. If a reasonable solution cannot be achieved without compromising the integrity of the intended design or would result in additional cost the Architect must be notified immediately prior to commencement of work. Failure to do so does not relieve the Contractor from providing and installing the systems to the satisfaction of the Architect at no additional cost.
- B. Contractor shall be responsible to review job conditions and identify conflicts and/or obstructions to ductwork and piping prior to fabrication. If conflicts and/or obstructions are noted the Architect must be notified immediately prior to commencement of work. The cost of any fabrication work performed without confirmation and notification of conflicts and/or obstructions shall be the responsibility of the contractor.

## 1.21 WORKPLACE SAFETY

Mechanical contractor shall be responsible for the safety of his workpeople.

## PART 2 - PRODUCTS

## 2.01 PIPING

## A. General

Provide and erect in accordance with best practice of trade all hot water supply, hot water return, drain and vent piping shown on the plans and as required to complete intended installation. Contractor shall make offsets as shown or required to place all piping in proper position to avoid other work, and to allow application of insulation and finish painting.

## B. Pipe Materials:

- |    |   |  |
|----|---|--|
| 1. | Heating hot water, 2½ inches and larger.  | Schedule 40 standard weight black steel, ASTM 12       |
| 2. | Heating hot water mains, 2 inches and smaller, cold water, drains from relief valves and automatic vents. | Type “L” hard drawn copper tubing with sweat fittings. |
| 3. | Heating water runouts to radiation, above grade, 180°F.maximum.   | PEX crosslinked flexible tubing, ASTM F876 and F877.   |

## C. Pipe Fittings:

- |    |                          |  |
|----|--------------------------|--|
| 1. | Screwed                  | ASTM 125# cast iron screwed, ASTM A126, ASA B16.1  |
| 2. | Welded                   | Standard weight butt weld carbon steel, ASTM A234, ANSI B16.9 from A106 Gr. B. seamless Tube |
| 3. | Unions                   | 250 malleable iron, brass to iron seats  |
| 4. | Flanges                  | 150# forged steel slip-on ASTM A234  |
| 5. | Sweat                    | Cast bronze or wrought copper made up with 95-5 solder                                       |
| 6. | Connections to equipment | 2 inches and smaller – unions, 2 ½ inches and larger – flanged.                              |

- D. All heating hot water mains 2½ inches and larger shall have welded connections using standard factory-fabricated tees, elbows, reducers, and caps. Branch outlets in welded sizes shall be made with tees for full size or one size reduction and with either "Weldolets" and "Threadolets" or factory shaped nipples for all other sizes. All welds shall be made by welders certified by the State of Maine and shall be capable of welding in any position "in the field". All welds shall conform with the rules set forth in the Standard Manual on Pipe Welding of the Heating, Piping and Air Conditioning Contractors national Association. All slip on fittings shall be back welded. Fire extinguishing equipment shall be kept within 25 feet of welding areas at all times. Contractor shall take additional measures when welding close to wood structures to protect the wood from igniting.
- E. All metallic piping 2 inches in size and smaller shall be type "L" hard drawn copper tube with sweat fittings.
- F. The Mechanical Contractor may, at his option, use schedule 40 standard weight black steel, ASTM 12, with threaded fittings for piping 2 inches and smaller in lieu of copper. The option of steel or copper MUST be stipulated in the bid and thereafter no deviation will be acceptable. If steel is to be used, the piping system shall be 100% steel with no mixture from copper to steel.
- G. The Mechanical Contractor may also, at his option, use an IPS Grooved Piping System in lieu of welded, flanged and threaded connectors for steel piping 2½ inches in size and larger. If this system is to be utilized contractor must state so very clearly in his bid and the system shall be 100% grooved. System shall employ grooved mechanical pipe couplings, fittings, valves and other grooved components. All grooved components shall be of one manufacturer, and conform to local code approval and/or as listed by ANSI-B-31.1, B-31.3, B-31.9, ASME, UL/ULC, FM, IAPMO or BOCA. Grooved end product manufacturer to be ISO-9001 certified. Grooved couplings shall meet the requirements of ASTM F-1476. System shall be by Victaulic or approved equal.
1. Pipe shall be Schedule 40 standard weight black steel, ASTM 12 - Roll or cut grooved-ends as appropriate to pipe material, wall thickness, pressures, size and method of joining. Pipe ends to be grooved in accordance with Victaulic current listed standards conforming to ANSI/AWWA C-606.
  2. Mechanical couplings shall be manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure-responsive synthetic rubber, grade "E" EPDM. There shall be two type of couplings utilized:
    - a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9, and NFPA 13. Victaulic Style 07 (Zero-Flex®).

- b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three Couplings shall be placed in close proximity to the vibration source. Victaulic Style 75 or 77.
- 3. Flange Adapters: For use with grooved end pipe and fittings, for mating to ANSI Class 125 / 150 flanges. Victaulic Style 741.
- 4. Grooved End Fittings: Fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12.
- 5. Hole-Cut Branch Outlets: Branch reductions on 2 inch through 8 inch header piping. Bolted branch outlets shall be manufactured from ductile iron conforming to ASTM A-536, Grade 65-45-12, with synthetic rubber gasket, and heat treated carbon steel zinc plated bolts and nuts conforming to physical properties of ASTM A-183. Victaulic Style 920 / 920N.
- 6. Grooved End Valves
  - a. Butterfly Valves are not permissible.
  - b. Ball valves in 2½ size shall be lever operated, 1,000 psi CWP suitable for bidirectional and dead-end service at full rated pressure. Body shall be grooved end black enamel coated ductile iron conforming to ASTM A536. Ball shall be chrome plated carbon steel with chrome plated carbon steel stem. Victaulic 726.
  - c. Check valves in 2½ inch size shall be spring assisted, PPS coated ductile iron body, ASTM A-536, Grade 65-45-12, aluminum bronze non-slam tilting disc, stainless steel spring and shaft, EPDM rubber seat, 300 psi (2065 kPa). Victaulic Series 716.
- 7. Grooved End Specialties
 

Dielectric waterways: 1 inch through 8 inch sizes, grooved, plain end, or threaded end, ASTM A-53 carbon steel or ASTM A-536 ductile iron body, zinc electroplated, with LTHS high temperature stabilized polyolefin polymer liner. Victaulic Style 47.
- 8. Assembly
  - a. Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove.
  - b. The gasket style and elastomeric material (grade) shall be verified as suitable for the intended service as specified.
  - c. See the latest copy of Victaulic's Field Assembly and Installation Instruction Pocket Handbook (I-100).
  - d. All grooved components (couplings, fittings, valves, gaskets, and specialties) shall be of one manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

- e. Manufacturer shall provide on-site training for contractor’s field personnel by a factory-trained representative in the proper use of grooving tools, application of groove, and product installation. Manufacturer’s authorized representative shall periodically visit the job site and inspect installation. Contractor shall remove and replace any improperly installed products.

2.02 VALVES

A. General

- 1. Valves shall be provided as shown and as required to make the installation and its apparatus complete in operation, locate to permit easy operation, replacement and repair. All pressures specified are steam working pressure.
- 2. All valves must be so constructed that they may be repacked under pressure while open.
- 3. Globe valves shall be installed in all lines where regulation is required.
- 4. Check valves shall be installed in all lines where flow may reverse from intended direction.
- 5. Except for above or as otherwise noted on drawings, ball valves shall be installed in all supply and return lines and on all drain lines.
- 6. All valves to comply with federal specifications and be so listed.
- 7. Butterfly valves shall not be used.

B. Types and Manufacturers

All valves shall be of one manufacturer and by one of the manufacturers listed. The following list is provided as a means of identifying the quality and type required.

- 1. Gate Valves 2 inches in size and smaller shall have bronze bodies, rising stem, solid wedge, union bonnet, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1169	1151
Stockham	B-124	B-120
NIBCO	S-134	T-134
Hammond	IB648	IB629

CRESCENT HEIGHTS

2. Globe Valves 2 inches in size and smaller shall have bronze bodies, union bonnet, renewable composition disc for service intended, rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1590-T	590-T
Stockham	B-24-T	B-22-T
NIBCO	S-235-Y	T-235-Y
Hammond	IB423	IB413T

3. Globe Valves (non-Victaulic) 2½ inches in size and larger shall have iron bodies, union trim, OS&Y, bolted bonnet, solid disc, gland packed, flanged ends. Rated for 125# WSP, 200# WOG:

	<u>Flanged Ends</u>
Milwaukee	F-2981
Stockham	G-512
NIBCO	F-718-B
Hammond	IR116

4. Plug type Globe valves 2 inches in size and smaller shall have bronze bodies, union bonnet, stainless steel plug type disc and seat. Rated for 150# WSP, 300# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	591-A	
NIBCO	T-256-AP	

5. Ball valves 1¼ inches in size and smaller shall have bronze bodies, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blow-out proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Ports shall be "full port". Rated for 400# WOG and 350°F:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	BA-350S	BA-300S
Apollo	82-200	82-100
Watts	B-6081	B-6080
NIBCO	-----	-----
Hammond	8614	8604

6. Ball valves 1½ and 2 inches in size shall have bronze bodies, two piece, standard port, Type 316 stainless steel stems and balls, reinforced Teflon seats and seals, blow-out proof stems and adjustable stem gland. Shall be equipped with suitable packing for service intended. Rated for 400# Bar non-shock cold working pressure.

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Apollo	70-200	70-300
Watts	B-6000-SS	B-6001-SS
NIBCO	S-580-66	T-580-66
Hammond	8513	8503

7. Ball valves (non-Victaulic) 2½ inches in size and larger shall have carbon steel bodies, Type 316 stainless steel stems, Type 351 stainless steel balls (vented), glass filled Teflon seats and seals and blow-out proof stems. Shall be equipped with suitable packing for service intended. Rated for 150# WOG and 350°F:

	<u>Flanged Ends</u>
Apollo	88-140
Watts	CF-1500-150-02-T316
NIBCO	F-510-CS-R-66-FS

8. Ball valves for grooved piping systems – see 2.01, G, 6, “Grooved end valves:.
9. Check Valves 2 inches in size and smaller shall be horizontal swing type with bronze body, Teflon disc. Rated for 125# WSP, 200# WOG:

	<u>Soldered Ends</u>	<u>Screwed Ends</u>
Milwaukee	1509-T	509-T
Stockham	B-310-T	B-320-T
NIBCO	S-413-Y	T-413-Y
Hammond	IB945	IB904

10. Check valves (non-Victaulic) 2½ inches in size and larger shall be horizontal swing type with iron body, bronze trim and flanged ends. Rated for 125# WSP, 200# WOG:

	<u>Flanged Ends</u>
Milwaukee	F-2974
Stockham	G-931
NIBCO	F-918-B
Hammond	IR1124

## 2.03 INTERIOR HANGERS AND SUPPORTS

### A. General

- All interior hangers and supports shall be specially manufactured for that purpose and shall be the pattern, design and capacity required for the location of use.
- Piping specified shall not be supported from piping of other trades.
- Hangers shall be steel, adjustable clevis type; plain for steel pipe and copper plated for copper tubing. Carpenter & Paterson, Inc., Fig. 100 (Fig. 100 CT copper plated) or approved equal. Hangers on hot water and drain piping shall be sized for the piping only (not including insulation). Hangers on cold water piping, and where specifically indicated on drawings, shall be sized to include the insulation and include thermal hanger shields (insulated pipe supports).
- Thermal hanger shields shall be Carpenter & Paterson, Inc., Fig. 265P or approved equal.

5. Exposed vertical risers 3/4 inch and smaller shall be supported at the mid-point between floor and ceiling with split ring type hangers; copper plated for copper tubing. Carpenter & Paterson, Inc., Fig. 81 (Fig. 81 CT copper plated) or approved equal.
6. Piping suspended from walls, trench walls and partitions shall be supported by steel support bracket. Carpenter & Paterson, Inc., Fig. 69 or approved equal.
7. All steel hangers shall be factory painted.
8. Supports for PEX tubing shall be designed specifically for PEX material, provided and approved by the tubing manufacturer.

B. Hanger Rods

1. Hanger rods shall be galvanized all thread rod. Rod size shall be as follows:

<u>Pipe Size</u>	<u>Rod Size</u>
1/2" to 2"	3/8"
2 1/2" to 3"	1/2"

2. Provide toggle bolts for fastening to concrete blocks and compound anchor shields for bolts for fastening to poured concrete.
3. Provide lag points with rod couplings or side beam connectors with drive screws for fastening to wood.
4. All nuts for hanger rod to be stainless steel.

C. Supports

Provide and install angle iron supports for pipe hangers as required. Angle iron supports shall be adequate size for span and piping or equipment load.

2.04 PIPE SLEEVES AND ESCUTCHEONS

A. Sleeves

1. Mechanical Contractor shall set sleeves for all piping penetrating walls and floors. Sleeves through masonry shall be steel pipe sleeves two sizes larger than the pipe. Pipe passing through walls other than masonry shall be provided with #24 gauge galvanized steel tubes with wired or hemmed edges.
2. Sleeves set in concrete floor shall finish flush with the underside, but extend a minimum of 1 inch above the finish floor. Sleeves set in partitions shall finish flush with each side.
3. Spaces between sleeves and pipes within building shall be sealed fire and smoke tight. Material shall be 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant, or approved equal. Sealant material shall be U.L. listed.



## B. Escutcheons

Where uninsulated piping passes through finish walls, floors, ceilings and partitions, provide and set two piece nickel plated steel floor and ceiling plates. Provide deep type floor plates as required for projecting sleeves. Piping through walls with insulation or where concealed shall not require escutcheons.

## 2.05 ANCHORS

Anchors shall be provided and installed as detailed and shown on the drawings, or as required to control expansion.

## 2.06 PAINTING

Painting shall be provided for all equipment supports, steel gas piping within boiler room, exposed flanges, fittings and valves within boiler room and mechanical rooms and where specified elsewhere within this section. Temperature control devices *shall not* be field painted.

Painting shall consist of no less than two (2) coats of rust inhibiting paint, Rust'O'leum or approved equal. Fuel oil piping shall be covered with no less than two (2) coats of industrial epoxy designed for resistance to fuel oils. Paint shall be capable of withstanding temperatures of up to 250°F.

Colors shall be as follows:

Equipment supports, exposed flanges, fittings and valves	Flat black
--	------------

All exposed unpainted metal parts of boilers, including foundation, headers and nipples shall be painted with one (1) coat of asphaltic base black paint. Metal shall be thoroughly cleaned of grease, oil, pipe compound, plaster and other dirt before application of paint.

## 2.07 POLYETHYLENE (PEX) HEATING HOT WATER PIPING - ABOVE GROUND

## A. General

Furnish and install complete system of pre-manufactured piping as shown on plans. The system shall consist of flexible crosslinked polyethylene tubing known in the trade as PEX. Tubing shall meet ASTM F876 and F877 standards and shall be capable of service temperatures up to 200°F. and working pressure to 100 psi.

## B. Construction and Components

The carrier pipe shall be PEX flexible crosslinked tubing, internal diameter as indicated on drawings. Connections to copper piping shall be by the tubing manufacturer and be sweat connectors and connections to steel piping shall be threaded connectors, all provided by the tubing manufacturer and installed in strict accordance with manufacturer's instructions.

Insert fittings shall be copper or brass, ASTM F 1807

Crimp rings shall be copper (black for PEX systems), ASTM F 1807

- C. PEX tubing must be labeled (on the tubing) as follows:
1. The manufacturer's name or trademark
  2. The standard to which it conforms (ASTM F876, F877, or both)
  3. Tube size and CTS
  4. Material designation code (PEX0006)
  5. Pressure/temperature rating(s)
  6. SDR9

The marking interval shall be not more than five feet.

## 2.08 HOT WATER SPECIALTIES

### A. Manual (Adjustable) Balancing Valves

1. Return mains and elsewhere as indicated shall be provided with a balancing valve equipped with readout valves to facilitate the connecting of a differential pressure meter where indicated (locate on return lines at each duct coil). Each readout valve shall be fitted with an integral EP check valve designed to minimize system fluid loss during the monitoring process. Each balancing valve shall have an indexing pointer and calibrated name plate to indicate the degree of closure of the precision machine orifice. Each balancing valve is to be constructed with internal O-ring seals to prevent leakage around the rotating element.
2. Valves shall be sized with an operating pressure differential range of 1.50 psig (minimum) to 2.00 psig (maximum).
3. Provide a schedule clearly indicating every valve, its location, GPM, size and pressure drop.
4. Each balancing valve shall be Taco Circuit Setter with a working pressure of 175 psig and a maximum operating temperature of 250°F. Units by Bell & Gossett or Tour and Anderson will be considered.

### B. Automatic (Preset) Balancing Valves

1. All finned radiation, convectors, cabinet unit heaters, unit heaters, unit ventilators and elsewhere as indicated, shall be provided on the return line from each unit with a balancing type valve equipped with readout taps to facilitate the connecting of a differential pressure meter. Valve body shall include a handle ball valve, Y-strainer, flow control cartridge assembly, two (2) pressure/temperature plugs, inlet union and outlet union. Valve bodies shall be line size.
2. Design
  - a. The GPM for the automatic flow control valves shall be factory set and shall automatically limit the rate of flow to within 5% of the specified amount.

- b. For ½ inch to 2 inch sizes the flow cartridge shall be removable from the Y body housing without the use of special tools to provide access for regulator changeout, inspection and cleaning without breaking the main piping (Access shall be similar to that provided for removal of a Y-strainer screen).
- c. True operating ranges of 2 - 32 psid or 5 - 60 psid are required. The design flow should be achieved at the minimum psi differential. A 50% safety factor applied to the lower operating range is not acceptable.
- d. Each valve shall have two PIT ports.
- e. All automatic flow control devices shall be supplied by a single source and certified flow tests, witnessed by a professional engineer, shall be available.
- f. Provide factory product warranty of not less than five (5) years and free first year cartridge exchange.

3. Construction

- a. Internal wear surfaces of the valve cartridge shall be electroless nickel or stainless steel.
- b. Internal flow cartridge body shall have machined threads so the spring free height may be compensated for without the use of fixed shims. A crimped sheet metal design is not acceptable.
- c. Internal flow cartridge shall be permanently marked with the GPM and spring range.
- d. For ½ inch through 2 inch pipe sizes: An assembly shall consist of a brass Y-type body, integral brass body ball valve and 'O' ring type union. Flow Design "AutoFlow" Model AC or approved equal.
- e. For 2½ inch pipe sizes and larger: Ductile iron body suitable for mounting wafer style between standard 150# or 300# flanges. The long flange bolts and nuts shall be provided with each control valve. Flow Design "AutoFlow" Model WS or approved equal.
- f. All valves shall be factory leak tested at 100 psi air under water.

4. Minimum ratings

½ inch through 2 inch pipe size: 400 PSIG at 250DF

5. Flow Verification

- a. Where indicated on the plans, the differential pressure across the Automatic Flow Control Valve shall be measured for flow verification and to determine the amount of system over heading or under pumping.
- b. Flow shall be verified by measuring the differential pressure across the coil served or the wide open temperature control valve and calculating the flow using the coil or valve Cv.

6. Test Kit

A differential pressure test kit shall be supplied to verify flow and measure overheading. The kit shall consist of a 42 inch diaphragm gauge equipped with ten foot hoses and P/T adapters all housed in a vinyl case. Calibration shall be 0-35 PSID for 2-32 PSI spring range or 0 - 65 PSID for 5-60 PSI range.

## 7. Installation

- a. Install automatic flow control valves on the return lines of equipment as indicated on the plans. Balancing valve on supply side is not acceptable.
- b. The standard ports and handles shall clear 1 inch thick insulation. Handle and port extensions are required for over 1 inch thick insulation.
- c. Install, on the supply side of coils, a Y strainer with a brass blowdown valve with  $\frac{3}{4}$  inch hose end connection with cap and chain.

## C. Radiator Valves

All radiation loops shall be provided with ball valves on both supply and return ends for 125 psig at 250°F. as specified under valves.

## D. Drains

Each downfeed convector, cabinet unit heater, unit heater, coil and unit ventilator shall be provided with a drain valve between the shut-off valves and heating equipment at the lowest point in the piping. All low points in piping mains shall be provided with drain valves. Drain valves shall be ball valves as specified under VALVES with hose connections and metal caps. Drain finned radiation with easily accessible drain couplings or drain elbows.

## E. Air Vents

1. Air vents shall be installed at the equipment, all high points in the piping as indicated on the plans or as may be required.
2. Automatic air vents shall be Taco 409 brass vent. Units by Anderson, Armstrong (No. 1-AV) or Sarco will also be considered. Pet cocks shall be installed with each unit and the drains from the vents shall be run as indicated on the plans. An air chamber shall be installed at each air vent and shall be line size for all piping up to 2 inches in size; 2 inch for larger piping. Do not use on glycol systems, use manual vents only.
3. Manual air vents shall consist of air chamber with a Dole No. 14A Coin Valve with copper tube extension. Install valve in accessible location.
4. By-pass type vents shall be installed where shown and as detailed on the drawings. By-pass valves shall be plug-type globe as specified under VALVES.

## F. Expansion Tank

Furnish and install vertical pressurized replaceable bladder type water expansion tank pre-charged to pressure indicated on drawings. Tank shall be constructed of steel for 125 psi working pressure in accordance with ASME Code, and have the necessary tappings for water connections and charging valve. Tank shall be furnished with ASME stamp and certification papers. A copy of ASME certification shall be provided with equipment submittal.

1. Tank shall be installed with a manual shut-off valve between the tank and the system and a union between the tank and the valve.

2. Tank shall be Taco CAX series. Units by Bell & Gossett or Wood will be considered. Capacities shall be as shown on drawings and are minimums.

G. Backflow Preventer

Backflow preventer shall be furnished under division 15400, "PLUMBING".

H. Water Pressure Reducing Valve

Furnish and install a pressure reducing valve with brass body construction and built-in strainer in the cold water piping connected to hot water heating system as shown on the drawings. The valve shall be adjustable and be No. 335, as manufactured by Taco. Units by Bell & Gossett and Watts will be considered. Provide pressure relief valve with operating pressure 100% over system pressure, but not exceeding 100 psi.

I. Flow Control Valve

Furnish and install flow control (flo-check) valves with line size cast iron body and threaded ends for pumps P-4, P-5 and P-6. Working parts shall be easily removable for inspection and cleaning without removing valve body from the pipeline. Taco Model "Flo-Chek" or approved equal by Bell & Gossett.

J. Air Separator

Furnish and install Taco AC25F in-line air separator. The unit shall be flanged and contain a removable strainer and blow down. Unit to be constructed in accordance with A.S.M.E. boiler and pressure vessel code and stamped 125 psig design pressure. Equal equipment by Bell & Gossett will be considered.

K. Flow Metering Station

1. Provide and install a flow metering station in the combined discharge of pumps P-X & P-X as indicated on drawings.
2. Unit shall be designed to thread into a weld-o-let pipe tap.
3. Unit shall include a type 304 stainless steel tube, brass block and vales and all required mounting hardware. Maximum working pressure shall be 200 psig at a maximum temperature of 250°F.
4. Unit shall be designed for the specific pipe size into which it is to be installed.
5. Unit shall be Taco Standard Metering Station 7026 or approved equal.

## L. Pressure Gauges

Furnish and install pressure gauges with gauge cocks on piping where shown on drawings. Tubing to pressure gauges shall be of sufficient length to extend beyond pipe insulation and still leave enough space to easily operate the gauge cock. The dial range shall be such that the normal pressure shall be approximately midway of the dial. Gauges shall be Weiss Series 4CTS with 4½ inch dial size, stainless steel or cast aluminum case, with brass "T" handle cocks and bronze pressure snubbers. Units by Ashcroft, Nurnburg & Trerice will be considered.

Pressure range: Water Systems 0-60 psi

## M. Thermometers

Furnish and install where indicated on the drawings and in Part 3 - EXECUTION, dial type thermometers with stainless steel case, 4½ or 5 inch dial size, bimetal, universal angle type. Thermometers shall be Weiss 5VBM series. Units by Ashcroft, Nurnburg & Trerice will be considered. Provide and install thermometer wells on supply and return branch piping to duct reheat coils (when present) and two thermometers in boxes for the Owner's use.

Temperature Range: Heating System... 30°F. - 240°F.

## 2.09 DOMESTIC HOT WATER STORAGE TANKS AND HEATERS

## A. Storage Water Heaters

Furnish and install hot water storage tank and heaters complete with all accessories as shown on drawings.

## B. Tanks

Tanks shall have sizes and capacities as indicated on drawings, installed in a vertical position and constructed of 316L stainless steel in accordance with the ASME Code for Unfired Pressure Vessels to withstand a working pressure of 150 psi. Tanks shall be provided with a heating element, aquastat control tapping, cold water inlet and drain, hot water outlet and T&P relief valve connection. The heating element in the tank shall consist of a 90/10 cupronickel coil. Storage tank shall be covered with a 2 inch thick closed cell foam insulation. Outer covering shall be heavy duty rigid plastic. The entire unit shall carry a manufacturer's lifetime warranty. All connections shall be standard I.P.S. threads. The tanks shall be the dimension as shown on drawings.

## C. Relief Valve

ASME temperature and pressure relief valves shall be provided and installed on the domestic hot water outlet by section 15400, "PLUMBING"

## D. Units to be Super-Stor Model SS or approved equal.

## 2.10 CIRCULATING PUMPS

## A. Circulating Pumps P-1 and P-2

1. Furnish and install hot water circulating pumps of the type, size and capacity shown on drawings. Pumps shall employ ECM technology, Wilo Stratos or approved equal.
2. Pumps shall be wet rotor, glandless inline circulating pumps and shall include electronic variable speed control to operate at constant/variable differential pressure control without external sensors.
3. Materials and Construction
  - a. Circulating pumps shall be constructed with Cast-Iron bodies with factory applied Catephoresic coating.
  - b. Shafts shall be constructed of high quality stainless steel. Motor bearings shall be metal impregnated carbon sleeve bearing type. Impellers will be constructed of a high strength, glass filled polypropylene engineered composite.
4. Pumps shall include the following features:
  - a. Integrated synchronous motors using ECM technology with permanent magnetic rotors, sensorless control electronics and single phase electronic converters.
  - b. Infra-red (IR) interface for wireless communication and an infra-red monitor.
  - c. Integrated overload motor protection.
  - d. Fault contact "FC" terminals shall be included in the terminal box and are to be potentially free, normally closed contacts that open on the event of a failure.
  - e. Interface (IF) modules shall be included and installed in the terminal box. Modules shall permit BMS communication via LONworks, 0 – 10 volt DC control of speed and head setpoint, external minimum speed, external off, dual pump communication and pump operation status.
  - f. Internal programming to regulate pump on/off operation based on outdoor temperature.
  - g. Internal programming to regulate pump speed in response to changes in system pressure.
  - h. Internal programming to provide lead/lag operation for pumps. Mechanical contractor to provide interface wiring between pumps.
5. Pumps shall have a terminal box with NPT electrical connections and a secure, gasketed cover, Class 2 protection level. Include on the face of the terminal box cover a single adjustment button, front readable graphical pump display, field adjustable for horizontal or vertical positioning of the terminal box. The display shall indicate:
  - a. Operation status
  - b. Control mode

- c. Differential pressure or speed/setpoint
  - d. Fault and warning signals
- 6. Pumps shall have a coded terminal strip indicating common/neutral/ground within the terminal box for field connections for single phase 230 volt, 60 Hz power.
- 7. Electrical
  - a. Motor shall be a minimum of class H winding insulation as defined by UL 778.
  - b. Voltage variances shall be less than +/- 10% from rated voltage with pump under load conditions. Maximum amperage not to be exceeded is indicated on the pump nameplate. Electrical power to the pump is confirmed when the face of the graphic display is lit.
- B. Circulating Pumps P-3, P-4 and P-5
  - 1. Furnish and install hot water circulating pumps of the type, size and capacity shown on drawings. Pump shall be TACO 00 Series Horizontal cartridge design. Pumps by Armstrong, Bell & Gossett or Weinman will be considered.
  - 2. Pumps to be single stage, cast iron bronze fitted construction. Pump shall incorporate a disc type lubrication system and be so designed that the bearing assembly can be removed in one piece.
  - 3. The impeller shall be one piece cast bronze, enclosed type, dynamically and hydraulically balanced and keyed to the shaft. Pump shall have a two piece mechanical seal assembly easily replaceable without the use of special tools.
  - 4. Pump bearing frame assembly, as well as the motor, shall be furnished with oil-lubricated sleeve bearings with readily accessible lubrication fittings.
  - 5. Pumps shall be factory tested at the operating condition, name plated for quiet operation as a unit, thoroughly cleaned and painted with one coat of machinery enamel prior to shipment. A set of installation instructions shall be included with at the time of shipment. Motor shall operate at 1,750 RPM. A set of installation instructions shall be included with each pump at the time of shipment.

## 2.11 BOILER UNITS

- A. Furnish and install where shown on the drawings, condensing, direct vent natural gas fired boiler units. Units shall condensing type with stainless steel burners. Units shall be wired for 120 volts, 1 phase, 60 hertz power, see "Boiler Schedule", sheet M5.
- B. Compliances
  - 1. ASME Compliance: Boilers shall bear ASME "H" stamp and be National-Board listed.
  - 2. FM Compliance: Control devices and control sequences according to requirements of FM.



3. IRI Compliance: Control devices and control sequences according to requirements of IRI.
4. Comply with NFPA 70 for electrical components and installation.
5. CSD-1
6. SCAQMD Rule 1146.2 for low NO<sub>x</sub> equipment
7. BACT Compliant (Best Available Control Technology)

C. Submittals

1. Product Data: Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories for each model indicated.
2. Detail equipment assemblies and indicate dimensions, required clearances, and method of field assembly, components, and location and size of each field connection.
3. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.
4. Source Quality Control Tests and Inspection Reports: Indicate and interpret test results for compliance with performance requirements before shipping.
5. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.
6. Maintenance Data: Include in the maintenance manuals specified in Division 1. Include parts list, maintenance guide, and wiring diagrams for each boiler.

D. Warranties

1. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents. Installing contractor shall provide one year of warranty parts and labor.
2. Special Warranty: Submit a written warranty, executed by the contractor for the heat exchanger.
3. Warranty Period: Manufacturer's standard, but not less than 10 years from date of Substantial Completion on the heat exchanger. Warranty shall be non-prorated and not limited to thermal shock.

H. Components

1. Cast Aluminum Block
2. 30 PSI ASME Relief Valve
3. Drain Valve
4. Stainless steel burner.
5. Direct Spark ignition
6. Variable Speed Blower Assembly
7. Negative Pressure Regulated Gas Valve.
8. 50 VA Transformer
9. Dual Scal T&P Gauge
10. Outlet water temperature sensor
11. Inlet Water Temperature Sensor
12. Flue gas Temperature Sensor
13. Outdoor Temperature Sensor.

## 14 System Water Temperature Sensors

## I. Burner and gas train

1. Burner Firing: Full modulation with 5:1 turndown @ Continuous CO2
2. Burner Ignition: Intermittent spark
3. Safety Controls: Energize ignition (14,000 Volts), limit time for establishing flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, and allow gas valve to open.
4. Flue-Gas Collector: Enclosed combustion chamber with integral combustion-air blower and single venting connection.
5. Gas Train: Manual gas valves (2), main gas valve (solenoid), 'B' valve, pilot gas pressure regulator, and automatic pilot gas valve. All components to be factory mounted.
6. Safety Devices: Low gas pressure switches, air-flow switch, and blocked flue detection switch. All safeties to be factory mounted.

## K. Motors

Open drip-proof motors where satisfactorily housed or remotely located during operation. Blower motor shall be externally mounted for ease of service. There shall be no requirement to remove covers or gas train components to remove the blower motor. Blower motor shall not exceed ½ HP and not require more than 5 amps.

## L. Controls

1. Each boiler shall maintain set temperature as determined by its own internal controls. Temperature shall be reset according to outdoor temperature. Provide outdoor and boiler temperature sensors with each boiler.
2. A domestic hot water override shall be included to provide 180°F. water whenever pump P-5 activates. ATC Contractor shall provide interface between pump controls and override cycle.
3. Controls shall include a "true run time" lead-lag controller to designate one boiler as the lead unit while the other boiler serves as stand-by. The lead boiler shall provide heat and domestic hot water as required by the heating system. Should the lead boiler not be able to meet load demands the stand-by boiler shall become active to supplement the lead boiler.
4. Either boiler shall activate pump P-3 or P-4 whenever the boilers are active. A flow switch mounted in the boiler shall verify flow before permitting boiler(s) to fire. ATC Contractor shall provide interface between pump control and boilers cycle.
5. Boiler manufacturer shall provide qualified personnel to install any controls and wiring requiring field installation. Installer shall work closely with the ATC Contractor to be sure interlocks between boiler controls and building controls are installed and functioning properly.

## M. Units shall be Weil McLain Ultra Series 3, shipped in one piece on skids. Units by the following manufacturers will be considered:

1. Triangle Tube
2. Viessmann
3. Lochinvar

## 4. Buderus

## N. Testing

Testing all pressure parts of the boilers shall be subjected to hydro-static tests according to ASME Code for low pressure boilers. Field tests shall be limited to maximum working pressure for which each boiler is intended. Contractor shall furnish all equipment, piping, water and labor necessary to perform such tests as may be required by the Boiler Inspector or as directed by Architect. Tests shall be of duration necessary to satisfy Boiler Inspector and Architect.

## O. Startup and Commissioning

1. Engage a factory-authorized service representative to assist the Contractor with startup service. Start up to be performed only after complete boiler room operation is field verified to offer a substantial load, and complete system circulation. One-year warranty shall be provided by the manufacturer. One year's service shall be provided by the Contractor. Manufacturer shall also include pricing to provide a factory authorized technician for up to 4 service calls over that one year period.
2. Verify that electrical wiring installation complies with manufacturer's submittal and installation requirements in Division 16 Sections. Do not proceed with boiler startup until wiring installation is acceptable to equipment Installer.
3. Complete manufacturer's installation and startup checklist and verify the following:
  - a. Boiler is level on concrete base.
  - b. Flue and chimney are installed without visible damage.
  - c. No damage is visible to boiler jacket, refractory, or combustion chamber.
  - d. Pressure-reducing valves are checked for correct operation and specified relief pressure. Adjust as required.
  - e. Clearances have been provided and piping is flanged for easy removal and servicing.
  - f. Heating circuit pipes have been connected to correct ports.
  - g. Labels are clearly visible.
  - h. Boiler, burner, and flue are clean and free of construction debris.
  - i. Pressure and temperature gages are installed.
  - j. Control installations are completed.
4. Ensure pumps operate properly.
5. Check operation of pressure-reducing valve on gas train, including venting.
6. Check that fluid-level, flow-switch, and high-temperature interlocks are in place.
7. Start pumps and boilers, and adjust burners to maximum operating efficiency.
  - a. Fill out startup checklist and attach copy with Contractor Startup Report.
  - b. Check and record performance of factory-provided boiler protection devices and firing sequences.
  - c. Check and record performance of boiler fluid-level, flow-switch, and high-temperature interlocks.
  - d. Run-in boilers as recommended or required by manufacturer.

8. Perform the following tests for each firing rate for high/low burners and for 100, 66, and 33 percent load for modulating burners. Adjust boiler combustion efficiency at each firing rate. Measure and record the following:
  - a. Gas pressure on manifold.
  - b. Combustion-air temperature at inlet to burner.
  - c. Flue-gas temperature at boiler discharge.
  - d. Flue-gas carbon-dioxide and oxygen concentration.
  - e. Natural flue draft (if applicable).
9. Measure and record temperature rise through each boiler.

P. One Year Service

Each boiler-burner unit shall be provided with free service period of one (1) year after acceptance by Owner. This service will include parts replacement and repair, excluding normal maintenance and adjustment. This service shall be a factory authorized service.

2.12 VENT PIPE AND COMBUSTION AIR

- A. Vent and combustion air pipe shall meet all requirements of a category IV positive pressure venting systems.
- B. Provide fire stopping collar (provided by smoke pipe manufacturer) at each ceiling and floor as the vent rises through the building.
- C. Vent pipe and accessories shall be PVC Schedule 40 Plastic

2.13 FINNED RADIATION

- A. Finned pipe radiation shall consist of ¾ inch copper tube with aluminum fins. Each radiator shall have the finned length and heating capacity indicated on the drawings.
- B. Covers for all types shall be not less than 18 gauge steel, residential style with full back plates and continuous dampers. Back plate (factory painted) shall be securely fastened to the wall studs with screws at 48 inch centers maximum. Elements shall be supported by approved slide cradles and universal brackets spaced a maximum of 48 inches on center. Provide return line hangers where shown on drawings. Covers shall have baked enamel finish in white color.
- C. Unless shown differently on the drawings, the covers shall be a minimum of 1'-6" longer than the finned length. End covers or wall sleeve and wall sleeve supports shall be provided for each end of the cover.
- D. All ratings shown on the drawings are based on 160°F. average water temperature with a 40°F. temperature drop and 2.0 gallons per minute flow rate. The following types are based on Sterling Radiator Co. to establish a standard:
  1. FP-A: Single tier element, 9.13/16 inches high x 3.1/4 inches deep enclosure with return line hangers, ¾ inch copper tube, 2¾ x 2 ½ inch aluminum fins, 60 per linear foot. Sterling Senior.

- E. Provide itemized list of exact amount of finned tube and cover to be provided in each room and output capacities with submittals.
- F. Units by Haydon, Rittling and Vulcan will be considered. However, if capacities cannot be met in the lengths indicated, additional lengths must be provided to meet minimum required output at no additional cost.
- G. The plans indicate locations that will require zone valves, ball valves and circuit setters in the enclosure. The mechanical contractor will need to supply and install end pieces that will accommodate these components (and in some locations return piping)

#### 2.14 CONVECTORS

- A. Convectors of the size and types listed on the drawings shall be provided and installed. They shall have removable front panels. Backs and end enclosures of the cabinets shall be constructed of not less than 20 gauge steel. Fronts and tops shall be of not less than 18 gauge steel, if less than 48 inches long and 16 gauge if 48 inches or longer. Elements shall consist of round seamless copper tubes, non-ferrous fins securely fastened to the tubing, taps at each end for venting on up-feed units and drains on down-feed units, with ratings as shown on the drawings. Cabinets shall have baked enamel finish in color to be selected by Architect. Provide not less than two (2) color chip cards with submittals (photocopies not acceptable). Ratings shown on the drawings based on 160°F. average water temperature with a 40°F. temperature drop as indicated on the drawings.
- B. The following types are based on Sterling to establish a standard:
  1. Fully recessed with front outlet and inlet grilles, four side overlapping front cover; Type FWG-A. Submittals must indicate the actual output after compensating for inlet grilles.
  2. Surface mount, wall hung, flat top with front outlet grille and bottom inlet; Type W-A.
  3. All units shall be firmly fastened to the walls.
- C. Units by Dun-Ham Bush, Rittling, Trane Co. and Vulcan will be considered.

#### 2.15 CABINET UNIT HEATERS

- A. Cabinet unit heaters shall be provided and installed where shown and fastened securely. The units shall be mounted as indicated on the drawings and shall include multi-blade centrifugal fans with quiet operating three (3) speed high efficiency direct drive motor, insulated casing, coils of copper tubes with aluminum fins, tamper proof access door to motor control switch. Capacities indicated on drawings to be based on 180°F. inlet water with a 20°F. drop.
- B. All units shall be provided with 3 speed fan switch and unit mounted disconnect switch with thermal overload protection, all factory installed and wired.
- C. Cabinets shall be 18-gauge steel with exposed corners and edges rounded, easily removed access panels. Finish shall be factory applied baked enamel in color as selected by Architect on visible surfaces of enclosure or cabinet. Provide two (2) color chip cards with submittals

(photocopies not acceptable).

- D. Cabinet insulation shall be 2 inch thick dual density bonded glass fiber. Exposed side shall be high density erosion proof material suitable for use in airstreams up to 4500 FPM.
- E. Coils shall be evenly spaced aluminum fins mechanically bonded to copper tubes, designed for 200 psi and 220 degrees F.
- F. Provide two (2) sets of 1 inch *pleated media* throwaway type filters for each unit as specified under paragraph 2.19, "FILTERS". One set to be provided WITH each unit from the manufacturer to be used during construction and the other set installed when project is completed.
- G. Units shall be vertical configuration, floor mounted with hot water supply line aquastat provided by A.T.C. Contractor. Models indicated are Sterling. Equivalent models by American Air Filter, McQuay or Trane will be considered.
- H. Shut-off valve, balancing valve, drain valve with metal cap and air vent shall be provided on each unit.

## 2.16 FANS

### A. General

1. Fans with capacities and types shown on the drawings shall be provided and installed. All roof curbs, unless otherwise noted, shall be provided by the fan manufacturer and installed by the General Contractor. This Contractor shall furnish the General Contractor with the correct sizes of roof curbs bases for units supplied.
2. Fan selection shall be based on sloping portion of curve with spare capacity of 20% of total CFM and static pressure without increasing motor size. **Provide full fan curves with submittals that shown the entire operating range of the fan - not just the operating point. Fans that are submitted without this data will not be accepted.**
3. All fans shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be listed by the Canadian Standards Association Testing Laboratory (CSA). Sones indicated on drawings are maximum allowable.
4. All roof fans shall be provided by this Contractor with a continuous ½ inch thick neoprene rubber curb gasket covering the full thickness of the curb wall.
5. All fans shown with vibration isolators on drawings shall be provided with spring type unless otherwise indicated.
6. Motor operated dampers shall be furnished by ATC Contractor.
7. Wall caps shall be provided where indicated and shall include weather hoods extending to the bottom of the outlet. Units shall be 26 gauge (min) steel, primed for field painting and include a 0.020 inch damper with magnetic closure strips. Turn units over to General Contractor for final painting prior to installation. All

units for exhaust fans and range hoods shall be identical in appearance and shall be provided by Aldes Ventilation Corp. (<http://www.americanaldes.com>) 2000 Series or Artis Metals Company (<http://www.artiscaps.com/exhaust.html>). Wall caps provided with fans are not permissible unless they meet these design and construction standards.

8. Roof curbs shall be not less than 13½ inches high, insulated, self-flashing type designed for EPDM roofing systems. Curbs shall include a damper shelf and be structurally designed to adequately support no less than twice the weight of the equipment to be placed on them.

B. Types

1. In order to establish a standard, fan model numbers indicated below are based on Air King and Cook (unless noted otherwise). Equivalent units by Acme and Greenheck ONLY will be considered.
2. Exhaust fans (EF) shall be ceiling mounted, direct driven, centrifugal exhaust fan. Fans shall be Energy Star rated and include a ceiling radiation damper for use in fire rated ceilings. Units shall be Nutone or equal by Broan or Panasonic.

Fan housings shall constructed of 24 gauge galvanized steel. Motors shall be heavy duty, permanent split capacitor, 4 pole, thermally protected. A field wiring compartment with receptacle shall be standard. Blower wheel shall be centrifugal, one piece polymeric. Grille shall be cold rolled steel, powder coated white. Duct collar shall be 4 inch diameter, metal, with backdraft damper. Provide a field fabricated 4 inch to 6 inch diameter duct adapter for each fan.

Provide a switch and turn over to Div 16. for installation. Switch shall turn on both the fan and separate room light (separate) simultaneously. An adjustable delay timer internal to the switch shall permit the fan to continue operation for an additional 20, 40 or 60 minutes when the switch is turned off.

Fire damper assembly shall include a non-asbestos ceramic blanket and a replaceable 165°F. fusible link. Ceiling radiation damper shall be ULC classified and rated for a 3 to 4 hour fire resistance, U.L. listed 555C.

3. EF-1 shall be Cook ACE-D Series centrifugal roof exhauster. Fan shall be a spun aluminum, roof mounted, direct driven, downblast centrifugal exhaust ventilator.

Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

Fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The spun aluminum structural components shall be constructed of minimum 16 gauge marine alloy aluminum, bolted to a rigid aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. The discharge baffle shall have a rolled bead for added strength. An integral conduit chase shall be provided through the curb cap and into the motor compartment to facilitate wiring connections. Bearings and drives shall be mounted

on a minimum 14 gauge steel power assembly, isolated from the unit structure with rubber vibration isolators. These components shall be enclosed in a weather-tight compartment, separated from the exhaust airstream. Unit shall bear an engraved aluminum nameplate and shall be shipped in ISTA certified transit tested packaging.

Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, *Balance Quality and Vibration Levels for Fans*.

Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure. A disconnect device/switch shall be factory installed and wired from the fan motor to a junction box. Standard wiring shall comply with National Electric Code and NBFU Standards and the fan shall be listed by Underwriters Laboratories (UL705). Thermal overload protectors shall be standard.

Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

Accessories shall include:

- a. Fully insulated roof curb with damper shelf
  - b. Gravity shutter
  - c. Hinged base
4. BF-1 Shall be a Fantech Model DBF4XL Dryer Exhaust Boosters.

Inline fan shall be of the centrifugal, direct driven type.

Construction

- a. Fan housing shall be constructed of heavy gauge galvanized sheet metal.
- b. Internal air straightening vanes shall be provided for maximum air performance.
- c. Fan shall be supplied with externally mounted electrical terminal box and pre-wired terminal strip connections.
- d. Capacitor shall be enclosed within the fan electrical junction box.

Motor

- a. Motorized impeller shall be an external rotor type, class B insulation, totally enclosed permanent split capacitor type.
- b. Bearings shall be permanently sealed self lubricating ball type.
- c. Motor shall be equipped with automatic reset thermal overload protection.
- d. Motor shall be acceptable for continuous duty.

Wheel



- a. Fan wheel shall be of the backward inclined centrifugal type with a well designed inlet venture for maximum performance.
- b. Motorized impeller shall be both statically and dynamically balanced as one intragal unit to provide for vibration free performance.

#### Switch

- a. Integral positive pressure sensing switch shall be mounted on the fan and prewired to the terminal strip provided in fan electrical junction box.
- b. Switch shall be set to 0.05' w.g. static pressure
- c. Switch shall incorporate a delay-on-break timer cycle to maintain fan performance for intervals of 10 minutes until drying cycle is completed.

#### Performance

- a. Fan performance shall be based on tests conducted in accordance with HVI.

#### Code Approval

- a. Fan shall be tested and approved by UL for safety. Rating shall include approval for residential dryer exhaust and air stream temperature of at least 60 deg. c.

### 2.17 RANGE HOODS (RH)

- A. Apartment kitchen range hoods shall be designed for under cabinet mounting, ducted operation, provided with (2) fluorescent lamps, 2 speed fan switch and light switch. Lamps to be provided with the units. Units to be 30 inches wide, baked-on white polyester finish with washable aluminum mesh grease filter.
- B. Units shall be Nutone ESN1030WH or approved equal with rear and top knockouts for 10 x 3¼ inch ductwork with integral shutter. Adapters for transition to round ductwork shall be provided under par. 2.23, "SHEETMETAL". Units shall be configured as shown on plans and labeled as Energy Star compliant.

### 2.18 SHEETMETAL

#### A. General

The work under this section includes all the required sheetmetal and duct work, extensions for grilles, manual dampers, automatic counterbalanced (backdraft) dampers, deflectors, setting of control dampers, grilles, registers, , flexible connections, fire dampers, and louvers, as shown on the drawings or required to make the installation complete in accordance with the intent of the drawings and specifications.

#### B. Ducts

- 1. The size of ducts marked on the drawings will be adhered to as closely as possible. The right is reserved to vary duct sizes to accommodate structural conditions during

the progress of the work without additional cost to the Owners. The duct layout is schematic to indicate size and general arrangement only. All ducts shall be arranged to adjust to "field conditions". The Sheet Metal Contractor shall coordinate his work with Division 16 and other trades.

2. Medium and low pressure ducts shall be constructed of galvanized steel in accordance with the following table of duct sizes OR the latest SMACNA HVAC Duct Construction Standards for Metal and Flexible Duct, whichever is stricter, unless otherwise shown on drawings.

<u>Dimensions of Longest Side</u> (inches)	<u>Minimum Sheet</u> <u>Metal Gauge</u>
Up thru 12	26
13 --> 30	24
31 --> 42	22

3. Methods of fabrication and installation shall be in strict accordance with guidelines set forth in the latest SMACNA Guide and Data Book for Low and Medium Pressure Duct Construction unless otherwise shown on drawings. Cross break all ducts with largest dimension being 18 inches and larger. Beaded ducts are not acceptable except for ductwork less than 18 inches in either direction.
4. All dampers and deflectors shall be a minimum of #22 gauge and stiffened as required. Splitter dampers shall not be acceptable.
5. All joints in ducts shall be made air tight, and all branches and turns shall be made with long radius elbows and fittings. Long radius elbows are defined as having a centerline radius of 12 times the width of the duct. If long radius elbows are not used, elbows 18 inches wide and larger shall be provided with fixed double wall airfoil turning vanes designed to reduce the resistance of the elbow to the equivalent of a long radius elbow with a throat radius of not less than duct width. Square elbows less than 18 inches wide shall be provided with single wall turning vanes. Square elbows with outside corners cut at 45° or rounded are not acceptable.
6. All ducts shall be installed with necessary offsets, changes in cross sections, risers, and drops which may be required. They shall be constructed with approved joints and be supported in an approved manner.
7. Round ductwork shall be constructed in accordance with the latest SMACNA HVAC Duct Construction Standards for round and oval duct construction. Ductwork larger than 8 inches in diameter shall employ spiral seams. All turns shall be made with smooth (not segmented), long radius elbows and fittings. All seams shall be type RL-5, grooved seam pipe lock or better. *Lap seams are not permissible.* Gauge thicknesses shall be as outlined in SMACNA for galvanized steel round duct gauge selections for maximum 2 inches w.g. static pressure. Ductwork shall be supported with full wrap-around band and single hanger strap as indicated in Figure 4-4 of the 1985 edition of the SMACNA HVAC Duct Construction Standards handbook.
8. Furnish and install flexible connections where indicated. Connections shall be made

from Ventglas neoprene coated glass fabric as furnished by Ventfabrics, Inc., or approved equal.

9. Every precaution shall be taken to keep interior of duct system free from dirt and rubbish and to protect all ducts and equipment during construction. At completion, this Mechanical Contractor shall thoroughly clean all equipment to the satisfaction of the Architect.
10. Spaces between ducts and wall, ceiling or floor construction shall be caulked to make smoke and water tight with 3M brand fire barrier caulk CP25 or putty 303, Ciba-Geigy CS240 Firestop Sealant or approved equal.
11. Testing, Balancing and Leak Testing... See Part 3, EXECUTION
12. Requirements set forth in applicable codes (see part one) shall supercede SMACNA standards.
13. Wall caps shall be provided for exhaust fans and range hoods where indicated and shall include weather hoods extending to the bottom of the outlet. Units shall be 26 gauge (min) steel, primed for field painting and include a 0.020 inch damper with magnetic closure strips. Turn units over to General Contractor for final painting prior to installation. All units for exhaust fans and range hoods shall be identical in appearance and shall be provided by Aldes Ventilation Corp. (<http://www.americanaldes.com>) 2000 Series or Artis Metals Company (<http://www.artiscaps.com/exhaust.html>). Wall caps provided with fans are not permissible unless they meet these design and construction standards.

#### C. Grilles and Registers

Grilles and/or registers shall be installed at all air supply, relief, return and exhaust openings as shown. All units to be aluminum, except as noted, and provided with baked enamel finish to match color of grille or register and countersunk screw holes. Mounting screws shall be oval head type with head painted to match finish. Unless stated otherwise, the following list is based on model numbers of Anemostat to establish a standard of quality. Krueger, Price and Titus only will be considered for review. If substituting, certified sound criteria shall be included with submittals (and highlighted) indicating CFM and NC levels of each register and grille.

1. Supply Registers: Double deflection; X2HO with opposed blade damper and ¾ inch front blade spacing; front blades set horizontal.
2. Supply Grilles: Double deflection; X2H, ¾ inch blade spacing; front blades set horizontal.
3. Exhaust and Return Registers: X3HOD with opposed blade damper and ¾ inch, 45° front blade spacing, front blades set horizontal.
4. Exhaust and Return Grilles: X3H with ¾ inch, 45° front blade spacing, front blades set horizontal.

## D. Louvers

1. All exterior louvers shall be extruded aluminum construction with interior bird screens and anodized in color to be selected by Architect. Provide not less than 2 color chip cards with submittals for review (photocopies not acceptable). Frames and blades shall a free area of not less than 47% (combination type) and 55% (stationary type) and no less than 0.081 inches thick. The following list is based on model numbers of Ruskin to establish a standard of quality; approved equal units by American Air Warming and Arrow are acceptable.
2. All louvers shall be stationary blade type. Units to be 6 inches deep with certified rating of zero water penetration at free area velocity of 900 FPM based on tests in accordance with AMCA Standard 500. Units 48 inches and less in width shall be Model ELF6375X. Units greater than 48 inches in width shall have drainable blades, Model ELF6375DX.
3. Frames of all louvers to be box type for mounting in masonry walls. with factory mounting flanges on head and side jambs with extended sill for units mounted in frame walls.
4. Louvers in doors shall be provided as a part of the door by the General Contractor.

## E. Roof Exhaust Vents

Roof exhaust vents to be heavy gauge aluminum, curb mounted, removable hood, with inside bird screens. Curbs to be provided with vents. Acme Model LQV or approved equal.

## F. Duct Sleeves

Provide aluminum duct sleeves through outside wall at all locations as shown on drawings.

## G. Sealing of Ducts

All interior ductwork (except prefabricated grease ducts and welded duct) shall be sealed with low VOC water based duct mastic, either "MP" (Multi-Purpose), Hardcast "Iron-grip 601", Polymer Adhesive "Airseal #11", or United Duct Seal (United McGill Corp.) water base, latex or acrylic type sealant. All transverse joints to be continuously sealed. Note that, except as noted, oil or solvent based sealants are specifically prohibited for use on this project. Duct tape, in any form or material, is also prohibited.

For exterior applications, "Uni-Weather" (United McGill Corp.) neoprene based sealant shall be used. No other sealants may be used.

All seams and joints in shop and field fabricated ductwork shall be sealed by applying one layer of sealant, then immediately spanning the joint with a single layer of 3" wide open weave fiberglass tape. Sufficient additional sealant shall then be applied to completely imbed the cloth.

All sealants shall be UL rated at no more than flame spread of 5 and smoke developed of 0. At contractor's option Hardcast 1602 sealant tape may be used in lap joints and flat seams.

#### H. Duct Access Doors

Hinged insulated access doors with seals shall be provided in ducts where indicated on drawings, or as required. Units shall be provided at each manual damper, motor operated damper, duct coil (both sides), duct mounted temperature control device and fire damper unless accessible through grilles and as shown on drawings. Units to be Ruskin Model ADH-22 for rectangular duct and Model ADR for round duct or approved equal by Elmdor.

#### I. Motor Operated Dampers

Motor operated control dampers mounted in ductwork shall be provided by ATC Contractor, but installed by this Contractor. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight seal between damper frames and ductwork.

#### J. Manual Dampers

1. See Part 3, EXECUTION for installation notes.
2. Manual dampers with smallest dimension 5 inches or less shall be shop fabricated, single 22 gauge blade, 3/8 inch rod, provided with position indicator and locking quadrant.
3. Manual dampers with smallest dimension larger than 5 inches but smaller than 11 inches shall be single blade steel, 16 gauge construction, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
4. Manual dampers with smallest dimension larger than 11 inches shall be opposed blade steel, 16 gauge construction, linkage concealed in frame, provided with position indicator and locking quadrant. Unit shall be Ruskin Type MD35 or approved equal.
5. Dampers to be installed in aluminum ductwork shall be fabricated of aluminum or isolated from ductwork with rubber grommets between the damper and the duct to prevent oxidation between dissimilar metals.
6. Provide hand quadrants for all manual dampers, Ventline Model 560 or approved equal.

#### K. Backdraft Dampers

Except where provided with exhaust fans, provide and install automatic counterbalanced backdraft dampers where indicated on the drawings. Unit frames shall be channel type, constructed of 0.090 inch extruded aluminum. Blades shall be 0.025 inch formed aluminum with extruded vinyl edge seals. Unit shall employ aluminum blade linkage concealed in the frame and adjustable zinc plated counterbalance bar on blades (except on top blade). Units shall be capable of being mounted in any position, Ruskin Model CBD2 or approved equal. Contractor shall seal dampers to ductwork to provide a completely waterproof and airtight

seal between damper frames and ductwork.

#### L. Fire Dampers

1. Fire dampers shall be installed to comply with NFPA Code No. 90A and shall bear a U.L. label. Provide fire rated access door at each fire damper not accessible through grille.
2. All fire dampers to be provided by damper manufacturer with integral sleeves (where required) and mounting angles. Sleeves provided "in-field" are not acceptable. Models indicated are Ruskin to establish a standard:
  - a. Wall and floor types; Model IBDT, style "B".
  - b. Wall type behind grilles; Model IBD20, Style G
  - c. Ceiling type above registers and grilles, Model CFD2W.
  - d. Ceiling type in range hood ducts, Model CFDR3W.
3. Provide factory mounted fusible links designed to melt at 165°F. and close the damper.
4. Installation shall be in accordance with damper manufacturer's instructions.

#### 2.19 FILTERS

- A. All cabinet unit heaters with filter banks shall be provided with a minimum of three (3) sets of filters with pleated media. One set to be used during construction (and replaced by the Mechanical Contractor during construction if required as determined by the Clerk of the Works and/or the Mechanical Engineer). Second set to be installed a minimum of one (1) day and a maximum of three (3) days prior to testing and balancing and/or final inspection. The third set shall be turned over to the Owner in their original unopened shipping boxes for their future use.
- B. Filters shall be Farr 30/30, Air Guard DP-40 or approved equal; 1 inch thick.

#### 2.20 EQUIPMENT IDENTIFICATION

Tag each fan (except kitchen range hoods and toilet exhaust fans), circulating pump, boiler, unit ventilator, unit heater, cabinet unit heater, compressor/condenser unit and switch with rectangular engraved nameplates with white letters on black, Brady Corp., Seton Name Plate Corp. or approved equals. Nameplates shall be mechanically fastened to equipment (adhesives are not acceptable). Embossed labels are not acceptable.

Boiler nameplates shall be 4 inches by 1½ inches, Setonply Style No. M1774. On all other units nameplates shall be 2½ inches by ¾ inch, Setonply Style No. M1771.

Identify all heating hot water supply and return mains with "Set Mark" full snap-around pipe markers by Seton Name Plate Corporation or approved equal by Brady Corp. Markers shall include both identification and direction of flow. Use yellow background with black letters. Markers shall be no less than 10 feet apart except in mechanical room where they shall be not less than 20 feet apart. Identification shall read "Heating Water Supply" or "Heating Water Return" as applicable. Domestic hot and cold water piping shall be labeled differently from heating water piping.

Tag all valves (if not tagged by valve manufacturer) with 1½ inch round brass tags and #6 bead chains, Seton #M4506. Tag shall be consecutively numbered. Provide valve charts identifying valve number, valve identification and service. Mount charts in Mechanical Room in 8½ inch x 10 inch and 8½ inch x 11 inch self-closing aluminum frame with plastic windows. Identify ducts and fire dampers with ventmark HVAC markers.

2.21 INSULATION AND CONDENSATE PROTECTION

A. General

1. Insulation shall be provided for all new metallic hot water supply and return piping, outside air intakes, exhaust ducts, relief ducts and other insulation where shown on drawings.
2. Insulation systems shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.

B. Hot Water Supply & Return Piping

1. All new metallic hot water supply and return piping, exposed, above ceilings, within walls, pipe chases or pipe enclosures, shall be insulated with heavy density fiberglass pipe insulation with 450°F. temperature rating and factory applied ASJ jacket. Longitudinal jacket flaps to be secured with flare type stainless steel staples. Cut insulation to include pipe hangers.

Insulation thickness for hot water shall be as follows:

<u>Pipe Size</u>	<u>Insulation Thickness</u>
½" - 2"	1"
2½" and larger	1½"

2. All fittings shall be wrapped with fiberglass insulation and covered with a one piece PVC insulated fitting cover secured with flare type stainless steel staples.
3. The ends of insulation on exposed pipes at valves, flanges, unions, etc., shall be finished neat with covering to match jacket and secured with mastic.
4. All valves 2½ inches and larger shall be wrapped with fiberglass insulation, covered and finished neat with covering material to match ASJ jacket on pipe insulation and secured with mastic.
5. Valves less than 2½ inches in size, flanges and unions shall not be insulated. Exception: All valves for cold water application shall be insulated.
6. PEX tubing needs no insulation.

C. Duct and Equipment Insulation

1. Insulate the following ducts with 3 inches thick fiberglass duct wrap with factory applied vapor barrier facing:
  - a. Ductwork from EF-1 (Elevator Machine Room) to the exterior wall.
  - b. Intake plenum behind louver for SF-1 and boiler combustion air in Mechanical Room.
  - c. Exhaust ducts connected to apartment range hoods from exterior walls to 72" inside building.
  - d. Ducts connected to all indoor exhaust fans from exterior walls to 72" inside building.
2. Material to carry U. L. label. All laps to be sealed and held in place with adhesive and flare staples. All lap joints to be folded under before stapling so no raw insulation will be showing. On the bottom of ducts 24 inches or wider, mechanical fasteners shall be provided approximately 12 inches O.C.

D. Air Separator

Air Separator shall be insulated with 2 inch thick heavy density fiberglass insulation with ASJ jacket. Insulation to be securely fastened. Finish cover insulation with 14 ounce re-wettable canvas. Note: Manufacturer's identification plates shall remain exposed with insulation material tapered down to plate and finished as specified above.

E. Condensate Protection

Solder or weld bottom and sides of ducts connected to outdoors to prevent water leaks from rain and snow. Seal duct wrap and liner to minimize condensation.

F. Installation

All insulation work shall be executed by skilled insulation workmen regularly employed in the trade.

2.22 AUTOMATIC TEMPERATURE CONTROL (ATC)

A. General

1. Furnish and install a complete system of electric/electronic temperature controls.
2. The control systems shall be provided and installed by trained control mechanics regularly employed in installation and calibration of ATC equipment by the manufacturer or manufacturer's franchised dealer of temperature control equipment.

NOTE: Control installation is not acceptable by wholesalers, contractors or by any firm whose principal business is not directly involved with the manufacture and installation of ATC systems.



Approved manufacturers and vendors are as follows

- a. T.A.C.  
Maine Controls  
400 Presumpscot Street  
Portland, Maine 04103  
(207) 774-0220
  - b. Honeywell, Inc.  
501 County Road  
Westbrook, Maine 04092  
(207) 775-3501
  - c. Trident, Inc.  
187 Gray Road  
Cumberland Center, Maine 04021  
(207) 829-4001
  - d. Johnson Controls  
39 Salem Street  
P.O. Box 840  
Lynnfield, MA 01940  
1-800-288-1028, ext. 4478
3. Shop drawings of entire control system shall be submitted for approval before work is started. ATC Contractor is required to attend a meeting with the Engineer, Mechanical Contractor and Commissioning Agent along with a preliminary copy of the ATC shop drawings for the purpose of coordination.
  4. Provide ATC technician to test the complete ATC systems sequences for specified cycles of operation with the Testing and Balancing Contractor.
  5. ATC Contractor must, at the end of the warranty period, furnish the Owner with all access codes and passwords assigned to the ATC control systems. ATC Contractor shall also instruct the Owner in the use and operation of the entire control system, including any software all control software that may be utilized (including a backup copy of the final software package to the Owner on CD), see paragraph F, "Instruction and Adjustment".

**B. Scope**

Control system shall consist of all area thermostats, air stream thermostats, valves, dampers, damper operators, relays, transformers, labor, 7 day program clocks and other accessory equipment, and a complete system of wiring to fulfill intent of ATC specification. Control shall be provided for, but not limited to the following:

1. Direct radiation
2. Fans operated by automatic temperature control system
3. Cabinet and horizontal unit heaters
4. Control of circulating Pumps.
5. Control of domestic hot water

## C. Incidental Work by Others

1. The following incidental work shall be furnished by the designated contractor under the supervision of the Control Contractor.
  - a. Mechanical Contractor shall:
    - (1) Install automatic valves and separable wells that are specified to be supplied by the Control Contractor.
    - (2) Furnish and install all necessary valved pressure taps, water, drain and overflow connections and piping.
  - b. Sheet Metal Contractor shall:
    - (1) Install all automatic dampers.
    - (2) Provide necessary blank-off plates required to install dampers that are smaller than duct size.
    - (3) Assemble multiple section dampers with required interconnecting linkages and extend required number of shafts through duct for external mounting of damper motors.
    - (4) Provide access doors or other approved means of access through ducts for service to control equipment.
  - c. The General Contractor shall:
    - (1) Provide all necessary cutting, patching and painting.
    - (2) Provide access doors or other approved means of access through ceilings and walls for service to control equipment.
  - d. Division 16 shall:
    - (1) Provide wiring as described in Fan Schedule on sheet M-X.
    - (2) Wire power to all motor operated dampers.

## D. Electric Wiring

1. All low voltage and data wiring for installation of temperature controls shall be by ATC Contractor, except as noted. Power wiring for equipment shall be by Division 16, "ELECTRICAL". See Part 1, Paragraph 1.05, sub-paragraph C, "MECHANICAL ELECTRICAL WORK" for specific requirements.
2. ATC Contractor shall be responsible for coordinating installation of his wiring conduits with Division 16, "ELECTRICAL".

## E. Submittal Brochure

1. The following shall be submitted for approval:
  - a. Control drawings with detailed wiring diagrams, including bill of material and description of operation for all systems.
  - b. Panel layouts and name plate lists for all local and central panels.

- c. Valve and damper schedules showing size, configuration, capacity and location of all equipment.
- d. Product data for all control system components.

F. Instruction and Adjustment

Upon completion of the project, the ATC Contractor shall:

- 1. Adjust for use by Owner, all thermostats, controllers, valves, damper operators, and relays provided under this section.
- 2. Furnish two (2) instruction manuals covering function and operation of control systems for use of the Owner's operating personnel. A competent technician shall be provided for instruction purposes.
- 3. Provide training in the setting, use and care of the ATC systems. Training shall commence after the Owner has taken possession of the building and shall not exceed three (3) hours. Cost of additional training shall be negotiated between the Owner and ATC Contractor.

G. Guarantee

Control system shall be guaranteed to be free from original defects in both material and workmanship for a period of not less than one (1) year of normal use and service. This guarantee shall become effective starting the date Architect agrees Owner has begun to receive beneficial use of the system.

H. Hazardous Materials

Mercury, or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the ATC system.

I. Control Panels

- 1. Provide and install surface mounted control panel with dust tight gasketed, hinged door with enamel finish in Mechanical Room where indicated on the drawings. All switches, relays and equipment necessary for system operation shall be provided in control panel including the following:
  - a. Separate thermometers indicating outdoor air and re-set water temperature (on face of panel).
  - b. Pump selector switches (on face of panel) where applicable.
  - c. Install engraved plastic identifying tags for each switch on unit.
- 2. All electric wiring within the panel shall be factory wired to terminal strips.

J. Thermostats

1. General

All thermostats shall be mounted as required by ADA standards but not higher than 48 inches above finish floor to top.

2. Apartments and common areas.

- a. Direct Radiation: Thermostats shall be low voltage, digital, single temperature, with large backlit L.E.D. temperature display.
- b. Thermostats shall not contain mercury or any other toxic material.
- c. Honeywell T8775A1005 for heating only or approved equal.
- d. Provide clear, tamperproof covers in corridors and common areas

3. Public areas– same as apartments and common areas but with clear, tamperproof cover.

4. Fan thermostats

Heavy duty, line voltage, all metal type. Reverse acting (cooling).

5. Cabinet unit heaters

- a. These thermostats shall be of the single temperature type intended for use in visible areas.
- b. Heavy duty with concealed adjustment and heavy duty clear plastic tamper proof covers.

K. Automatic Control Valves

All automatic control valves for direct radiation shall be two position. Valves shall be quiet in operation and fail safe in the normally open position in the event of control power failure.

All control valves shall be line size and guaranteed to meet the heating loads as specified. All control valves shall be suitable for the pressure conditions and shall close against the differential pressure involved. Valve operators shall be low voltage. Body pressure rating and connection type (screwed or sweat) shall conform to pipe schedule in this specification.

L. Miscellaneous Devices

Provide all the necessary relays, transformers, valves, positioners, switches, etc. to make a complete and operable system.

M. Dampers

1. Control dampers shall have 16 gauge galvanized frames not less than 2 inches in width with airfoil blades not less than 14 gauge galvanized steel, and shall be adequately braced to form a rigid assembly. No dampers shall have blades more than 6 inches wide. Dampers shall be painted with one coat of lacquer. Dampers shall be two position or proportioning as required by specific application, opposed blade type with linkage concealed within the frame. Oilite bronze bearings shall be

provided at the ends of damper blades. ALL DAMPERS SHALL BE MOUNTED WITH BLADES ORIENTED HORIZONTALLY.

2. Damper operators shall be provided with bracket arrangement for location outside of air stream wherever possible. All damper motors shall be sufficient size to operate dampers, including slow opening and fast closing.
3. Dampers shall be provided with flexible metal edge and jamb seals and neoprene blade edge seals for tight closure. Leakage shall be certified to be no more than 2.0 CFM per square foot at 1 inch w.g. on units 24 inches wide and larger, 3.0 CFM per square foot at 1 inch w.g. on units less than 24 inches wide.
4. Control dampers furnished by the Automatic Temperature Control Contractor shall include motor operated dampers installed in supply fan 1 and 2 ducts. Dampers at all combination wall louvers shall be furnished by manufacturer of louver equipment involved.
5. Dampers shall be Ruskin Model CD60 or approved equal by Air Balance or Arrow.

#### N. Description of Operation

1. System shall be hot water with water supplied from the boilers at a maximum of 180°F, with 40°F drop through the heating system.
2. Reset Water Control

A control sequence and hardware to maintain the water temperature to the system by modulating (resetting) boiler output temperature shall be provided within each boiler's own controls. ATC Contractor shall adjust the reset schedule to provide 180°F water @ 20°F outdoors to 130°F water @ 65°F outdoors (and higher). As the outside temperature falls, the supply water temperature shall be decreased. On a rise in outdoor air temperature, the temperature of the water shall be decreased.

Additional control shall be provided to give priority to domestic hot water. Whenever pumps P-4, P-5 or P-6 activate, the reset water controller shall increase boiler output temperature to 180°F water for as long as required.

Coordinate with boiler manufacturer's literature for required control components and sequences not provided with boilers.

3. Boiler Controls
  - a. A true run time lead-lag control is specified to be supplied with the boiler controls.
  - b. ATC Contractor shall provide interlock wiring between boiler controls and pump P-1.
  - c. ATC Contractor shall provide interlock wiring between boiler controls and pumps P-3, P-4 and P-5 for domestic hot water override control.
  - d. Coordinate with boiler manufacturer for required control components (if any) and sequences not provided with boilers.
  - e. Boiler manufacturer is required to provide qualified personnel to install

boiler related controls and wiring requiring field installation. Installer is required to work closely with the ATC Contractor to be sure interlocks between boiler controls and building controls are installed and functioning properly. See par. 2.11, "BOILERS".

4. Control of Circulating pumps

- a. Heating Pumps (P-1 and P-2): Pumps shall be provided from the factory with lead/lag controls and outdoor air controls. Provide and install communication wiring between each pump's controller. Work with commissioning agent to program pumps for lead/lag operation and pump on/off operation based on outdoor air temperature. Active pump shall run continuously when outdoor temperature is below 62°F. and off above 65°F. (adjustable).
- b. Domestic Hot Water Pumps (P-4, P-5 and P-6): Each domestic hot water storage heater is provided with it's own pump to supply boiler water to the heat exchanger coil. Each pump shall be controlled by an immersion aquastat (adjustable setpoints) to be provided and installed into the tank by the ATC Contractor. Pumps shall have a high limit (off) of 140 deg. F. and a low limit (on) of 120 deg. F. Interlock each pump with boiler domestic hot water over-ride controls.

5. Occupied-Unoccupied Control

There shall be no automatic occupied to unoccupied control.

6. Control Panel

Provide a control panel where indicated in Mechanical Room. The panel shall contain temperature indicators showing outdoor air temperature, boiler discharge temperature and supply (reset) water temperature. Panel shall also contain controls for pumps as previously outlined. All relays and accessories to accomplish the specified sequence of control shall also be contained in the panel.

7. Direct radiation

All direct radiation shall be controlled by single temperature thermostats and two position, line size zone valves. When a thermostat calls for heat the zone valve opens.

8. Cabinet Unit Heaters

Units to be supplied with remote thermostats and aquastats on hot water supply to each unit furnished and installed by ATC Contractor. When thermostat calls for heat the zone valve will open and the fan shall start provided the supply water temperature is not less than 130°F.

8. Fans shall operate as indicated on "FAN SCHEDULE" on sheet M3.01. Provide 120 volt motor operated dampers to open when fans cycle (where indicated); wiring by Division 16 unless noted otherwise.

- a. Fans tagged "EF" to operate from switches provided with the fans and

installed by Division 16. All fans shall be switched individually with the room lights. A 7 day timing controller by Div. 16, shall permit all fans to operate simultaneously for a set time interval.

Exception: See Par. "b" below for fan in Elevator Machine room.

- b. EF-2 in Elevator Machine Room shall operate from heavy duty, 120 volt reverse acting cooling thermostats.
- C, EF-3 mounted on the roof, for the corridors, shall be controlled by an average temperature of the corridor thermostats. Energize EF-3 when temperature is greater than 75 deg. (adjustable) average.

## PART 3 – EXECUTION

## 3.01 SURFACE CONDITIONS

## A. Inspection

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all work is complete to the point where this installation may properly commence.
2. Verify that Mechanical systems may be installed in strict accordance with all pertinent codes and regulations and the approved shop drawings.

## B. Discrepancies

1. In the event of discrepancy, immediately notify Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

## 3.02 INSTALLATION OF PIPING AND EQUIPMENT

## A. General

1. All piping shall be installed within building insulation.
2. Size and general arrangements as well as methods of connecting all piping, valves, and equipment shall be as indicated, or to meet requirements for complete installation.
3. All vertical pumps shall be supported independently of the piping system.
4. All piping shall be erected to provide for easy and noiseless passage of hot water under all working conditions. Inverted eccentric reducing fittings shall be used whenever water pipes reduce in size in the direction of flow. Tee fittings with reduction in the main direction of flow (run) are not acceptable.
5. All hot water mains shall be run level or pitch slightly upward so that no air pockets are formed in piping. Mains shall be set at elevations so runouts feeding heating equipment shall have no pockets where air can collect or automatic vents shall be provided.
6. Where preset balancing valves are used, it is critical that there not be two valves installed in series anywhere throughout the piping system.
7. Provide drains with hose threads and metal caps at all low points in the water piping system.
8. In erection of hot water piping care must be taken to make allowance for expansion and contraction; piping shall be anchored as necessary to control expansion.



9. Runouts to hot water radiation shall be size indicated on plans.
10. Install brass fittings at all points of dissimilar piping connections.
11. Install a sufficient number of unions or flanges to facilitate assembly and disassembly of piping and removal of equipment.
12. Install all piping promptly, capping or plugging all open ends and making pipe generally level and plumb, free from traps, and in a manner to conserve space for other work.
12. Inspect each piece of pipe, tubing, fittings, and equipment for defects and obstructions; promptly remove all defective materials from the job site.
13. Install pipes to clear all beams and obstructions; do not cut into or reduce the size of load carrying members without the approval of the Architect.
14. All risers and offsets shall be substantially supported.
15. Make all changes in pipe size with approved reducing fittings.
16. All low points in water piping shall be provided with an accessible plug tee or drain valve.
17. All high points in water piping shall be provided with an accessible automatic vent.
18. Maximum spacing of pipe hangers (for metallic piping) shall be as follows:

<u>Pipe Size</u>	<u>Spacing</u>
½", ¾" & 1"	6'-0"
1¼" & 1½"	8'-0"
2" & 3"	10'-0"

19. Whenever possible valves shall be installed with the operating stems in the upright position, however when conditions dictate it is acceptable to position valves 90° to either side of vertical. Valves shall not be installed with the stems in the downward position.
20. Do not substitute one style of valve indicated on drawings for another unless authorized by the Architect. Example: If a gate valve is shown use ONLY a gate valve or if a ball valve is shown use ONLY a ball valve.
21. Mount in-line air separators 3 inches in size and larger independent of the piping system. Do not obstruct removal area of strainer with pipe hangers, equipment or other piping.

B. Joints and Connections

1. Smoothly ream all cut pipe; cut all threads straight and true; apply best quality Teflon tape to all male pipe threads but not to inside of fittings; use graphite on all plugs.
2. Make all joints in copper tube (water and drains) with 95-5 tin-antimony solder applied in strict accordance with the manufacturer's recommendations.

C. Fire Safety

Fire extinguishing equipment shall be kept within 25 feet of welding areas at all times. No flammable materials shall be placed within 25 feet of welding areas unless they are physically connected to the building structure. Contractor shall take additional measures when welding close to flammable structures to protect the wood from igniting.

D. Thermometers

1. Install thermometers where indicated on drawings and:
2. Install thermometer wells on supply and return branch piping at all duct hot water heating coils and two (2) thermometers with storage cases for the Owner's use.
3. Install thermometers on hot water piping at each port of reset water valve.

E. PEX tubing

1. Install PEX tubing where indicated on drawings.
2. Tubing shall be supported from building structure only, not from other piping or equipment.
3. Do not support other piping or equipment from PEX tubing.
4. PEX tubing may be threaded through structure with the structure acting as support so long as support is not provided in lengths greater than 32 inches on center. Use protective sleeves or bushings where tubing passes through metal studs. Tubing shall not have sags or low points that would prevent thorough drainage of the system.
5. Support devices shall be a product of the PEX manufacturer. Support devices shall be screwed, not nailed, into wood. Do not attach to the underside of floor decks. It is acceptable to support PEX tubing to the side of steel bar joists with "zip" strip draw bands at 32 inch centers (maximum).

## 3.03 PIPING TEST AND ADJUST

- A. During the installation, all hot water supply and return piping shall be tested with water to a pressure of not more than 125 psi and held for a period of not less than four (4) hours. Isolate cast iron boilers and any other piping or devices not designed for this pressure. Do not use compressed air on PEX tubing systems. Any leaks shall be repaired and another test applied to the piping. All piping shall be tested before it is insulated or otherwise concealed. Contractor shall be required to certify in writing that piping has been tested and conforms to these requirements.
- B. Before operating the water system, all of the new piping shall be flushed out to remove oil and foreign materials. This shall be accomplished by circulating a solution of heavy duty detergent by use of Mechanical Contractor supplied pump.
- C. After the installation is complete and ready for operation, the system shall be tested under normal operating conditions in the presence of the Architect and demonstrated that the system functions as designed.
- D. It shall be demonstrated that all parts of heating system have a free and noiseless circulation of steam and water and that all parts are tight. It shall also be demonstrated that all units are functioning properly and that control system operates correctly.
- E. Should any defects in operation develop during the test periods, the Mechanical Contractor will proceed to correct defects immediately. Additional tests will be conducted after correction.

## 3.04 INSTALLATION OF DUCTWORK AND EQUIPMENT

- A. General
  - 1. Size and general arrangements as well as methods of connecting all registers, grilles, duct coils and equipment shall be as indicated, or to meet requirements for complete installation.
  - 2. Construction standards and sheet metal gauges shall be as outlined in the latest edition of the SMACNA HVAC Duct Construction Standards handbook for metal and flexible ducts unless specifically indicated otherwise.
  - 3. See paragraph 2.18, "Sheetmetal", sub-paragraph F., "Sealing of Ducts" for duct sealing.
  - 4. Manual Dampers
    - a. Manual dampers may be shop-fabricated on units 5 inches in height and less. All dampers larger than 5 inches MUST be pre-fabricated as previously outlined in this specification.
    - b. All manual dampers located within 10 feet of a fan outlet shall have the blades oriented perpendicular to the fan shaft.
    - c. Provide duct access door as large as possible up to 12 inches x 12 inches at EACH manual damper larger than 5 inches.

## B. Protection and Cleaning

1. All open ends of ductwork which is to be unattended for 4 hours or more shall be temporarily protected with plastic sheeting and duct tape (or similar method) to reduce the collection of construction dust and debris.
2. All openings in mechanical equipment (unit ventilators, cabinet unit heaters, fans, etc.) shall be covered with cardboard and thoroughly sealed to duct and contaminants with painters tape during the construction period unless work is actually being performed on the equipment.
3. Prior to testing and balancing and at the end of the construction, clean the interiors of all supply and return air ductwork before changing filters in air handling equipment. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

## 3.04 TESTING, ADJUSTING AND BALANCING (TAB)

## A. General

1. TAB contractor shall be a subcontractor to the Mechanical Subcontractor.
2. TAB contractor shall perform functional performance test of all Division 15 equipment and entire ATC system for specified operation and control sequences.
3. The mechanical contractor shall startup all Division 15 equipment as required by the equipment specifications. Mechanical contractor shall verify that systems are complete and operable before TAB commencing work. Ensure the following conditions:
  - a. Systems are started and operating in a safe and normal condition.
  - b. Temperature control systems are installed complete and operable.
  - c. Proper thermal overload protection is in place for electrical equipment.
  - d. Final filters are clean and in place. If required, install temporary media in addition to final filters.
  - e. Duct systems are clean of debris.
  - f. Fans are rotating correctly.
  - g. Fire and volume dampers are in place and open.
  - h. Air coil fins are cleaned and combed.
  - i. Access doors are closed and duct end caps are in place.
  - j. Air outlets are installed and connected.
  - k. Duct system leakage is minimized.
  - l. Hydronic systems are flushed, filled, and vented.
  - m. Pumps are rotating correctly.
  - n. Mechanical equipment is thoroughly clean and free of debris.
4. TAB Contractor shall submit field reports to General Contractor and Architect. Report defects and deficiencies noted during performance of services which prevent system testing and balance.

5. TAB contractor shall submit all verification and functional performance checklists/results, signed by indicated personnel, organized by system and sub-system.
6. TAB contractor shall submit other reports described below.

B. Work Included

1. Test, adjust and balance all air and water systems, including components to conform to air and water flow rates shown on drawings.
2. Test complete automatic temperature control sequences for specified operations described under AUTOMATIC TEMPERATURE CONTROLS.
3. Complete and submit balance report in spreadsheet format. Report shall be submitted with information noted on one side of sheet only (i.e., backside of sheet shall be blank.).
4. Testing of air and water systems will be done by the same agency.
5. Mechanical Contractor SHALL PROVIDE copies of shop drawings indicating coil gpm's, air handling unit air volumes, etc. to the Testing and Balancing contractor at no cost to the contractor.
6. The Balancing Contractor shall carry an allowance of \$250. which may be used, if directed by the Architect, to change motor drives and belts as job conditions require. The allowance or unused portion shall be returned to the Owner upon acceptance of the system.
7. Careful coordination must be maintained between the time of testing and balancing and final delivery to avoid re-accumulation of dust and debris within the duct systems which will require additional cleaning by the Mechanical Contractor.

C. Quality of Compliance

1. Qualification: TAB Contractor must be independent test and balancing agency.
2. AABC Compliance: Comply with AABC Manual MN-1 "AABC National Standards" as applicable to mechanical and hydronic distribution systems and/or Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA).
3. Industry Standards: Comply with ASHRAE recommendations for measurements, instruments and testing and balancing.
4. Coordination: Work together with Automatic Temperature Control Contractor to adjust set points of various devices to balance system(s) and test ATC sequences of operation. Temperature Control Contractor shall be responsible for balancing return air, exhaust (relief) air and outdoor air dampers on Air Handling Units in order to achieve proper mixed air temperatures.

5. ASHRAE Guideline 1-1996, "The HVAC Commissioning Process".

D. Execution of TAB Work

1. TAB Contractor shall visit job site and determine that control devices, test devices and valves are correctly installed and ready for balancing.
2. Examine each air and hydronic distribution system to see that it is free from obstructions. Determine that all dampers, registers and valves are in a set or full open position; that moving equipment is lubricated, and that required filters are clean and functioning. Request that Installing Contractor perform any adjustments necessary for proper functioning of the system.
3. TAB Contractor shall use test instruments that have been calibrated within a time period recommended by the manufacturer, and have been checked for accuracy prior to start of testing, adjusting and balancing activity.
4. Verify that all equipment performs as specified. Adjust variable type drives, volume dampers, control dampers, balancing valves and control valves as required by TAB work.
5. Test pressure profile of systems by traverse as required.
6. Adjust each register and damper to handle and properly distribute design airflow within 5% of specified quantities. Mark all setpoints.
7. Adjust front and rear discharge louvers on each supply register to distribute air in an even pattern or as indicated on plans.
8. Set all adjustable balancing valves so that each is furnished with design fluid flow within 5% of the specified quantities. Mark all set points.
9. Take readings at pre-set balancing valves and record flow readings.
10. Adjust air discharge patterns of all supply air diffusers, registers and grilles for optimal air diffusion.
11. Document results of all testing on approved TAB report formats and submit 3 copies for approval and record within 15 days of completion of TAB work. Include a warranty period of 90 days, during which time the Architect/Engineer may request a re-check or re-adjustment of any part of the work. Reports shall be compiled on a spreadsheet such as Excel, Quattro-Pro, Lotus, etc. and shall clearly indicate the following *minimum* information:
  - a. Air (Rated and Actual)
    - 1) System/unit name
    - 2) HP, BHP, voltage, amperage and fan rpm
    - 3) Static pressures; suction, discharge and total
    - 4) Total system flow rate

- 5) Individual terminal flow rates (Terminal readings must show location, make, model and size of register, grille or diffuser).
  - 6) Filter status report
- b. Water
- 1) Pump full flow and no-flow suction and discharge pressures.
  - 2) Rated and actual amperage, voltage and total discharge head (TDH).
  - 3) Calibrated balancing device readings will indicate location, size, setting, differential pressure and rated and actual gpm.

Reports to have a minimum of color or must be compatible with monochrome printers. Reports must be submitted to the Architect electronically in addition to hard copies.

E. Drawings

Drawings in CAD format may be made available to the TAB Contractor after the contract for this work is awarded. Contact the Engineer via telephone or at [mechsyst@maine.rr.com](mailto:mechsyst@maine.rr.com) and request the drawings, indicating CAD format required and a return e-mail address. Files will be compressed and will require WinZip to extract them (available at <http://www.winzip.com>).

F. Acceptable TAB Contractors (listed alphabetically)

1. Central Air Balance
2. Maine Air Balance
3. Tab-Tech International
4. Tekon-Technical Consultants
5. Yankee Balancing

### 3.05 CLOSING IN UNINSPECTED WORK

A. General

Do not cover up or enclose work until it has been properly and completely inspected and approved.

B. Noncompliance

Should any work be covered up or enclosed prior to all required inspections and approvals, uncover the work as required. After it has been inspected completely and approved, make all repairs and replacements with materials necessary for approval by the Architect and at no additional cost to the Owner.

If it is not practical to uncover the uninspected work it may, at the Architect's discretion, be considered inadequate and credit given to the Owner for the work as if it were not done in satisfactory accordance with the terms of the contract documents.

## 3.06 TEMPORARY HEATING

- A. Mechanical Contractor shall install the new heating system and related equipment as soon as those portions of the building are ready and the work can be performed.
- B. Mechanical Contractor will be required to permanently connect as many units as possible for temporary heat.
- C. At the conclusion of the temporary heating period, the complete system shall be thoroughly cleaned.
- D. General Contractor will be required to assume full responsibility for the care and operation of the new equipment during its temporary use and to return the equipment to the Mechanical Contractor in perfect order, normal wear and tear excepted.
- E. Water, fuel and electric power required to operate the heating system for temporary heat shall be provided by the General Contractor.

## 3.07 CLEANING

Prior to acceptance of the buildings, thoroughly clean all exposed portions of the heating and ventilating installation, including the removal all labels and all traces of foreign substance. Prior to testing and balancing vacuum and clean inside of all convectors, finned radiators (spackle droppings), unit ventilators, heat recovery units, fans and cabinet unit heaters. Clean the interiors of ductwork (where accessible) as outlined in 3.03, "INSTALLATION OF DUCTWORK AND EQUIPMENT"; paragraph "B", "Protection and Cleaning".

## 3.08 INSTRUCTIONS

On completion of the job, the Mechanical Contractor shall provide a competent technician to thoroughly instruct the Owner's Representative in the care and operation of the system. The total period of instruction shall not exceed four (4) hours. (Temperature control system instruction shall be in addition to this instruction period). The time of instruction shall be arranged with the Owner.

## 3.09 RECYCLING

Discarded materials shall be recycled whenever practical through metal salvage dealers (ductwork, piping, etc.), paper salvage (cardboard shipping containers, etc.), wood & plastic products, etc. The Mechanical Contractor shall retain the salvage value of discarded materials and may use this value to offset his project bid price if so desired. Toxic materials such as adhesives, coolants, refrigerants, etc. SHALL be disposed of in a manner acceptable to the State of Maine Department of Environmental Protection.

## 3.10 HAZARDOUS MATERIALS

Mercury, asbestos or any other material deemed hazardous by the Federal Environmental Protection Agency or the State of Maine Department of Environmental Protection, shall not be used in any components of the mechanical systems.

END OF SECTION 230000