

# Maine Medical Center

Portland, Maine

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## Pavilion 6 Renovations

### Project Manual

*Issued for Construction  
November 19, 2009*

**ARCHITECT:  
OWNER:**

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

**ARCHITECT:**

MorrisSwitzer~Environments for Health  
One Dana Street  
Portland, Maine

telephone 207.773.8841  
facsimile 207.773.8840

Project No. 28034



**SECTION 000101  
PROJECT DIRECTORY**

**PROJECT:** Maine Medical Center  
Pavilion 6 Renovations

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22 Bramhall Street  
Portland, Maine 04102  
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Facsimile: 207-662-6516  
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9 Gould Road  
Lewiston, Maine 04240  
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**ARCHITECT:** MorrisSwitzer~Environments for Health  
One Dana Street  
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Project Architect: Beth Schidzig, AIA  
Project Manager: Charles Rizza, AIA

**STRUCTURAL  
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75 York Street  
Portland, Maine 04101  
Telephone: 207-879-1838  
Facsimile: 207-879-1822  
Contact: Ethan Rhile, P.E.

**M/E/P ENGINEER:** Fitzemeyer & Tocci Associates, Inc.  
92 Montvale Avenue, Suite 4100  
Stoneham, Massachusetts 02180  
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Facsimile: 781-481-0203  
Contact: Scott LeClair, P.E.

**END OF PROJECT DIRECTORY**

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034

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28034



PROPOSAL FORM FOR GENERAL CONTRACTOR

BIDDER: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

TO: MAINE MEDICAL CENTER  
22 BRAMHALL STREET  
PORTLAND, MAINE 04102

Attention: Marshall Bartlett, Project Manager

- A. Having carefully examined the Form of Contract, General Conditions, and the Drawings and Project Manual prepared by MorrisSwitzer~Environments for Health, Inc. for the construction of Pavilion 6 Renovations as well as the premises and conditions affecting the work, we the undersigned propose to furnish all labor, equipment and materials necessary for, and reasonably incidental to the construction and completion of this project for the tax exempt sum of:

**Base Bid:** \$ \_\_\_\_\_

- B. This proposal includes the following addenda to the Drawings and Project Manual:

Addendum # \_\_\_\_\_, Dated \_\_\_\_\_  
Addendum # \_\_\_\_\_, Dated \_\_\_\_\_  
Addendum # \_\_\_\_\_, Dated \_\_\_\_\_

- C. Cost Breakdown for **Pavilion 6C** proposed contract are as follows:

	<u>DIVISION</u>	<u>COST</u>
1.	Administrative and Procedural	\$ _____
2.	Sitework/Demolition	\$ _____
3.	Concrete	\$ _____
4.	Unit Masonry	\$ _____
5.	Metals	\$ _____
6.	Wood & Plastics	\$ _____
7.	Thermal & Moisture	\$ _____
8.	Doors & Windows	\$ _____
9.	Finishes	\$ _____

10.	Specialties	\$ _____
11.	Equipment	\$ _____
12.	Furnishings	\$ _____
13.	Special Construction	\$ _____
14.	Conveying Equipment	\$ _____
15.	Mechanical	\$ _____
15a.	Fire Suppression	\$ _____
16.	Electrical	\$ _____
<b>Total Base Bid Cost for Pavilion 6C</b>		\$ _____

D. Cost Breakdown for **Pavilion 6A** proposed contract are as follows:

	<u>DIVISION</u>	<u>COST</u>
1.	Administrative and Procedural	\$ _____
2.	Sitework/Demolition	\$ _____
3.	Concrete	\$ _____
4.	Unit Masonry	\$ _____
5.	Metals	\$ _____
6.	Wood & Plastics	\$ _____
7.	Thermal & Moisture	\$ _____
8.	Doors & Windows	\$ _____
9.	Finishes	\$ _____
10.	Specialties	\$ _____
11.	Equipment	\$ _____
12.	Furnishings	\$ _____
13.	Special Construction	\$ _____
14.	Conveying Equipment	\$ _____

15.	Mechanical	\$ _____
15a.	Fire Suppression	\$ _____
16.	Electrical	\$ _____
<b>Total Base Bid Cost for Pavilion 6A</b>		\$ _____
<b>Total Base Bid Cost for Pavilion 6A &amp; C</b>		\$ _____

E. Alternates For **Pavilions 6A & C**:

Alternate No. 1 – Aluminum Windows:	\$ _____	(ADD)
Alternate No. 2 – Exterior Walls:	\$ _____	(ADD)
Alternate No. 3 – Skylights:	\$ _____	(ADD)
Alternate No. 4 – P6A HVAC:	\$ _____	(DEDUCT)
Alternate No. 5 – DX Condensing System:	\$ _____	(DEDUCT)
Alternate No. 6 – Low Voltage Controls:	\$ _____	(DEDUCT)

F. Cost Breakdown for **Pavilion 2A** proposed contract are as follows:

	<u>DIVISION</u>	<u>COST</u>
1.	Administrative and Procedural	\$ _____
2.	Sitework/Demolition	\$ _____
3.	Concrete	\$ _____
4.	Unit Masonry	\$ _____
5.	Metals	\$ _____
6.	Wood & Plastics	\$ _____
7.	Thermal & Moisture	\$ _____
8.	Doors & Windows	\$ _____
9.	Finishes	\$ _____
10.	Specialties	\$ _____
11.	Equipment	\$ _____
12.	Furnishings	\$ _____
13.	Special Construction	\$ _____
14.	Conveying Equipment	\$ _____

15.	Mechanical	\$ _____
15a.	Fire Suppression	\$ _____
16.	Electrical	\$ _____
<b>Total Base Bid Cost for Pavilion 2A</b>		<b>\$ _____</b>

G. Alternates for **Pavilion 2A**

Alternate No. 7 - Sprinkler System Extension:	\$ _____ (ADD)
Alternate No. 8 – Acoustical Ceiling Tile	\$ _____ (ADD)

H. Cost Breakdown for **Pavilions 2C & D** proposed contract are as follows:

	<u>DIVISION</u>	<u>COST</u>
1.	Administrative and Procedural	\$ _____
2.	Sitework/Demolition	\$ _____
3.	Concrete	\$ _____
4.	Unit Masonry	\$ _____
5.	Metals	\$ _____
6.	Wood & Plastics	\$ _____
7.	Thermal & Moisture	\$ _____
8.	Doors & Windows	\$ _____
9.	Finishes	\$ _____
10.	Specialties	\$ _____
11.	Equipment	\$ _____
12.	Furnishings	\$ _____
13.	Special Construction	\$ _____
14.	Conveying Equipment	\$ _____
15.	Mechanical	\$ _____
15a.	Fire Suppression	\$ _____

16. Electrical \$ \_\_\_\_\_

**Total Base Bid Cost for Pavilion 2C & D** \$ \_\_\_\_\_

UNIT PRICES

- 1. Acoustical Ceiling Tile (Type 1) (s.f.) \$ \_\_\_\_\_
- 2. Suspended Ceiling Grid, installed (s.f.) \$ \_\_\_\_\_
- 3. Carpet (sq.yd.), installed \$ \_\_\_\_\_
- 4. Sheet vinyl (sq.ft.), installed \$ \_\_\_\_\_
- 5. VCT (sq.ft.), installed \$ \_\_\_\_\_
- 6. Rubber (sq.ft.), installed \$ \_\_\_\_\_

I. Cost of Performance & Payment Bond \$ \_\_\_\_\_

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

K. The undersigned agrees, if awarded the Contract, to complete the work within \_\_\_\_\_ calendar days.

L. This proposal includes the full cost of all bonds, insurance and permits required for the completion of this work.

Signed \_\_\_\_\_

By (Name & Title) \_\_\_\_\_

Address \_\_\_\_\_

Telephone and Fax Numbers \_\_\_\_\_

Note: If Bidder is a corporation, write State of incorporation, and if a partnership, give full name of all partners.

END OF PROPOSAL FORM

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034

Original



# General Conditions of the Contract for Construction

## AIA Document A201 - Electronic Format

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REVISED  
~~1-16-2008~~  
8-28-2009

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NOTE: THIS DOCUMENT HAS BEEN MODIFIED TO INCORPORATE MMC'S SUPPLEMENTAL GENERAL CONDITIONS.

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# GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION

## ARTICLE 1 GENERAL PROVISIONS

### 1.1 BASIC DEFINITIONS

#### 1.1.1 THE CONTRACT DOCUMENTS

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

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:

Highest Priority: Modifications

Second Priority: Agreement

Third Priority: Addenda - later date to take precedence

Fourth Priority: Modified General Conditions

Fifth Priority: Division 1 - General Requirements

Sixth Priority: Drawings and Specifications

1.1.1.2 In the event of uncertainty as to the type or quality of materials to be supplied, the Specifications shall govern, unless otherwise directed by written Addendum.

1.1.1.3 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.

1.1.1.4 In the event of a discrepancy between the Drawings and the Specifications, the Specifications shall govern.

#### 1.1.2 THE CONTRACT

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

#### 1.1.3 THE WORK

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

#### 1.1.4 THE PROJECT

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

#### 1.1.5 THE DRAWINGS

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

#### 1.1.6 THE SPECIFICATIONS

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

#### 1.1.7 THE PROJECT MANUAL

The Project Manual is the volume usually assembled for the Work which may include the bidding requirements, sample

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forms, Conditions of the Contract and Specifications.

1.1.8 Phrases like "with reasonable promptness" and "so as to cause no delay" and similar phrases are used throughout the Contract to indicate the time frame within which a party to the Contract is required to perform. These terms are to be interpreted within the context of the Contractor's Project CPM Schedule, and all elements of the Contract requiring timely execution are to be separately and distinctly included in the Contractor's Project CPM Schedule. The Project CPM Schedule will then be the determinant of the number of days available to perform these works and the dates on which they are individually required.

## 1.2 EXECUTION, CORRELATION AND INTENT

1.2.1 The Contract Documents shall be signed by the Owner and Contractor as provided in the Agreement. If either the Owner or Contractor or both do not sign all the Contract Documents, the Architect shall identify such unsigned Documents upon request.

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

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

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

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

## 1.3 OWNERSHIP AND USE OF ARCHITECT'S DRAWINGS, SPECIFICATIONS AND OTHER DOCUMENTS

1.3.1 The Drawings, Specifications and other documents prepared by the Architect are instruments of the Architect's

service through which the Work to be executed by the Contractor is described. The Contractor may retain one contract record set. Neither the Contractor nor any Subcontractor, Sub-subcontractor or material or equipment supplier shall own or claim a copyright in the Drawings, Specifications and other documents prepared by the Architect, ~~and unless otherwise indicated the Architect shall be deemed the author of them and will retain all common-law, statutory and other reserved rights, in addition to the copyright.~~ All copies of them, except the Contractor's record set, shall be returned or suitably accounted for to the Architect, on request, upon completion of the Work. The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Contractor, are for use solely with respect to this Project. They are not to be used by the Contractor or any Subcontractor, Sub-subcontractor or material or equipment supplier on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner and Architect. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license shall bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by the Architect. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be construed as publication in derogation of the Architect's copyright or other reserved rights.

## 1.4 CAPITALIZATION

1.4.1 Terms capitalized in these General Conditions include those which are (1) specifically defined, (2) the titles of numbered articles and identified references to Paragraphs, Subparagraphs and Clauses in the document or (3) the titles of other documents published by the American Institute of Architects.

## 1.5 INTERPRETATION

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

## ARTICLE 2

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## OWNER

### 2.1 DEFINITION

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

2.1.2 Within fifteen days after receipt of a written request, The Owner ~~upon reasonable written request~~ shall furnish to the Contractor in writing information which is necessary and relevant for the Contractor to evaluate, give notice of or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein at the time of execution of the Agreement and, within five days after any change, information of such change in title, recorded or unrecorded.

### 2.2 INFORMATION AND SERVICES REQUIRED OF THE OWNER

2.2.1 ~~The Owner shall, at the request of the Contractor, prior to execution of the Agreement and promptly from time to time thereafter, furnish to the Contractor reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. (Note: Unless such reasonable evidence were furnished on request prior to the execution of the Agreement, the prospective contractor would not be required to execute the Agreement or to commence the Work.)~~

2.2.2 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site.

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

2.2.4 Information or services under the Owner's control and required by the Contract Documents shall be furnished by the Owner with reasonable promptness to avoid delay in orderly progress of the Work. Any other

information or services relevant to the Contractor's performance of the Work under the Owner's control shall be furnished by the Owner after receipt from the Contractor of a written request for such information or services.

2.2.5 ~~Unless otherwise provided in the Contract Documents, the Contractor will be furnished, free of charge, such copies of Drawings and Project Manuals as are reasonably necessary for execution of the Work. The Contractor will be furnished free of charge with 6 sets of drawings and project manuals. Additional sets will be made available to the Contractor, at the cost of reproductions postage and handling, in an electronic and reproducible format.~~

2.2.6 The foregoing are in addition to other duties and responsibilities of the Owner enumerated herein and especially those in respect to Article 6 (Construction by Owner or by Separate Contractors), Article 9 (Payments and Completion) and Article 11 (Insurance and Bonds).

### 2.3 OWNER'S RIGHT TO STOP THE WORK

2.3.1 If the Contractor fails to correct Work which is not in accordance with the requirements of the Contract Documents as required by Paragraph 12.2 or persistently fails to carry out Work in accordance with the Contract Documents, the Owner, by written order signed personally or by an agent specifically so empowered by the Owner in writing, may order the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Subparagraph 6.1.3.

### 2.4 OWNER'S RIGHT TO CARRY OUT THE WORK

2.4.1 If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a seven-day period after receipt of written notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may after such seven-day period give the Contractor a second written notice to correct such deficiencies within a second seven-day period. If the Contractor within such second seven-day period after receipt of such second notice fails to commence and continue to correct any deficiencies, the Owner may, without prejudice to other remedies the Owner may have, correct such deficiencies. In such case an appropriate Change Order shall be issued deducting from payments then or thereafter due the Contractor the cost of

correcting such deficiencies, including compensation for the Architect's additional services and expenses made necessary by such default, neglect or failure. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect. If payments then or thereafter due the Contractor are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner.

### ARTICLE 3 CONTRACTOR

#### 3.1 DEFINITION

3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Contractor" means the Contractor or the Contractor's authorized representative.

#### 3.2 REVIEW OF CONTRACT DOCUMENTS AND FIELD CONDITIONS BY CONTRACTOR

3.2.1 Before starting the work, and at frequent intervals during the progress thereof, The Contractor shall carefully study and compare the Contract Documents with each other and with information furnished by the Owner pursuant to Subparagraph 2.2.2 and shall at once report to the Architect errors, inconsistencies or omissions discovered. The Contractor shall not be liable to the Owner or Architect for damage resulting from errors, inconsistencies or omissions in the Contract Documents unless the Contractor recognized such error, inconsistency or omission and knowingly failed to report it to the Architect. If the Contractor performs any construction activity knowing it involves a recognized error, inconsistency or omission in the Contract Documents without such notice to the Architect, the Contractor shall assume appropriate responsibility for such performance and shall bear an appropriate amount of the attributable costs for correction.

3.2.2 The Contractor shall take field measurements and verify field conditions and shall carefully compare such field measurements and conditions and other information known to the Contractor with the Contract Documents before commencing activities. Errors, inconsistencies or omissions discovered shall be reported to the Architect at once.

3.2.3 The Contractor shall perform the Work in accordance with the Contract Documents and submittals approved pursuant to Paragraph 3.12.

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 Any necessary changes shall be ordered as provided in Article 7, Changes in the Work.

\* See Page 10A for inserts of 3.2.6, 3.2.7 & 3.2.8.

#### 3.3 SUPERVISION AND CONSTRUCTION PROCEDURES

3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for and have control over construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.

3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons performing portions of the Work under a contract with the Contractor.

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

3.3.4 The Contractor shall be responsible for inspection of portions of Work already performed under this Contract to determine that such portions are in proper condition to receive subsequent Work.

#### 3.4 LABOR AND MATERIALS

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

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

3.4.3 After the Contract has been executed, the Owner

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## ARTICLE 3

### 3.2.6

The Contractor shall assist in the coordination of all Work as set forth in the Drawings and Specifications.

### 3.2.7

The Contractor shall be held to have examined the premises and Site so as to compare them with the Contract Drawings and Specifications and to have satisfied himself as to the condition of the premises, any obstruction, the actual levels, and all excavating, filling, etc., necessary for carrying out the Work before the submission of the Guaranteed Maximum Price to the Owner. The Contractor shall also acquaint himself with the character and extent of the Owner's and any other contractor's operations in the area of the Work, so that he may make his construction plans accordingly.

### 3.2.8

The Contractor shall comply with the rules and regulations of the Owner in place at the time of the GMP and those pertinent to its hospital facilities, concerning restrictions or access to patient care areas and shall obtain Owner's approval to enter any patient or related service area prior to making any examination or inspection of the Site or surrounding areas.

and the Architect will consider a formal written request by the Contractor for the substitution of products in place of those specified only under the conditions set forth in the Contract Documents, Section 01600 Product Requirements 01300

### 3.5 WARRANTY

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

### 3.6 TAXES

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

### 3.7 PERMITS, FEES AND NOTICES

3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit and other permits and governmental fees, licenses and inspections necessary for proper execution and completion of the Work which are customarily secured after execution of the Contract and which are legally required when bids are received or negotiations concluded.

3.7.2 The Contractor shall comply with and give notices required by laws, ordinances, rules, regulations and lawful orders of public authorities bearing on performance of the Work.

3.7.3 It is not the Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations. However, if the Contractor observes that portions of the Contract Documents are at variance therewith, the Contractor shall promptly notify the Architect and Owner in writing, and necessary changes shall be

accomplished by appropriate Modification.

3.7.4 If the Contractor performs Work knowing it to be contrary to laws, statutes, ordinances, building codes, and rules and regulations without such notice to the Architect and Owner, the Contractor shall assume full responsibility for such Work and shall bear the attributable costs.

### 3.8 ALLOWANCES

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

3.8.2 Unless otherwise provided in the Contract Documents:

- 1 materials and equipment under an allowance shall be selected promptly by the Owner to avoid delay in the Work;
- 2 allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- 3 Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum and not in the allowances;
- 4 whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Clause 3.8.2.2 and (2) changes in Contractor's costs under Clause 3.8.2.3.

### 3.9 ~~XXXXXXXXXXXXXXXXXXXX~~ CONSTRUCTION PROJECT SUPERINTENDENT PERSONNEL

3.9.1 ~~The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be binding as if given to the Contractor. Important communications shall be confirmed in writing. Other communications shall be similarly confirmed on written request in each case.~~ The Contractor shall assign a competent Construction Superintendent and Project

Manager, reasonably acceptable to the Owner, and an adequate workforce during the progress of the Work until the date of Substantial Completion, and for such additional time thereafter as necessary for the expeditious Total Completion of the Work.

3.9.2 The Construction Superintendent and the workforce shall be in attendance at the Project site.

3.9.3 The Contractor shall provide and maintain a telephone pager for use by the Construction Superintendent. The Construction Superintendent shall wear the pager at all times that he is, by contract, required to be present at the Project site. The pager number shall be issued to MMC's Project Manager, MMC's Engineering Services Secretarial Staff, and the Architect.

3.9.4 If the Owner has reasonable objection to the Construction Superintendent and/or the Project Manager, the Contractor shall remove the Construction Superintendent and/or Project Manager if requested to do so in writing by the Owner. The Contractor shall promptly submit a competent person and, upon acceptance by the Owner, replace the removed person with the accepted person.

3.9.5 The Contractor shall not make any changes in Construction Project Personnel without prior written approval from the Owner.

3.9.6 The Contractor shall provide the resumes of the proposed Construction Project Personnel as an attachment to the Contractor's bid proposal.

3.9.7 The Project Manager shall represent the Contractor, and communications given to the Project Manager shall be binding as if given to the Contractor. Communications shall be confirmed in writing.

### **3.10 CONTRACTOR'S CONSTRUCTION SCHEDULES**

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

this Contract.

3.10.2 The Contractor shall prepare and keep current, for the Architect's approval, a schedule of submittals which is coordinated with the Contractor's construction schedule and allows the Architect reasonable time to review submittals. The Owner and Contractor recognize the importance of scheduling in the planning and execution of the Work. To this end, the Owner has prepared a scheduling specification, Section 01325 - Project CPM Schedule. The Contractor's scheduling shall conform to these specifications.

3.10.3 The Contractor shall conform to the most recent schedules. Notwithstanding the requirements of Section 01325, the Contractor shall:

- (a) Use CPM methodology in all scheduling;
- (b) Prepare and submit a Project CPM Schedule for acceptance by the Owner;
- (c) Prepare and submit monthly progress updates;
- (d) Prepare for and participate in monthly progress review and contemporaneous period analysis meetings;
- (e) Support all claims for extensions of time with a contemporaneous period analysis; and
- (f) Support all change order applications with relevant scheduling showing the impact of the proposed change order on the Work.

### **3.11 DOCUMENTS AND SAMPLES AT THE SITE**

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

### **3.12 SHOP DRAWINGS, PRODUCT DATA AND SAMPLES**

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

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

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

**3.12.4** Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The purpose of their submittal is to demonstrate for those portions of the Work for which submittals are required the way the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents. Review by the Architect is subject to the limitations of Subparagraph 4.2.7.

**3.12.5** The Contractor shall review for compliance with the contract documents, approve and submit to the Architect Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence shown by the Project CPM Schedule so as to cause no critical path delay in the Work or in the activities of the Owner or of separate contractors. Submittals made by the Contractor which are not required by the Contract Documents may be returned without action.

**3.12.6** The Contractor shall perform no portion of the Work requiring submittal and review of Shop Drawings, Product Data, Samples or similar submittals until the respective submittal has been approved by the Architect. Such Work shall be in accordance with approved submittals.

**3.12.7** By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, the Contractor represents that the Contractor has determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

**3.12.8** The Contractor shall not be relieved of responsibility for deviations from requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples or similar submittals unless the Contractor has specifically informed the Architect in writing of such deviation at the time of submittal and the Architect has given written approval to the specific deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.

**3.12.9** The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples or similar submittals, to revisions other than those requested by the Architect on previous submittals.

**3.12.10** Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents.

**3.12.11** When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, the Architect shall be entitled to rely upon the accuracy and completeness of such calculations and certifications.

### **3.13 USE OF SITE**

**3.13.1** The Contractor shall confine operations at the site to areas permitted by law, ordinances, permits and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.  
*\* See Page 13A for additional inserts here.*

### **3.14 CUTTING AND PATCHING**

**3.14.1** The Contractor shall be responsible for cutting, fitting or patching required to complete the Work or to make its parts fit together properly.

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

### **3.15 CLEANING UP**

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

**3.15.2** If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the cost thereof shall be charged to the Contractor.

### **3.16 ACCESS TO WORK**

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

**3.13.2** The right of possession of the Site and the improvements made thereon by the Contractor shall remain at all times in the Owner. The Contractor's right to entry and use thereof arises solely from the permission granted by the Owner under the Contract Documents.

**3.13.3** The Contractor shall not, without the Owner's prior written consent, install or maintain any sign, trademark, advertisement, or other identification symbol in or about the Site. The Owner shall have the right, without notice to the Contractor to remove any sign, trademark, advertisement or other identification symbol installed in violation of this Article 3.13.3, at the Contractor's expense.

**3.13.4** The Contractor shall confine his equipment, storage of materials, and the operations of his workmen to limits indicated by the Contract Documents, law, ordinances, permits and directions of the Owner and shall not unreasonably encumber the Site with his materials. The Contractor shall not load or permit any part of a structure to be loaded with a weight that will endanger its safety. The Contractor shall enforce the Owner's instructions regarding signs, advertisements, fires and smoking.

**3.13.5** The Contractor, all Subcontractors and their employees and agents shall be subject to and shall at all times conform to the Owner's rules and requirements in place at the time of the GMP for the protection of the hospital, materials, equipment and Owner's patients and employees.

**3.13.6** The Contractor shall consult with the Owner as to the priority of items of work so as not to interfere with the Owner's operations. Contractor shall also consult with the Owner as to the available space for storage of materials and location in the Owner's facilities, places of access to the work, etc., and all shall be arranged to suit the Owner's requirements. Materials and equipment shall be placed to avoid interference with the work of others and the Owner.

**3.13.7** The Contractor is liable for damage to the existing facilities, parking lots, roads and grounds and is required to restore any such area that is damaged to its original condition at no additional cost to the Owner.

**3.13.8** The Contractor shall render all necessary assistance to the Owner, and, if required, shall take and furnish the Owner with levels, measurements, etc., of the Work."

### 3.17 ROYALTIES AND PATENTS

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

### 3.18 INDEMNIFICATION \*

3.18.1 To the fullest extent permitted by law, and to the extent claims, damages, losses or expenses are not covered by Project Management Protective Liability Insurance purchased by the Contractor in accordance with Paragraph 11.3, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) ~~including loss of use resulting therefrom,~~ but only to the extent caused in whole or in part by negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Paragraph 3.18. \*See page 17A for amendments

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

3.18.3 ~~The obligations of the Contractor under this Paragraph 3.18 shall not extend to the liability of the~~

~~Architect, the Architect's consultants, and agents and employees of any of them arising out of (1) the preparation or approval of maps, drawings, opinions, reports, surveys, Change Orders, designs or specifications, or (2) the giving of or the failure to give directions or instructions by the Architect, the Architect's consultants, and agents and employees of any of them provided such giving or failure to give is the primary cause of the injury or damage.~~

## ARTICLE 4 ADMINISTRATION OF THE CONTRACT

### 4.1 ARCHITECT

4.1.1 The Architect is the person lawfully licensed to practice architecture or an entity lawfully practicing architecture identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The term "Architect" means the Architect or the Architect's authorized representative.

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

4.1.3 In case of termination of employment of the Architect, the Owner shall appoint an architect against whom the Contractor makes no reasonable objection and whose status under the Contract Documents shall be that of the former architect.

4.1.4 ~~Disputes arising under Subparagraphs 4.1.2 and 4.1.3 shall be subject to arbitration.~~

### 4.2 ARCHITECT'S ADMINISTRATION OF THE CONTRACT

4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents, and will be ~~the~~ an Owner's representative (1) during construction, (2) until final payment is due and (3) with the Owner's concurrence, from time to time during the correction period described in Paragraph 12.2. The Architect will advise and consult with the Owner. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents, unless otherwise modified by written instrument in accordance with other provisions of the Contract.

4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction to become generally familiar with the progress and quality of the completed Work

### 3.18.1

At the end of 3.18.1 Add:

"Provided, however, that Contractor's liability hereunder relating to Owner's property damage shall be limited to actual property damage to the Work and other tangible property of Owner, including actual costs and losses resulting from such property damage, but the Owner hereby waives all other claims for consequential damages, including speculative or punitive damages.

### 4.1.2

The duties, responsibilities and limitations of authority of the Architect as Owner's representative during construction as set forth in the Contract Documents will not be modified or extended without Architect's and Owner's written consent which will be shown to the Contractor prior to modifications of authority becoming effective.

and to determine in general if the Work is being performed in a manner indicating that the Work, when completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check quality or quantity of the Work. On the basis of on-site observations as an architect, the Architect will keep the Owner informed of progress of the Work, and will endeavor to guard the Owner against defects and deficiencies in the Work.

**4.2.3** The Architect will not have control over or charge of and will not be responsible for construction means, methods, techniques, sequences or procedures, or for safety precautions and programs in connection with the Work, since these are solely the Contractor's responsibility as provided in Paragraph 3.3. The Architect will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or of any other persons performing portions of the Work.

**4.2.4 Communications Facilitating Contract Administration.** Except as otherwise provided in the Contract Documents or when direct communications have been specially authorized, the Owner and Contractor shall endeavor to communicate through the Architect. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and material suppliers shall be through the Contractor. Communications by and with separate contractors shall be through the Owner.

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

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

**4.2.7** The Architect will review and approve or take other appropriate action upon the Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken with such reasonable promptness as to cause no critical path delay in the Work or in the activities of the Owner, Contractor or separate contractors, while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Paragraphs 3.3, 3.5 and 3.12. The Architect's review shall not constitute approval of safety precautions or, unless otherwise specifically stated by the Architect, of any construction means, methods, techniques, sequences or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

**4.2.8** The Architect will prepare Change Orders and Construction Change Directives, and may authorize minor changes in the Work as provided in Paragraph 7.4.

**4.2.9** The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion, will receive and forward to the Owner for the Owner's review and records written warranties and related documents required by the Contract and assembled by the Contractor, and will issue a final Certificate for Payment upon compliance with the requirements of the Contract Documents.

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

**4.2.11** The Architect will interpret and decide matters concerning performance under and requirements of the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made with reasonable promptness and within any time limits agreed upon. If no agreement is made concerning the time within which interpretations required of the Architect shall be furnished in compliance with this Paragraph 4.2, then delay



shall not be recognized on account of failure by the Architect to furnish such interpretations until 15 days after written request is made for them.

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

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

### 4.3 CLAIMS AND DISPUTES

**4.3.1 Definition.** A Claim is a demand or assertion by one of the parties seeking, as a matter of right, adjustment or interpretation of Contract terms, payment of money, extension of time or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. Claims must be ~~made~~ initiated by written notice. The responsibility to substantiate Claims shall rest with the party making the Claim.

**4.3.2 Decision of Architect.** Claims, including those alleging an error or omission by the Architect, shall be referred initially to the Architect for action as provided in Paragraph 4.4. A decision by the Architect, as provided in Subparagraph 4.4.4, shall be required as a condition precedent to ~~arbitration or litigation~~ of a Claim between the Contractor and Owner as to all such matters arising prior to the date final payment is due, regardless of (1) whether such matters relate to execution and progress of the Work or (2) the extent to which the Work has been completed. The decision by the Architect in response to a Claim shall not be a condition precedent to ~~arbitration or litigation~~ in the event (1) the position of Architect is vacant, (2) the Architect has not received evidence or has failed to render a decision within agreed time limits, (3) the Architect has failed to take action required under Subparagraph 4.4.4 within 30 days after the Claim is made, (4) 45 days have passed after the Claim has been referred to the Architect or (5) the Claim relates to a mechanic's lien.

**4.3.3 Time Limits on Claims.** Claims by either party must be made within 21 7 calendar days after occurrence of the event giving rise to such Claim or within 21 7 calendar days after the claimant first recognizes the condition giving

rise to the Claim, whichever is later. Claims must be made by written notice. An additional Claim made after the initial Claim has been implemented by Change Order will not be considered unless submitted in a timely manner.

**4.3.4 Continuing Contract Performance.** Pending final resolution of a Claim ~~including arbitration~~, unless otherwise agreed in writing the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

**4.3.5 Waiver of Claims: Final Payment.** The making of final payment shall constitute a waiver of Claims by the Owner except those arising from:

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

**4.3.6 Claims for Concealed or Unknown Conditions.** If conditions are encountered at the site which are (1) subsurface or otherwise concealed physical conditions which differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, then notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event later than 21 7 calendar days after first observance of the conditions. The Architect will promptly investigate such conditions and, if they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall so notify the Owner and Contractor in writing, stating the reasons. Claims by either party in opposition to such determination must be made within 21 7 calendar days after the Architect has given notice of the decision. If the Owner and Contractor cannot agree on an adjustment in the Contract Sum or Contract Time, the adjustment shall be referred to the Architect for initial determination, subject to further proceedings pursuant to Paragraph 4.4.

**4.3.7 Claims for Additional Cost.** If the Contractor wishes to make Claim for an increase in the Contract Sum, written notice as provided herein shall be given before proceeding to execute the Work. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Paragraph 10.3. If the Contractor believes additional cost is involved for reasons including but not limited to (1) a written interpretation from the Architect, (2) an order by the Owner to stop the Work where the Contractor was not at fault, (3) a written order for a minor change in the Work issued by the Architect, (4) failure of payment by the Owner, (5) termination of the Contract by the Owner, (6) Owner's suspension or (7) other reasonable grounds, Claim shall be filed in accordance with the procedure established herein.

#### **4.3.8 Claims for Additional Time**

**4.3.8.1** If the Contractor wishes to make Claim for all increase in the Contract Time, written notice as provided herein shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay only one Claim is necessary.

4.3.8.1.1 The Contractor shall have the burden of demonstrating the effect of the claimed delay on the Contract Time, and shall furnish the Owner with such documentation relating thereto as the Owner may require, including but not limited to a contemporaneous Project CPM Schedule update demonstrating, at the time of the occurrence of the delaying activity, the change to the Substantial Completion date of the Project due solely to the inclusion of the delaying activity.

**4.3.8.2** If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time and could not have been reasonably anticipated, and that weather conditions had an adverse effect on the scheduled construction Contractor's ability to perform critical path work. If another contractor works in the Portland greater regional area in similar conditions and performing similar work on that day, as determined by the Architect, no delay will be granted.

4.3.8.2.1 The Contractor must consider weather in the Project CPM Schedule by adding duration to those activities which are weather dependent and which occur during seasons when weather may be an issue.

#### **4.3.9 Injury or Damage to Person or Property. If**

either party to the Contract suffers injury or damage to person or property because of an act or omission of the other party, of any of the other party's employees or agents, or of others for whose acts such party is legally liable, written notice of such injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after first observance. The notice shall provide sufficient detail to enable the other party to investigate the matter. If a Claim for additional cost or time related to this Claim is to be asserted, it shall be filed as provided in Subparagraphs 4.3.7 or 4.3.8.

\* 4.3.10 [Insert] page 17A.

#### **4.4 RESOLUTION OF CLAIMS AND DISPUTES**

**4.4.1** The Architect will review Claims and take one or more of the following preliminary actions within ten days of receipt of a Claim: (1) request additional supporting data from the claimant, (2) submit a schedule to the parties indicating when the Architect expects to take action, (3) reject the Claim in whole or in part, stating reasons for rejection, (4) recommend approval of the Claim by the other party or (5) suggest a compromise. The Architect may also, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim.

**4.4.2** If a Claim has been resolved, the Architect will prepare or obtain appropriate documentation.

**4.4.3** If a Claim has not been resolved, the party making the Claim shall, within ten days after the Architect's preliminary response, take one or more of the following actions: (1) submit additional supporting data requested by the Architect, (2) modify the initial Claim or (3) notify the Architect that the initial Claim stands.

**4.4.4** If a Claim has not been resolved after consideration of the foregoing and of further evidence presented by the parties or requested by the Architect, the Architect will notify the parties in writing that the Architect's decision will be made within seven days, which decision shall be final and binding on the parties ~~but subject to arbitration~~. Upon expiration of such time period, the Architect will render to the parties the Architect's written decision relative to the Claim, including any change in the Contract Sum or Contract Time or both. If there is a surety and there appears to be a possibility of a Contractor's default, the Architect may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

#### **4.5 ARBITRATION**

**4.5.1 Controversies and Claims Subject to Arbitration.** ~~Any controversy or Claim arising out of or related to the Contract, or the breach thereof, shall be settled by arbitration in accordance with the Construction Industry~~

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\*See Exhibit E, Supplemental Conditions to the AIA A201 General Conditions.

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

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

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 4.3.10 shall be deemed to preclude an award of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

~~Arbitration Rules of the American Arbitration Association, and judgment upon the award rendered by the arbitrator or arbitrators may be entered in any court having jurisdiction thereof, except controversies or Claims relating to aesthetic effect and except those waived as provided for in Subparagraph 4.3.5. - Such controversies or Claims upon which the Architect has given notice and rendered a decision as provided in Subparagraph 4.4.4 shall be subject to arbitration upon written demand of either party. - Arbitration may be commenced when 45 days have passed after a Claim has been referred to the Architect as provided in Paragraph 4.2 and no decision has been rendered.~~

**4.5.2 Rules and Notices for Arbitration.** ~~Claims between the Owner and Contractor not resolved under Paragraph 4.4 shall, if subject to arbitration under Subparagraph 4.5.1, be decided by arbitration in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. Notice of demand for arbitration shall be filed in writing with the other party to the Agreement between the Owner and Contractor and with the American Arbitration Association, and a copy shall be filed with the Architect.~~

**4.5.3 Contact Performance During Arbitration.** ~~During arbitration proceedings, the Owner and Contractor shall comply with Subparagraph 4.3.4.~~

**4.5.4 When Arbitration May Be Demanded.** ~~Demand for arbitration of any Claim may not be made until the earlier of (1) the date on which the Architect has rendered a final written decision on the Claim, (2) the tenth day after the parties have presented evidence to the Architect or have been given reasonable opportunity to do so, if the Architect has not rendered a final written decision by that date, or (3) any of the five events described in Subparagraph 4.3.2.~~

**4.5.4.1** ~~When a written decision of the Architect states that (1) the decision is final but subject to arbitration and (2) a demand for arbitration of a Claim covered by such decision must be made within 30 days after the date on which the party making the demand receives the final written decision, then failure to demand arbitration within said 30 days' period shall result in the Architect's decision becoming final and binding upon the Owner and Contractor. If the Architect renders a decision after arbitration proceedings have been initiated, such decision may be entered as evidence, but shall not supersede arbitration proceedings unless the decision is acceptable to all parties concerned.~~

**4.5.4.2** ~~A demand for arbitration shall be made within the time limits specified in Subparagraphs 4.5.1 and 4.5.4 and~~

~~Clause 4.5.4.1 as applicable, and in other cases within a reasonable time after the Claim has arisen, and in no event shall it be made after the date when institution of legal or equitable proceedings based on such Claim would be barred by the applicable statute of limitations as determined pursuant to Paragraph 13.7.~~

**4.5.5 Limitation on Consolidation or Joinder.** ~~No arbitration arising out of or relating to the Contract Documents shall include, by consolidation or joinder or in any other manner, the Architect, the Architect's employees or consultants, except by written consent containing specific reference to the Agreement and signed by the Architect, Owner, Contractor and any other person or entity sought to be joined. - No arbitration shall include, by consolidation or joinder or in any other manner, parties other than the Owner, Contractor, a separate contractor as described in Article 6 and other persons substantially involved in a common question of fact or law whose presence is required if complete relief is to be accorded in arbitration. No person or entity other than the Owner, Contractor or a separate contractor as described in Article 6 shall be included as an original third party or additional third party to an arbitration whose interest or responsibility is insubstantial. - Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of a dispute not described therein or with a person or entity not named or described therein. - The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement shall be specifically enforceable under applicable law in any court having jurisdiction thereof.~~

**4.5.6 Claims and Timely Assertion of Claims.** ~~A party who files a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded. - When a party fails to include a Claim through oversight, inadvertence or excusable neglect, or when a Claim has matured or been acquired subsequently, the arbitrator or arbitrators may permit amendment.~~

**4.5.7 Judgment on Final Award.** ~~The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.~~

## ARTICLE 5 SUBCONTRACTORS

### 5.1 DEFINITIONS

**5.1.1** A Subcontractor is a person or entity who has a

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

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

## **5.2 AWARD OF SUBCONTRACTS AND OTHER CONTRACTS FOR PORTIONS OF THE WORK**

**5.2.1** Unless otherwise stated in the Contract Documents or the bidding requirements, the Contractor, as soon as practicable after award of the Contract, shall furnish in writing to the Owner through the Architect the names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each principal portion of the Work. The Architect will promptly reply within 14 calendar days to the Contractor in writing stating whether or not the Owner or the Architect, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Architect to reply promptly within 14 calendar days shall constitute notice of no reasonable objection.

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

**5.2.3** If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. The Contract Sum shall be increased or decreased by the difference in cost occasioned by such change and an appropriate Change Order shall be issued. However, no increase in the Contract Sum shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

**5.2.4** The Contractor shall not change a Subcontractor, person or entity previously selected ~~if the Owner or Architect makes reasonable objection to such change~~ without the written consent of the Owner or Architect.

## **5.3 SUBCONTRACTUAL RELATIONS**

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

## **5.4 CONTINGENT ASSIGNMENT OF SUBCONTRACTS**

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

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

**5.4.2** Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increase in costs shown to have resulted directly from the suspension.

**ARTICLE 6  
CONSTRUCTION BY OWNER OR BY SEPARATE  
CONTRACTORS**

**6.1 OWNERS RIGHT TO PERFORM  
CONSTRUCTION AND TO AWARD  
SEPARATE CONTRACTS**

**6.1.1** The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and to award separate contracts in connection with other portions of the Project or other construction or operations on the site under Conditions of the Contract identical or substantially similar to these including those portions related to insurance and waiver of subrogation.

If the Contractor claims that delay or additional cost is involved because of such action by the Owner, the Contractor shall make such Claim as provided elsewhere in the Contract Documents.

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

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

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

**6.2 MUTUAL RESPONSIBILITY**

**6.2.1** The Contractor shall afford the Owner and separate contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities and shall connect and coordinate the Contractor's construction and operations with theirs as

required by the Contract Documents.

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

**6.2.3** Costs caused by delays or by improperly timed activities or defective construction shall be borne by the party responsible therefor.

**6.2.4** The Contractor shall promptly remedy damage wrongfully caused by the Contractor to completed or partially completed construction or to property of the Owner or separate contractors as provided in Subparagraph 10.2.5.

**6.2.5** Claims and other disputes and matters in question between the Contractor and a separate contractor shall be subject to the provisions of Paragraph 4.3 provided the separate contractor has reciprocal obligations.

**6.2.6** The Owner and each separate contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Paragraph 3.14.

**6.3 OWNER'S RIGHT TO CLEAN UP**

**6.3.1** If a dispute arises among the Contractor, separate contractors and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish as described in Paragraph 3.15, the Owner may clean up and allocate the cost among those responsible as the Architect determines to be just.

**ARTICLE 7  
CHANGES IN THE WORK**

**7.1 CHANGES**

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

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7.1.1.1 Changes in the Work shall be incorporated by a Change Order, which outlines the modifications to the Work and lists the increase or reduction in the Contract Sum and the Contract Time. Any such increase in the Contract Sum shall be based upon the Contractor's actual cost of completion of any such additional or changed work. Any such increase or decrease in the Contract Time shall be supported by contemporaneous schedules showing the project at the time of the change order both with and without the proposed change order work. The change in Contract Time shall be equal to or less than the change in the project end date between those two schedules. The Contractor shall prepare all Change Orders and present them to the Architect for approval using AIA standard form G701. The Contractor must submit the Change Order in a timely fashion so that it will minimize and mitigate to the extent possible any critical path delay to the Project. The Contractor shall account for the Architect and Owner's approval time when planning its Change Order submissions. Each Change Order will be approved or rejected by the Owner and Architect in a reasonable period of time. The Contractor shall not proceed with commencement of the Change Order Work without the proper written approval to proceed by the Owner and Architect.

7.1.1.2 The Contract Sum and the Contract Times may be amended by agreed-upon Change Orders.

7.1.1.3 The Contractor shall use AIA standard form G709 to obtain price quotations required in the negotiation of change orders.

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

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

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

prices shall be equitably adjusted.

7.1.5 The allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:

7.1.5.1 For the Contractor, for any Work performed by the Contractor's own forces: 15 (fifteen) percent of the cost.

7.1.5.2 For the Contractor, for Work performed by his Subcontractor: 5 (five) percent of the amount due the Subcontractor.

7.1.5.3 For each Subcontractor or Sub-subcontractor involved, for any Work performed by that Subcontractor's own forces: 10 (ten) percent of the cost.

7.1.5.4 Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.3.6.

7.1.5.5 For the Contractor, at no time will the total Contractors mark up exceed 15 (fifteen) percent.

7.1.6 In order to facilitate checking for quotations of extras or credits, all proposals shall be accompanied by a complete itemization of costs including labor, materials and subcontracts. Each labor and materials component shall be itemized to show quantities, unit costs and the resulting mathematical extensions. Subcontract cost items shall be itemized in the same manner, as noted above. In no case will a change involving over \$600.00 be approved without such itemization.

## **7.2 CHANGE ORDERS**

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

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

7.2.2 Methods used in determining adjustments to the Contract Sum may include those listed in Subparagraph 7.3.3.

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### 7.3 CONSTRUCTION CHANGE DIRECTIVES

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

**7.3.2** A Construction Change Directive in the form of AIA standard form G714 shall be used in the absence of total agreement on the terms of a Change Order.

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

- .1 mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- .2 unit prices stated in the Contract Documents or subsequently agreed upon;
- .3 cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- .4 as provided in Subparagraph 7.3.6.

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

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

**7.3.6** If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the method and the adjustment shall be determined by the Architect on the basis of reasonable expenditures and savings of those performing the Work attributable to the

change, including, in case of an increase in the Contract Sum, ~~a reasonable allowance for overhead and profit - an allowance for overhead and profit in accordance with the schedule set forth in Subparagraph 7.1.5.~~ In such case, and also under Clause 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Subparagraph 7.3.6 shall be limited to the following:

- .1 costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and workers' or workmen's compensation insurance;
- .2 costs of materials, supplies and equipment, including cost of transportation, whether incorporated or consumed;
- .3 rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;
- .4 costs of premiums for all bonds and insurance, permit fees, and sales, use or similar taxes related to the Work; and
- .5 additional costs of supervision and field office personnel directly attributable to the change.

**7.3.7** Pending final determination of cost to the Owner, amounts not in dispute may be included in Applications for Payment. The amount of credit to be allowed by the Contractor to the Owner for a deletion or change which results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

**7.3.8** If the Owner and Contractor do not agree with the adjustment in Contract Time or the method for determining it, the adjustment or the method shall be referred to the Architect for determination.

**7.3.9** When the Owner and Contractor agree with the determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.



## 7.4 MINOR CHANGES IN THE WORK

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

## ARTICLE 8 TIME

### 8.1 DEFINITIONS

8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work using the Project CPM Schedule as described in Article 3. Commencement of the Work means the date of notice to proceed issued by the Owner or as otherwise stipulated in the agreement.

8.1.1.1 The Contractor agrees to the commencement of construction of the Project, as contemplated by this Agreement, in a timely manner, which is anticipated to be at or prior to that shown in the Initial Project CPM Schedule. The Contractor recognizes time is of the essence in this Agreement.

8.1.2 Time limits stated in the Contract Documents are of the essence of this contract. The Work to be performed under this contract shall commence upon receipt of a notice to proceed from the Owner unless otherwise agreed and subject to authorized Modifications. The date of commencement of the Work is the date established in the Agreement. The date shall not be postponed by the failure to act of the Contractor or of persons or entities for whom the Contractor is responsible.

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

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

### 8.2 PROGRESS AND COMPLETION

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

period for performing the Work.

8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, prematurely commence operations on the site or elsewhere prior to the effective date of insurance required by Article 11 to be furnished by the Contractor. The date of commencement of the Work shall not be changed by the effective date of such insurance. Unless the date of commencement is established by a notice to proceed given by the Owner, the Contractor shall notify the Owner in writing not less than five days or other agreed period before commencing the Work to permit the timely filing of mortgages, mechanic's liens and other security interests.

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

8.2.4 If in any Application for Payment, the total value of the completed Work in place, as certified by the Architect, is less than 90 percent of the total value of the Work in place estimated in the Project CPM Schedule and/or the schedule of values and the monthly pay requests, the Owner may, at the Owner's option, require the Contractor to recover the lost time as necessary to complete the Project on its contractual completion date without cost to the Owner, using whatever means are reasonable and effective. The Contractor shall prepare and submit a text and Project CPM Schedule recovery plan to the Architect and Owner prior to executing its plan.

8.2.5 Whenever it becomes apparent that the Project completion date may not be met, the Contractor shall take whatever actions are reasonable and effective, and which will substantially eliminate the backlog of work and which will return the Project CPM Schedule to show on-time completion of the Project.

8.2.5.1 If the Contractor fails to take reasonable, effective action within four calendar days after receiving written notice, the Owner shall take action to put the Project back on schedule. This action may include but not be limited to some or all of:

- a. increasing manpower;
- b. increasing the working hours per shift, shifts per day, or days per week;
- c. increasing the amount of equipment; or
- d. re-scheduling activities to achieve maximum practical concurrency of activities.

Costs related to such actions shall be deducted from the

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monies due or to become due to the Contractor.

8.2.6 If each of three successive applications, as certified by the Architect, indicate that the actual Work completed is less than 90 percent of the Work estimated in the Project CPM Schedule to be completed by the respective dates, the Owner may at the Owner's option, treat the Contractor's delinquency as a default, justifying the action permitted under Article 14.2.

8.2.7 If the Owner has determined that the Contractor should be permitted to extend the time for completion as provided in Paragraph 8.3, the Project CPM Schedule shall be adjusted accordingly, and the dollar value of Work to be completed as of the first of each month shall be re-calculated.

### 8.3 DELAYS AND EXTENSIONS OF TIME

8.3.1 If the Contractor is delayed at any time in progress of the Work by an act or neglect of the Owner or Architect, or of an employee of either, or of a separate contractor employed by the Owner, or by changes ordered in the Work, not caused by the fault of the contractor or his subcontractors or by labor disputes, fire, unusual delay in deliveries transportation, extreme weather conditions not reasonably anticipated, unavoidable casualties or other causes beyond the Contractor's control, or by delay authorized by the Owner pending arbitration-litigation, or by other causes which the Owner or Architect determines may justify delay, then the Contract Time shall be reasonably extended by Change Order for such reasonable time as the Owner or Architect may determine.

8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Paragraph 4.3.

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

8.3.4 The existence of and extent of delay shall be determined according to Article 4.3.8.1.1.

## ARTICLE 9 PAYMENTS AND COMPLETION

### 9.1 CONTRACT SUM

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

### 9.2 SCHEDULE OF VALUES

9.2.1 Before the first Application for Payment, the Contractor shall submit to the Architect a schedule of values allocated to various portions of the Work, prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. The schedule of values must be consistent with and supportable by the Project CPM Schedule as described in Article 3. It should be submitted using AIA Document G702 and G703. It shall be broken out by CSI format using individual line items by area, then by Subcontractor and then by Sub-subcontractor and or major supplier.

### 9.3 APPLICATIONS FOR PAYMENT

9.3.1 ~~At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment for operations completed in accordance with the schedule of values. Such application shall be notarized, if required, and supported by such data substantiating the Contractor's right to payment as the Owner or Architect may require, such as copies of requisitions from Subcontractors and material suppliers, and reflecting retainage if provided for elsewhere in the Contract Documents. At the time or times established in the Agreement, the Contractor shall submit to the Owner an itemized Application for Payment for operations completed in accordance with the Project CPM Schedule. The Application for Payment will include an updated schedule reflecting all payments including the current Application for Payment. Such application shall be notarized, and supported by such data substantiating the Contractor's right to payment as the Owner may require, such as copies of requisitions, lien waivers (commencing with the first application for payment), from Subcontractors, Sub-subcontractors and material suppliers, and reflecting retainage if provided for elsewhere in the Contract Documents. Applications for Payment will be submitted on AIA form G702 and G703.~~

A detailed schedule of values will be required as described in Article 9.2.1. All Applications for Payment will include a lien waiver summary as per Exhibit "B".

9.3.1.1 ~~Such applications may include requests for payment on account of changes in the Work which have been properly authorized by Construction Change Directives but not yet included in Change Orders. The Contractor shall submit an~~

Application for Payment on or about the twenty-fifth day of each month.

9.3.1.2 Such applications may not include requests for payment of amounts the Contractor does not intend to pay to a Subcontractor or material supplier because of a dispute or other reason.

9.3.1.3 Each Application for Payment shall be based upon the schedule of values submitted by the Contractor. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work.

9.3.1.4 Applications for Payment shall show the percentage of completion and remaining duration of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage of completion shall be the lesser of: (1) the percentage of that portion of the Work which has actually been completed; or (2) the percentage obtained by dividing (a) the expense which has actually been incurred by the Contractor on account of that portion of the Work for which the Contractor has made or intends to make actual payment prior to the next Application for Payment by (b) the share of the Contract Sum allocated to that portion of the Work.

9.3.1.5 Typographical and/or arithmetical errors in Applications for Payment or Change Orders shall not be grounds for additional payments.

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

9.3.2.1 The Contractor, his Subcontractors, 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, the Owner

will require proper proof of insurance naming the Owner as an additionally insured party, and a letter in which is furnished:

- a. the name of the Contractor and/or Subcontractor or Subordinate Subcontractor leasing the storage area;
- b. the location of such leased space;
- c. the leased area: the entire premises of certain areas of a warehouse giving the number of floors or portions thereof;
- d. the date on which the material is first stored;
- e. the value of the material stored; and
- f. Transfer of Title to the Owner, Right of Entry and Removal.

9.3.2.2 The Contractor, its 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.

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

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

9.3.2.5 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 withheld from subsequent payments made to the Contractor.

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

indicated, the quality of the Work covered by the Application is in accordance with the Contract Documents, and the Contractor is entitled to payment in the amount requested.

#### 9.4 CERTIFICATES FOR PAYMENT

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

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

9.4.3 Within twenty-one calendar days of the Owner's receipt from the Architect of a properly submitted, complete and correct Application for Payment, the Owner shall make payment to the Contractor.

#### 9.5 DECISIONS TO WITHHOLD CERTIFICATION

9.5.1 The Architect may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary as determined by the

Architect and Owner, to protect the Owner, if in the Architect's and Owner's opinion the representations to the Owner required by Subparagraph 9.4.2 cannot be made. If the Owner is unable to certify payment in the amount of the Application, the Owner will notify the Contractor. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Subparagraph 9.4.1. If the Contractor, Owner and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also decide not to certify the entire Application for payment or, because of subsequently discovered evidence or subsequent observations, may nullify the whole ~~or a part of a~~ Certificate for Payment previously issued, ~~to such extent as may be necessary~~ if in the Architect's and Owner's opinion this is necessary to protect the Owner from loss because of:

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

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

#### 9.6 PROGRESS PAYMENTS

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

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shall so notify the Architect.

**9.6.2** The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's portion of the Work, the amount to which said Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of such Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in similar manner.

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

**9.6.4** Neither the Owner nor Architect shall have an obligation to pay or to see to the payment of money to a Subcontractor except as may otherwise be required by law.

**9.6.5** Payment to material suppliers shall be treated in a manner similar to that provided in Subparagraphs 9.6.2, 9.6.3 and 9.6.4.

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

**9.6.7** Until Construction Work in an established phase is substantially complete, the Owner will pay 90 percent of the amount due the Contractor on account of progress payments. The Owner may subsequently withhold the full Contract retainage if the manner of completion of the Work and its progress do not remain satisfactory to the Owner, or if the Surety withholds its consent, or for other good and sufficient reasons.

## **9.7 FAILURE OF PAYMENT**

**9.7.1** If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents the amount certified by the Architect ~~or awarded by arbitration~~, then the Contractor may, upon seven additional days' written notice to the Owner and Architect,

stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shut-down, delay and start-up, which shall be accomplished as provided in Article 7.

## **9.8 SUBSTANTIAL COMPLETION**

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

**9.8.1.1** The Contractor shall obtain and deliver promptly to the Owner any occupancy permit and any certificates of final inspection of any part of the Contractor's Work and operating permits for any mechanical apparatus, such as elevators, escalators, boilers, air compressors, etc., which may be required by law to permit full use and occupancy of the premises by the Owner. Receipt of such permits or certificates by the Owner shall be a condition precedent to Substantial Completion of the Work.

**9.8.2** When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected. The Contractor shall proceed promptly to complete and correct items on the list. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents. Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not in accordance with the requirements of the Contract Documents, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item, upon notification by the Architect. The Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion. When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion using AIA standard form G704 which shall establish the date of Substantial Completion, shall establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance, and shall fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall

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commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion. The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

**9.8.3** Upon Substantial Completion of the Work or designated portion thereof and upon application by the Contractor and certification by the Architect, the Owner shall make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents.

## **9.9 PARTIAL OCCUPANCY OR USE**

**9.9.1** The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer as required under Subparagraph 11.3.11 and authorized by public authorities having jurisdiction over the Work. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Subparagraph 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

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

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

## **9.10 FINAL COMPLETION AND FINAL PAYMENT**

**9.10.1** Upon receipt of written notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection and, when the Architect finds the Work

acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's observations and inspections, the Work has been completed in accordance with terms and conditions of the Contract Documents and that the entire balance found to be due the Contractor and noted in said final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Subparagraph 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

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

**9.10.3** If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of surety to payment of the balance due for that portion of the Work fully completed and

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accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of claims. The making of final payment shall constitute a waiver of claims by the Owner as provided in Subparagraph 4.3.5.

9.10.4 Acceptance of final payment by the Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment. Such waivers shall be in addition to the waiver described in Subparagraph 4.3.5.

9.10.5 The making of final payment shall constitute a waiver of all claims by the Owner except those arising from:

- .1 unsettled liens;
- .2 faulty or defective Work appearing after Substantial Completion;
- .3 failure of the Work to comply with requirements of the Contract Documents;
- .4 terms of special warranties required by the Contract Documents; or
- .5 as described in Subparagraph 9.10.3 above

## ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

### 10.1 SAFETY PRECAUTIONS AND PROGRAMS

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

~~10.1.2 In the event the Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and 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 polychlorinated biphenyl (PCB) and has not been rendered harmless. The Work in the affected area shall be resumed in the absence of asbestos or polychlorinated biphenyl (PCB), or when it has been rendered harmless, by written agreement of the Owner and Contractor, or in accordance with final determination by the Architect on which arbitration has not been demanded, or by arbitration under Article 4.~~

~~10.1.3 The Contractor shall not be required pursuant to Article 7 to perform without consent any Work relating to asbestos or polychlorinated biphenyl (PCB).~~

~~10.1.4 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material is asbestos or polychlorinated biphenyl (PCB) and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself) including loss of use resulting therefrom, but only to the extent caused in whole or in part by negligent acts or omissions of the Owner, anyone directly or indirectly employed by the Owner or anyone for whose acts the Owner may be liable, regardless of whether or not such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Subparagraph 10.1.4.~~

### 10.2 SAFETY OF PERSONS AND PROPERTY

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

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

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

10.2.3 The Contractor shall erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including

posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.

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

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

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

**10.2.7** The Contractor shall not load or permit any part of the construction or site to be loaded so as to endanger its safety.

### **10.3 EMERGENCIES**

**10.3.1** In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Paragraph 4.3 and Article 7.

### **10.4 HAZARDOUS MATERIALS:**

**10.4.1** The Architect is not responsible for the survey, identification, or removal or any hazardous materials, including asbestos or polychlorinated biphenyl (PCB), on the Project.

**10.4.2** With the exception of lead containing materials,

the Contractor is not responsible for the survey, identification, or removal of any hazardous materials, including asbestos or polychlorinated biphenyl (PCB), on the Project.

**10.4.3** If reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing.

**10.4.4** The Owner shall obtain the service of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment or such material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. The Contract Time shall be extended appropriately and the Contract Sum shall be increased in the amount of the Contractor's reasonable additional costs of shut-down, delay and start-up, which adjustments shall be accomplished as provided in Article 7.

**10.4.5** To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Subparagraph 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or

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destruction of tangible property (other than the Work itself) and provided that such damage, loss or expense is not due to the sole negligence of a party seeking indemnity.

#### **10.5 LEAD CONTAINING MATERIALS:**

10.5.1 The Contractor is not responsible for the survey or identification of lead containing materials.

10.5.2 Lead containing materials encountered during demolition shall be demolished and removed by the Contractor from the job site to an approved container supplied by the Owner in accordance with all applicable OSHA requirements. Disposal of lead containing materials if deemed hazardous, shall be by the Owner.

10.5.3 The Contractor's base bid shall include demolition and removal of lead containing materials using typical OSHA safety precautions for all materials containing lead.

10.5.4 The Owner shall perform air testing during demolition of materials containing lead and shall make these test reports available to the Contractor. The Owner shall at no time be responsible for determining the levels of protection required for any personnel on the Project.

10.5.5 The Owner shall not be responsible under Paragraph 10.3 for materials and substances brought to the site by the Contractor unless such materials or substances were required by the Contract Documents.

10.5.6 If, without negligence on the part of the Contractor, the Contractor is held liable for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall indemnify the Contractor for all cost and expense thereby incurred.

### **ARTICLE 11 INSURANCE AND BONDS**

#### **11.1 CONTRACTOR'S LIABILITY INSURANCE**

11.1.1 The Contractor shall purchase from and maintain in a company or companies lawfully authorized licensed to do business in the jurisdiction state in which the Project is located such insurance as will protect the Contractor from claims set forth below which may arise out of or result from the Contractor's operations under the Contract and for which

the Contractor may be legally liable, whether such operations be by the Contractor or by a Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- .1 claims under workers' or workmen's compensation, disability benefit and other similar employee benefit acts which are applicable to the Work to be performed;
- .2 claims for damages because of bodily injury, occupational sickness or disease, or death of the Contractor's employees;
- .3 claims for damages because of bodily injury, sickness or disease, or death of any person other than the Contractor's employees;
- .4 claims for damages insured by usual personal injury liability coverage which are sustained (1) by a person as a result of an offense directly or indirectly related to employment of such person by the Contractor, or (2) by another person;
- .5 claims for damages, other than to the Work itself, because of injury to or destruction of tangible property, including loss of use resulting therefrom;
- .6 claims for damages because of bodily injury, death of a person or property damage arising out of ownership, maintenance or use of a motor vehicle; and
- .7 claims involving contractual liability insurance applicable to the Contractor's obligations under Paragraph 3.18.

11.1.2 The insurance required by Subparagraph 11.1.1 shall be written for not less than limits of liability specified in the Contract Documents or required by law, whichever coverage is greater. Coverages, whether written on an occurrence or claims-made basis, shall be maintained without interruption from date of commencement of the Work until date of final payment and termination of any coverage required to be maintained after final payment.

11.1.2.1 The insurance required by Subparagraph 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. (a) State: Statutory

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(b) Applicable Federal: Statutory

2. Employer's Liability: \$500,000

3. Comprehensive General Liability (including Premises-Operations; Independent Contractors' Protective; Products and Completed Operations; Broad Form Property Damage and XCU Hazards Liability):

(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) Bodily Injury: \$5,000,000 Each Occurrence  
\$5,000,000 Annual Aggregate

(b) Property Damage: \$2,000,000 Each Occurrence  
\$5,000,000 Annual Aggregate

5. Personal Injury, with Employment Exclusion deleted:

(a) \$5,000,000 Annual Aggregate

6. 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

7. Aircraft Liability (owned and non-owned) when applicable:

- (Owner to approve limits proposed by Contractor).

8. Watercraft Liability (owned and non-owned) when applicable: (Owner to approved limits proposed by Contractor).

11.1.2.2 All Subcontractors shall carry policies with \$1,000,000 insurance coverage for their work on this project.

11.1.3 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates and the insurance policies required by this Paragraph 11.1 shall contain a provision that coverages afforded under the policies will not be cancelled or

allowed to expire until at least 30 days' prior written notice has been given to the Owner. If any of the foregoing insurance coverages are required to remain in force after final payment and are reasonably available, all additional certificate evidencing continuation of such coverage shall be submitted with the final Application for Payment as required by Subparagraph 9.10.2. Information concerning reduction of coverage shall be furnished by the Contractor with reasonable promptness in accordance with the Contractor's information and belief.

11.1.3.1 The Contractor shall furnish 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 AIA G-705. The Contractor shall furnish to the Owner copies of any endorsements that are subsequently issued amending coverage of limits.

## 11.2 OWNER'S LIABILITY INSURANCE

11.2.1 The Owner shall be responsible for purchasing and maintaining the Owner's usual liability insurance. Optionally, the Owner may purchase and maintain other insurance for self-protection against claims which may arise from operations under the Contract. The Contractor shall not be responsible for purchasing and maintaining this optional Owner's liability insurance unless specifically required by the Contract Documents.

## 11.3 PROPERTY INSURANCE

11.3.1 Unless otherwise provided, the Owner shall purchase and maintain, in a company or companies lawfully authorized to do business in the jurisdiction in which the Project is located, property insurance in the amount of the initial Contract Sum as well as subsequent modifications thereto for the entire Work at the site on a replacement cost basis without voluntary deductibles. Such property insurance shall be maintained, unless otherwise provided in the Contract Documents or otherwise agreed in writing by all persons and entities who are beneficiaries of such insurance, until final payment has been made as provided in Paragraph 9.10 or until no person or entity other than the Owner has an insurable interest in the property required by this Paragraph 11.3 to be covered, whichever is earlier. This insurance shall include interests of the Owner, <sup>and</sup> the Contractor, ~~Subcontractors and Sub-subcontractors~~ in the Work.

11.3.1.1 Property insurance shall be on an all-risk policy form and shall insure against the perils of fire and extended coverage and physical loss or damage including, without duplication of coverage, theft, vandalism, malicious mischief,

collapse, false-work, temporary buildings and debris removal including demolition occasioned by enforcement of any applicable legal requirements, and shall cover reasonable compensation for Architect's services and expenses required as a result of such insured loss. Coverage for other perils shall not be required unless otherwise provided in the Contract Documents.

**11.3.1.2** If the Owner does not intend to purchase such property insurance required by the Contract and with all of the coverages in the amount described above, the Owner shall so inform the Contractor in writing prior to commencement of the Work. The Contractor may then effect insurance which will protect the interests of the Contractor, Subcontractors and Sub-subcontractors in the Work, and by appropriate Change Order the cost thereof shall be charged to the Owner. If the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain insurance as described above, without so notifying the Contractor, then the Owner shall bear all reasonable costs properly attributable thereto.

**11.3.1.3** If the property insurance requires minimum deductibles and such deductibles are identified in the Contract Documents, the Contractor shall pay costs not covered because of such deductibles. If the Owner or insurer increases the required minimum deductibles above the amounts so identified or if the Owner elects to purchase this insurance with voluntary deductible amounts, the Owner shall be responsible for payment of the additional costs not covered because of such increased or voluntary deductibles. If deductibles are not identified in the Contract Documents, the Owner shall pay costs not covered because of deductibles.

**11.3.1.4** Unless otherwise provided in the Contract Documents, this property insurance shall cover portions of the Work stored off the site after written approval of the Owner at the value established in the approval, and also portions of the Work in transit.

**11.3.2 Boiler and Machinery Insurance.** The Owner shall purchase and maintain boiler and machinery insurance required by the Contract Documents or by law, which shall specifically cover such insured objects during installation and until final acceptance by the Owner; this insurance shall include interests of the Owner, Contractor, Subcontractors and Sub-subcontractors in the Work, and the Owner and Contractor shall be named insureds.

**11.3.3 Loss of Use Insurance.** The Owner, at the Owner's option, may purchase and maintain such insurance as will insure the Owner against loss of use of the Owner's property due to fire or other hazards, however caused. The

Owner waives all rights of action against the Contractor for loss of use of the Owner's property, including consequential losses due to fire or other hazards however caused.

**11.3.4** If the Contractor requests in writing that insurance for risks other than those described herein or for other special hazards be included in the property insurance policy, the Owner shall, if possible, include such insurance, and the cost there of shall be charged to the Contractor by appropriate Change Order.

**11.3.5** If during the Project construction period the Owner insures properties, real or personal or both, adjoining or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, the Owner shall waive all rights in accordance with the terms of Subparagraph 11.3.7 for damages caused by fire or other perils covered by this separate property insurance. All separate policies shall provide this waiver of subrogation by endorsement or otherwise.

**11.3.6** Before an exposure to loss may occur, the Owner shall file with the Contractor a copy of each policy that includes insurance coverages required by this Paragraph 11.3. Each policy shall contain all generally applicable conditions, definitions, exclusions and endorsements related to this Project. Each policy shall contain a provision that the policy will not be cancelled or allowed to expire until at least 30 days' prior written notice has been given to the Contractor.

**11.3.7 Waivers of Subrogation.** The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents and employees, each of the other, and (2) the Architect, Architect's consultants, separate contractors described in Article 6, if any, and any of their subcontractors, sub-subcontractors, agents and employees, for damages caused by fire or other perils to the extent covered by property insurance obtained pursuant to this Paragraph 11.3 or other property insurance applicable to the Work, except such rights as they have to proceeds of such insurance held by the Owner as fiduciary. The Owner or Contractor, as appropriate, shall require of the Architect, Architect's consultants, separate contractors described in Article 6, if any, and the subcontractors, sub-subcontractors, agents and employees of any of them, by appropriate agreements, written where legally required for validity, similar waivers each in favor of other parties enumerated herein. The policies shall provide such waivers of subrogation by endorsement or otherwise. A waiver of subrogation shall be effective as to a

person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

**11.3.8** A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgage clause and of Subparagraph 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

**11.3.9** If required in writing by a party in interest, the Owner as fiduciary shall, upon occurrence of an insured loss, give bond for proper performance of the Owner's duties. The cost of required bonds shall be charged against proceeds received as fiduciary. The Owner shall deposit in a separate account proceeds so received, which the Owner shall distribute in accordance with such agreement as the parties in interest may reach, ~~or in accordance with an arbitration award in which case the procedure shall be as provided in Paragraph 4.5.~~ If after such loss no other special agreement is made, replacement of damaged property shall be covered by appropriate Change Order.

**11.3.10** The Owner as fiduciary shall have power to adjust and settle a loss with insurers unless one of the parties in interest shall object in writing within five days after occurrence of loss to the Owner's exercise of this power; ~~if such objection be made, arbitrators shall be chosen as provided in Paragraph 4.5. The Owner as fiduciary shall, in that case, make settlement with insurers in accordance with directions of such arbitrators. If distribution of insurance proceeds by arbitration is required, the arbitrators will direct such distribution.~~

**11.3.11** Partial occupancy or use in accordance with Paragraph 9.9 shall not commence until the insurance company or companies providing property insurance have consented to such partial occupancy or use by endorsement or otherwise. The Owner and the Contractor shall take reasonable steps to obtain consent of the insurance company or companies and shall, without mutual written consent, take no action with respect to partial occupancy or use that would cause cancellation, lapse or reduction of insurance.

~~11.3.12 The Contractor may, at its own choosing, purchase and maintain All Builders Risk Insurance as described in all paragraphs under Paragraph 11.3. The~~

~~Owner does have Builders Risk coverage. The Owner does not require the Contractor to carry additional Builders Risk coverage. Should the Contractor decide to carry Builders Risk Insurance for this project, the cost shall not be passed on to the Owner.~~

## 11.4 PERFORMANCE BOND AND PAYMENT BOND

**11.4.1** The Owner shall have the right to require the Contractor to furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder as stipulated in bidding requirements or specifically required in the Contract Documents on the date of execution of the Contract.

**11.4.2** Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall permit a copy to be made.

## ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

### 12.1 UNCOVERING OF WORK

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

**12.1.2** If a portion of the Work has been covered which the Architect has not specifically requested to observe prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

### 12.2 CORRECTION OF WORK

**12.2.1** The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing

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person or entity even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, did not pay the insurance premium directly or indirectly, and whether or not the person or entity had an insurable interest in the property damaged.

11.3.8 A loss insured under Owner's property insurance shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Subparagraph 11.3.10. The Contractor shall pay Subcontractors their just shares of insurance proceeds received by the Contractor, and by appropriate agreements, written where legally required for validity, shall require Subcontractors to make payments to their Sub-subcontractors in similar manner.

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12.1.2 If a portion of the Work has been covered which the Architect has not specifically requested to observe prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement shall, by appropriate Change Order, be charged to the Owner. If such Work is not in accordance with the Contract Documents, the Contractor shall pay such costs unless the condition was caused by the Owner or a separate contractor in which event the Owner shall be responsible for payment of such costs.

### 12.2 CORRECTION OF WORK

12.2.1 The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed or completed. The Contractor shall bear costs of correcting such rejected Work, including additional testing

and inspections and compensation for the Architect's services and expenses made necessary thereby.

**12.2.2** If, within one year after the date of Substantial Completion of the Work or designated portion thereof, or after the date for commencement of warranties established under Subparagraph 9.9.1, or by terms of an applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the Owner to do so unless the Owner has previously given the Contractor a written acceptance of such condition. This period of one year shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation under this Subparagraph 12.2.2 shall survive acceptance of the Work under the Contract and termination of the Contract. The Owner shall give such notice promptly after discovery of the condition.

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

**12.2.4** If the Contractor fails to correct nonconforming Work within a reasonable time, the Owner may correct it in accordance with Paragraph 2.4. If the Contractor does not proceed with correction of such nonconforming Work within a reasonable time fixed by written notice from the Architect, the Owner may remove it and store the salvable materials or equipment at the Contractor's expense. If the Contractor does not pay costs of such removal and storage within ten days after written notice, the Owner may upon ten additional days' written notice sell such materials and equipment at auction or at private sale and shall account for the proceeds thereof, after deducting costs and damages that should have been borne by the Contractor, including compensation for the Architect's services and expenses made necessary thereby. If such proceeds of sale do not cover costs which the Contractor should have borne, the Contract Sum shall be reduced by the deficiency. If payments then or thereafter due the Contractor are not sufficient to cover such amount, the Contractor shall pay the difference to the Owner.

**12.2.5** The Contractor shall bear the cost of correcting destroyed or damaged construction, whether completed or partially completed, of the Owner or separate contractors caused by the Contractor's correction or removal of Work which is not in accordance with the requirements of the Contract Documents.

**12.2.6** Nothing contained in this Paragraph 12.2 shall be construed to establish a period of limitation with respect to other obligations which the Contractor might have under the Contract Documents. Establishment of the time period of one year as described in Subparagraph 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

### **12.3 ACCEPTANCE OF NONCONFORMING WORK**

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

## **ARTICLE 13 MISCELLANEOUS PROVISIONS**

### **13.1 GOVERNING LAW**

**13.1.1** The Contract shall be governed by the law of the place where the Project is located. \_\_\_\_\_

**13.1.2** The table of contents and the headings of articles and paragraphs are for convenience only and shall not modify rights and obligations created by this agreement.

**13.1.3** In case a provision of this agreement is held to be invalid, illegal or unenforceable, the remaining provisions of this agreement shall remain in force and shall be considered valid and enforceable.

### **13.2 SUCCESSORS AND ASSIGNS**

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

Contract.

### 13.3 WRITTEN NOTICE

13.3.1 Written notice shall be deemed to have been duly served if delivered in person to the individual or a member of the firm or entity or to an officer of the corporation for which it was intended, or if delivered at or sent by registered or certified mail to the last business address known to the party giving notice.

### 13.4 RIGHTS AND REMEDIES

13.4.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.

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

### 13.5 TESTS AND INSPECTIONS

13.5.1 Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations or orders of public authorities having jurisdiction shall be made at an appropriate time. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections and approvals. The Contractor shall give the Architect timely notice of when and where tests and inspections are to be made so the Architect may observe such procedures. The Owner shall bear costs of tests, inspections or approvals which do not become requirements until after bids are received or negotiations concluded.

13.5.2 If the Architect, Owner or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection or approval not included under Subparagraph 13.5.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection or approval by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so the Architect may observe such procedures. The Owner shall bear such costs except as provided in Subparagraph 13.5.3.

13.5.3 If such procedures for testing, inspection or approval under Subparagraphs 13.5.1 and 13.5.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, the Contractor shall bear all costs made necessary by such failure including those of repeated procedures and compensation for the Architect's services and expenses.

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

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

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

### 13.6 INTEREST

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

### 13.7 COMMENCEMENT OF STATUTORY LIMITATION PERIOD

13.7.1 As between the Owner and Contractor:

- .1 **Before Substantial Completion.** As to acts or failures to act occurring prior to the relevant date of Substantial Completion, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than such date of Substantial Completion;
- .2 **Between Substantial Completion and Final Certificate for Payment.** As to acts or failures to act occurring subsequent to the relevant date of Substantial Completion and prior to issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of issuance of the final Certificate for Payment; and

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.3 After Final Certificate for Payment. As to acts or failures to act occurring after the relevant date of issuance of the final Certificate for Payment, any applicable statute of limitations shall commence to run and any alleged cause of action shall be deemed to have accrued in any and all events not later than the date of any act or failure to act by the Contractor pursuant to any warranty provided under Paragraph 3.5, the date of any correction of the Work or failure to correct the Work by the Contractor under Paragraph 12.2, or the date of actual commission of any other act or failure to perform any duty or obligation by the Contractor or Owner, whichever occurs last.

### 13.8 EQUAL OPPORTUNITY:

13.8.1 The Contractor shall maintain policies 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 or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, religion, color, sex or national origin. 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, and shall include notices setting forth the policies of non-discrimination.

## ARTICLE 14

### TERMINATION OR SUSPENSION OF THE CONTRACT

#### 14.1 TERMINATION BY THE CONTRACTOR

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

portions of the Work under contract with the Contractor, for any of the following reasons:

- .1 issuance of an order of a court or other public authority having jurisdiction;
- .2 an act of government, such as a declaration of national emergency, making material unavailable;
- .3 because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Subparagraph 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents;
- .4 if repeated suspensions, delays or interruptions by the Owner as described in Paragraph 14.3 constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less; or
- .5 the Owner has failed to furnish to the Contractor promptly, upon the Contractor's request, reasonable evidence as required by Subparagraph 2.2.1.

14.1.2 If one of the above reasons exists, the Contractor may, upon seven additional days written notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead and profit for work completed at the time of such termination.

14.1.3 If the Work is stopped for a period of 60 days through no act or fault of the Contractor or a Subcontractor or their agents or employees or any other persons performing portions of the Work under contract with the Contractor because the Owner has persistently failed to fulfill the Owner's obligations under the Contract Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' written notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Subparagraph 14.1.2.

#### 14.2 TERMINATION BY THE OWNER FOR CAUSE

14.2.1 The Owner may terminate the Contract if the Contractor:

- .1 persistently or repeatedly refuses or fails to supply enough properly skilled workers or proper materials;



- .2 fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between the Contractor and the Subcontractors;
- .3 persistently disregards laws, ordinances, or rules, regulations or orders of a public authority having jurisdiction; or
- .4 otherwise is guilty of substantial breach of a provision of the Contract Documents.

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

- .1 take possession of the site and of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- .2 accept assignment of subcontracts pursuant to Paragraph 5.4; and
- .3 finish the Work by whatever reasonable method the Owner may deem expedient.

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

14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, such excess shall be paid to the Contractor. If such costs exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Architect, upon application, and this obligation for payment shall survive termination of the Contract.

**14.3 SUSPENSION BY THE OWNER FOR CONVENIENCE**

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

14.3.2 An adjustment shall be made for increases in the cost of performance of the Contract, including profit on the

increased cost of performance, caused by suspension, delay or interruption. No adjustment shall be made to the extent:

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

14.3.3 Adjustments made in the cost of performance may have a mutually agreed fixed or percentage fee. \_\_\_\_\_

**14.4 TERMINATION BY THE OWNER FOR CONVENIENCE:**

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

14.4.2 Upon receipt of written notice from the Owner of such termination for the Owner's convenience, the Contractor shall:

- a. cease operations as directed by the Owner in such notice;
- b. take such actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- c. except for the Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing Subcontracts and purchase orders and enter into no further Subcontracts and purchase orders.

14.4.3 In case of such termination for the Owner's convenience, the Contractor shall be entitled to receive payment from the Owner on the same basis provided in Subparagraph 14.1.2.

**ARTICLE 15 - OTHER CONDITIONS OF THE CONTRACT**

**15.1 MISCELLANEOUS PROVISIONS:**

15.1.1 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.

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15.1.2 Access to Records. 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 4 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 a 12 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.

15.1.3 Assignments of costs related to Fees, General Conditions, etc., shall be as per the Matrix provided in Exhibit "D".

#### 15.2 SEALING OF SMOKE AND FIRE PENETRATIONS:

15.2.1 All penetrations (temporary or permanent), in walls, or floors shall be sealed or patched with a suitable material designed and developed for this purpose. Penetrations shall be sealed or patched so that no gap exists around or through the penetrating object. An approved list of sealing and patching materials is available from MMC Engineering. Reference NFPA 101B 1997; 12/13-3.6.2.

15.2.2 Penalties. Each unsealed penetration discovered during the punch list shall have a value withheld equal to a minimum of \$100 per penetration or an estimated corrected cost; whichever is greater.

#### 15.3 SMOKING POLICY:

15.3.1 Maine Medical Center has instituted a Smoke-Free (Tobacco-Free) Policy that covers all hospital owned property and grounds as per Exhibit "C". This shall include all Maine Medical Center projects.

15.3.2 Penalties. For each tobacco product or portion thereof found on the construction site, a minimum value of \$100 per item shall be withheld from the Contractor's pay.

15.3.3 The Contractor shall have a written Smoking Policy approved by the Owner, and adopted by all Subcontractors and Sub-Subcontractors. The Smoking Policy shall be complete with penalties that include monetary fines and grounds for dismissal. All employees of the Contractor, Subcontractors and Sub-Subcontractors shall be issued a copy of such policy and shall sign an agreement form to abide by the said policy.

#### 15.4 PROJECT MEETINGS:

15.4.1 Exhibit "A" contains a schedule of meetings and meeting attendees. The Contractor shall ensure that these meetings are properly coordinated and attended by its employees, Subcontractors, Sub-subcontracts, suppliers and others as requested.

15.4.2 The meetings shall be held at the job site unless otherwise arranged.

15.4.3 The Owner will require the attendance of the Architect and other disciplines as required



# AIA<sup>®</sup> Document A121<sup>™</sup>CMc – 2003 and AGC Document 565

## *Standard Form of Agreement Between Owner and Construction Manager where the Construction Manager is Also the Constructor*

**AGREEMENT** as amended by Maine Medical Center November 2006 and made as of the date indicated by Maine Medical Center on the signature page of this document.  
(In words, indicate day, month and year.)

**BETWEEN** the Owner:  
(Name and address)

Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

and the Construction Manager:  
(Name and address)

Hebert Construction  
9 Gould Street  
Lewiston, Maine 04240

The Project is:  
(Name, address and brief description)

MMC Pavilion 6 Renovation

The Architect is:  
(Name and address)

MorrisSwitzer~Environments for Health, LLC  
1 Dana Street  
Portland, ME 04101

The Owner and Construction Manager agree as set forth below:

### **ADDITIONS AND DELETIONS:**

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

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

The 1997 Edition of AIA Document A201, General Conditions of the Contract for Construction, is referred to herein. This Agreement requires modification if other general conditions are utilized.

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### ARTICLE 3 OWNER'S RESPONSIBILITIES

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### ARTICLE 11 OTHER CONDITIONS AND SERVICES

## ARTICLE 1 GENERAL PROVISIONS

### § 1.1 RELATIONSHIP OF PARTIES

The Construction Manager accepts the relationship of trust and confidence established with the Owner by this Agreement, and covenants with the Owner to furnish the Construction Manager's reasonable skill and judgment and to cooperate with the Architect in furthering the interests of the Owner. The Construction Manager shall furnish construction administration and management services and use the Construction Manager's best efforts to perform the Project in an expeditious and economical manner consistent with the interests of the Owner. The Owner shall endeavor to promote harmony and cooperation among the Owner, Architect, Construction Manager and other persons or entities employed by the Owner for the Project.

### § 1.2 GENERAL CONDITIONS

For the Construction Phase, the General Conditions of the contract shall be the AIA® Document A201™-1987, General Conditions of the Contract for Construction, which is incorporated herein by reference. For the Preconstruction Phase, or in the event that the Preconstruction and Construction Phases proceed concurrently, A201™-1987 shall apply to the Preconstruction Phase only as specifically provided in this Agreement. The term "Contractor" as used in A201™-1987 shall mean the Construction Manager.

## ARTICLE 2 CONSTRUCTION MANAGER'S RESPONSIBILITIES

The Construction Manager shall perform the services described in this Article. The services to be provided under Sections 2.1 and 2.2 constitute the Preconstruction Phase services. If the Owner and Construction Manager agree, after consultation with the Architect, the Construction Phase may commence before the Preconstruction Phase is completed, in which case both phases will proceed concurrently.

### § 2.1 PRECONSTRUCTION PHASE

#### § 2.1.1 PRELIMINARY EVALUATION

The Construction Manager shall provide a preliminary evaluation of the Owner's program and Project budget requirements, each in terms of the other.

#### § 2.1.2 CONSULTATION

The Construction Manager with the Architect shall jointly schedule and attend regular meetings with the Owner. The Construction Manager shall consult with the Owner and Architect regarding site use and improvements and the selection of materials, building systems and equipment. The Construction Manager shall provide recommendations on construction feasibility; actions designed to minimize adverse effects of labor or material shortages; time requirements for procurement, installation and construction completion; and factors related to construction cost, including estimates of alternative designs or materials, preliminary budgets and possible economies.

#### § 2.1.3 PRELIMINARY PROJECT SCHEDULE

When Project requirements described in Section 3.1.1 have been sufficiently identified, the Construction Manager shall prepare, and periodically update, a preliminary Project schedule for the Architect's review and the Owner's approval. The Construction Manager shall obtain the Architect's approval of the portion of the preliminary Project schedule relating to the performance of the Architect's services. The Construction Manager shall coordinate and integrate the preliminary Project schedule with the services and activities of the Owner, Architect and Construction Manager. As design proceeds, the preliminary Project schedule shall be updated at appropriate intervals agreed to by the Owner, Construction Manager and Architect to indicate proposed activity sequences and durations, milestone dates for receipt and approval of pertinent information, submittal of a Guaranteed Maximum Price proposal, preparation and processing of shop drawings and samples, delivery of materials or equipment requiring long-lead-time procurement, Owner's occupancy requirements showing portions of the Project having occupancy priority, and proposed date of Substantial Completion. If preliminary Project schedule updates indicate that previously approved schedules may not be met, the Construction Manager shall make appropriate recommendations to the Owner and Architect.

§ 2.1.3.1 As a minimum the Construction Manager will:

- Provide milestones and for all pre-construction coordination meetings
- Develop project phasing options and impact pros and cons.
- Provide input on the need for packages and phasing.

- Develop a comprehensive construction logistics plan.
- Provide a coordination drawing schedule as soon as bidding is complete.
- Provide a submittal schedule as soon as bidding is complete.
- Provide a comprehensive construction schedule including phasing, design, permitting, bidding

#### § 2.1.4 PHASED CONSTRUCTION

The Construction Manager shall make recommendations to the Owner and Architect regarding the phased issuance of Drawings and Specifications to facilitate phased construction of the Work, if such phased construction is appropriate for the Project, taking into consideration such factors as economies, time of performance, availability of labor and materials, and provisions for temporary facilities.

#### § 2.1.5 PRELIMINARY COST ESTIMATES

§ 2.1.5.1 When the Owner has sufficiently identified the Project requirements and the Architect has prepared other basic design criteria, the Construction Manager shall prepare, for the review of the Architect and approval of the Owner, a preliminary cost estimate utilizing area, volume or similar conceptual estimating techniques.

§ 2.1.5.2 When Schematic Design Documents have been prepared by the Architect and approved by the Owner, the Construction Manager shall prepare, for the review of the Architect and approval of the Owner, a more detailed estimate with supporting data. During the preparation of the Design Development Documents, the Construction Manager shall update and refine this estimate at appropriate intervals agreed to by the Owner, Architect and Construction Manager.

§ 2.1.5.3 When Design Development Documents have been prepared by the Architect and approved by the Owner, the Construction Manager shall prepare a detailed estimate at 50% CD and at 100% CD with supporting data for review by the Architect and approval by the Owner. During the preparation of the Construction Documents, the Construction Manager shall update and refine this estimate at appropriate intervals agreed to by the Owner, Architect and Construction Manager.

§ 2.1.5.4 If any estimate submitted to the Owner exceeds previously approved estimates or the Owner's budget, the Construction Manager shall make appropriate recommendations to the Owner and Architect.

#### § 2.1.6 SUBCONTRACTORS AND SUPPLIERS

The Construction Manager shall seek to develop subcontractor interest in the Project and shall furnish to the Owner and Architect for their information a list of possible subcontractors, including suppliers who are to furnish materials or equipment fabricated to a special design, from whom proposals will be requested for each principal portion of the Work. The Architect will within 14 days of receipt of such lists reply in writing to the Construction Manager if the Architect or Owner know of any objection to such subcontractor or supplier. The receipt of such list shall not require the Owner or Architect to investigate the qualifications of proposed subcontractors or suppliers, nor shall it waive the right of the Owner or Architect later to object to or reject any proposed subcontractor or supplier.

#### § 2.1.7 LONG-LEAD-TIME ITEMS

The Construction Manager shall recommend to the Owner and Architect a schedule for procurement of long-lead-time items which will constitute part of the Work as required to meet the Project schedule. If such long-lead-time items are procured by the Owner, they shall be procured on terms and conditions acceptable to the Construction Manager. Upon the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal, all contracts for such items shall be assigned by the Owner to the Construction Manager, who shall accept responsibility for such items as if procured by the Construction Manager. The Construction Manager shall expedite the delivery of long-lead-time items and any additional costs shall be included as costs of work, included within the GMP to the extent based on assumptions valid at the time GMP is established.

#### § 2.1.8 EXTENT OF RESPONSIBILITY

The Construction Manager does not warrant or guarantee estimates and schedules except as may be included as part of the Guaranteed Maximum Price. The recommendations and advice of the Construction Manager concerning design alternatives shall be subject to the review and approval of the Owner and the Owner's professional consultants. It is not the Construction Manager's responsibility to ascertain that the Drawings and Specifications are in accordance with applicable laws, statutes, ordinances, building codes, rules and regulations. However, if the Construction Manager recognizes that portions of the Drawings and Specifications are at variance therewith, the

Construction Manager shall promptly notify the Architect and Owner in writing notwithstanding any advice or recommendation of the Construction Manager or any review by the Construction Manager of the Drawings and Specification or any other documents prepared by the Architect, the Owner or any of the Owner's other professional consultants, under no circumstances shall the Construction Manager have any responsibility or liability for any design defects contained in the Drawings and Specifications or in any other documents prepared by the Architect, the Owner, or any of the Owner's other professional consultants, or for the failure of any design to meet the Owner's requirements; except for the means and methods.

#### **§ 2.1.9 EQUAL EMPLOYMENT OPPORTUNITY AND AFFIRMATIVE ACTION**

The Construction Manager shall comply with applicable laws, regulations and special requirements of the Contract Documents regarding equal employment opportunity and affirmative action programs.

#### **§ 2.2 GUARANTEED MAXIMUM PRICE PROPOSAL AND CONTRACT TIME**

**§ 2.2.1** When the Drawings and Specifications are sufficiently complete, the Construction Manager shall propose a Guaranteed Maximum Price, which shall be the sum of the estimated Cost of the Work and the Construction Manager's Fee. The total GMP is guaranteed, individual line items are not. The Construction Manager reserves the right to adjust the individual schedule values within the GMP while maintaining the total GMP sum.

**§ 2.2.2** As the Drawings and Specifications may not be finished at the time the Guaranteed Maximum Price proposal is prepared, the Construction Manager shall provide in the Guaranteed Maximum Price for further development of the Drawings and Specifications by the Architect that is consistent with the Contract Documents and reasonably inferable therefrom. Such further development does not include such things as changes in scope, systems, kinds and quality of materials, finishes or equipment, all of which, if required, shall be incorporated by Change Order.

**§ 2.2.3** The estimated Cost of the Work shall include a contingency, the amount of the contingency shall be \_\_\_% of the Construction Cost, as mutually agreed to by the Construction Manager and the Owner.

**§ 2.2.3.1** The contingency is the Owner's money for the Construction Manager's use. The use of those contingency funds shall require written approval of the Owner which shall not be unreasonably withheld. The Construction Manager shall notify the Owner monthly in writing with its Application for Payment of costs that the Construction Manager proposes to be charged to the contingency together with an explanation of the reason such cost is incurred. In advance of incurring any single cost in excess of \$2,500 during any calendar month, which cost the Contractor proposes to charge to the contingency, the Construction Manager shall be required to notify the Owner, provide an explanation of the reason for, and to obtain the Owner's approval of such expenditure.

**§ 2.2.3.2** The contingency shall be available to cover costs which are properly reimbursable as Cost of the Work but not the basis for a change in the amount of the GMP, including without limitations: all costs incurred pursuant to the Contract Documents prior to Final Completion of the Work not otherwise specifically reimbursable.

**§ 2.2.3.3** The contingency shall be available to cover Subcontract costs exceeding the Subcontract Amount in the GMP schedule, due to such things as unanticipated local market, labor and material conditions. The contingency shall be available for legal and court fees relating to Subcontractor disputes, liens and claims, Subcontractor defaults and obligations of the Contractor to the Owner under the Contract Documents. The Construction Contingency shall not be used for legal fees, or for costs correcting the results of Contractor and/or Subcontractor default.

**§ 2.2.3.4** The entire unused amount of the contingency fund shall be returned to the Owner at the end of the Project without added penalties or administrative fees.

#### **§ 2.2.4 BASIS OF GUARANTEED MAXIMUM PRICE**

The Construction Manager shall include with the Guaranteed Maximum Price proposal a written statement of its basis, which shall include:

- .1 A list of the Drawings and Specifications, including all addenda thereto and the Conditions of the Contract, which were used in preparation of the Guaranteed Maximum Price proposal.
- .2 A list of allowances and a statement of their basis.

- .3 A list of the clarifications and assumptions made by the Construction Manager in the preparation of the Guaranteed Maximum Price proposal to supplement the information contained in the Drawings and Specifications.
- .4 The proposed Guaranteed Maximum Price, including a statement of the estimated cost organized by trade categories, allowances, contingency, and other items and the Fee that comprise the Guaranteed Maximum Price.
- .5 The Date of Substantial Completion upon which the proposed Guaranteed Maximum Price is based, and a schedule of the Construction Documents issuance dates upon which the date of Substantial Completion is based.

§ 2.2.5 The Construction Manager shall meet with the Owner and Architect to review the Guaranteed Maximum Price proposal and the written statement of its basis. In the event that the Owner or Architect discover any inconsistencies or inaccuracies in the information presented, they shall promptly notify the Construction Manager, who shall make appropriate adjustments to the Guaranteed Maximum Price proposal, its basis, or both.

§ 2.2.6 Unless the Owner accepts the Guaranteed Maximum Price proposal in writing on or before the date specified in the proposal for such acceptance and so notifies the Construction Manager, the Guaranteed Maximum Price proposal shall not be effective without written acceptance by the Construction Manager.

§ 2.2.7 Prior to the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal and issuance of a Notice to Proceed, the Construction Manager shall not incur any cost to be reimbursed as part of the Cost of the Work, except as the Owner may specifically authorize in writing.

§ 2.2.8 Upon acceptance by the Owner of the Guaranteed Maximum Price proposal, the Guaranteed Maximum Price and its basis shall be set forth in Amendment No. 1. The Guaranteed Maximum Price shall be subject to additions and deductions for a change in the Work as provided in the Contract Documents, and the Date of Substantial Completion shall be subject to adjustment as provided in the Contract Documents.

§ 2.2.9 The Owner shall authorize and cause the Architect to revise the Drawings and Specifications to the extent necessary to reflect the agreed-upon assumptions and clarifications contained in Amendment No. 1. Such revised Drawings and Specifications shall be furnished to the Construction Manager in accordance with schedules agreed to by the Owner, Architect and Construction Manager. The Construction Manager shall promptly notify the Architect and Owner if such revised Drawings and Specifications are inconsistent with the agreed-upon assumptions and clarifications.

§ 2.2.10 The Guaranteed Maximum Price shall include in the Cost of the Work only those taxes which are enacted at the time the Guaranteed Maximum Price is established.

## § 2.3 CONSTRUCTION PHASE

### § 2.3.1 GENERAL

§ 2.3.1.1 The Construction Phase shall commence on the earlier of:

- (1) the Owner's acceptance of the Construction Manager's Guaranteed Maximum Price proposal and issuance of a Notice to Proceed, or
- (2) the Owner's first authorization to the Construction Manager to:
  - (a) award a subcontract, or
  - (b) undertake construction Work with the Construction Manager's own forces, or
  - (c) issue a purchase order for materials or equipment required for the Work.

### § 2.3.2 ADMINISTRATION

§ 2.3.2.1 Those portions of the Work that the Construction Manager does not customarily perform with the Construction Manager's own personnel shall be performed under subcontracts or by other appropriate agreements with the Construction Manager. The Construction Manager shall obtain bids from Subcontractors and from suppliers of materials or equipment fabricated to a special design for the Work from the list previously reviewed and, after analyzing such bids, shall deliver such bids to the Owner and Architect. The Owner will then determine, with the advice of the Construction Manager and subject to the reasonable objection of the Architect, which bids will be accepted. The Owner may designate specific persons or entities from whom the Construction Manager shall obtain bids; however, if the Guaranteed Maximum Price has been established, the Owner may not prohibit the Construction



Manager from obtaining bids from other qualified bidders. The Construction Manager shall not be required to contract with anyone to whom the Construction Manager has reasonable objection.

§ 2.3.2.2 If the Guaranteed Maximum Price has been established and a specific bidder among those whose bids are delivered by the Construction Manager to the Owner and Architect (1) is recommended to the Owner by the Construction Manager; (2) is qualified to perform that portion of the Work; and (3) has submitted a bid which conforms to the requirements of the Contract Documents without material reservations or exceptions, but the Owner requires that another bid be accepted, then the Construction Manager may require that a change in the Work be issued to adjust the Contract Time and the Guaranteed Maximum Price by the difference between the bid of the person or entity recommended to the Owner by the Construction Manager and the amount of the subcontract or other agreement actually signed with the person or entity designated by the Owner.

§ 2.3.2.3 Subcontracts and agreements with suppliers furnishing materials or equipment fabricated to a special design shall conform to the payment provisions of Sections 7.1.8 and 7.1.9 and shall not be awarded on the basis of cost plus a fee without the prior consent of the Owner.

§ 2.3.2.4 The Construction Manager shall schedule and conduct meetings at which the Owner, Architect, Construction Manager and appropriate Subcontractors can discuss the status of the Work. The Construction Manager shall prepare and promptly distribute meeting minutes.

§ 2.3.2.5 Promptly after the Owner's acceptance of the Guaranteed Maximum Price proposal, the Construction Manager shall prepare a schedule in accordance with Section 3.10 of A201™-1987, including the Owner's occupancy requirements.

§ 2.3.2.6 The Construction Manager shall provide monthly written reports to the Owner and Architect on the progress of the entire Work. The Construction Manager shall maintain a daily log containing a record of weather, Subcontractors working on the site, number of workers, Work accomplished, problems encountered and other similar relevant data as the Owner may reasonably require. The log shall be available to the Owner and Architect.

§ 2.3.2.7 The Construction Manager shall develop a system of cost control for the Work, including regular monitoring of actual costs for activities in progress and estimates for uncompleted tasks and proposed changes. The Construction Manager shall identify variances between actual and estimated costs and report the variances to the Owner and Architect at regular intervals.

#### § 2.4 PROFESSIONAL SERVICES

The Construction Manager shall not be required to provide professional services which constitute the practice of architecture or engineering, unless they are related to means and methods the Construction Manager has specifically agreed in writing to provide such services. In such event, the Construction Manager shall cause such services to be performed by appropriately licensed professionals.

#### § 2.5 HAZARDOUS UNSAFE MATERIALS

In addition to the provisions of Paragraph 10.1 in AIA Document 201, if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance encountered by not created on the site by the Construction Manager, the Construction Manager shall, upon recognizing the condition, immediately stop work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Construction Manager, and Architect shall then proceed in the same manner described in Subparagraph 10.1.2 of AIA Document A201. The Owner shall be responsible for obtaining the services of a licensed laboratory to verify the presence or absence of the material of substance reported by the Construction Manager and, in the event such material of substance is found to be present, to verify that it has been rendered harmless. The Owner shall furnish in writing to the Construction Manager and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of such material or substance or who are to perform the task of removal or safe containment of such material or substance.

## ARTICLE 3 OWNER'S RESPONSIBILITIES

### § 3.1 INFORMATION AND SERVICES

§ 3.1.1 The Owner shall provide full information in a timely manner regarding the requirements of the Project, including a program which sets forth the Owner's objectives, constraints and criteria, including space requirements and relationships, flexibility and expandability requirements, special equipment and systems, and site requirements.

§ 3.1.2 The Owner shall, at the written request of the Construction Manager prior to commencement of the Construction Phase and thereafter, furnish to the Construction Manager reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. Furnishing of such evidence shall be a condition precedent to commencement or continuation of the Work. After such evidence has been furnished, the Owner shall not materially vary such financial arrangements without prior notice to the Construction Manager.

§ 3.1.3 The Owner shall establish and update an overall budget for the Project, based on consultation with the Construction Manager and Architect, which shall include contingencies for changes in the Work and other costs which are the responsibility of the Owner.

### § 3.1.4 STRUCTURAL AND ENVIRONMENTAL TESTS, SURVEYS AND REPORTS

In the Preconstruction Phase, the Owner shall furnish the following with reasonable promptness and at the Owner's expense. Except to the extent that the Construction Manager knows of any inaccuracy, the Construction Manager shall be entitled to rely upon the accuracy of any such information, reports, surveys, drawings and tests described in Sections 3.1.4.1 through 3.1.4.4 but shall exercise customary precautions relating to the performance of the Work.

§ 3.1.4.1 Reports, surveys, drawings and tests concerning the conditions of the site which are required by law.

§ 3.1.4.2 Surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a written legal description of the site. The surveys and legal information shall include, as applicable, grades and lines of streets, alleys, pavements and adjoining property and structures; adjacent drainage; rights-of-way, restrictions, easements, encroachments, zoning, deed restrictions, boundaries and contours of the site; locations, dimensions and necessary data pertaining to existing buildings, other improvements and trees; and information concerning available utility services and lines, both public and private, above and below grade, including inverts and depths. All information on the survey shall be referenced to a project benchmark.

§ 3.1.4.3 The services of a geotechnical engineer when such services are requested by the Construction Manager. Such services may include but are not limited to test borings, test pits, determinations of soil bearing values, percolation tests, evaluations of hazardous materials, ground corrosion and resistivity tests, including necessary operations for anticipating subsoil conditions, with reports and appropriate professional recommendations.

§ 3.1.4.4 Structural, mechanical, chemical, air and water pollution tests, tests for hazardous materials, and other laboratory and environmental tests, inspections and reports which are required by law.

§ 3.1.4.5 The services of other consultants when such services are reasonably required by the scope of the Project and are requested by the Construction Manager.

### § 3.2 OWNER'S DESIGNATED REPRESENTATIVE

The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. This representative shall have the authority to make decisions on behalf of the Owner concerning estimates and schedules, construction budgets, and changes in the Work, and shall render such decisions promptly and furnish information expeditiously, so as to avoid unreasonable delay in the services or Work of the Construction Manager. Except as otherwise provided in Section 4.2.1 of A201™-1987, the Architect does not have such authority.

### § 3.3 ARCHITECT

The Owner shall retain an Architect to provide Basic Services, including normal structural, mechanical and electrical engineering services, other than cost estimating services, described in the edition of AIA® Document B141™-1997, *Abbreviated Standard Form of Agreement Between Owner and Architect* current as of the date of this Agreement. The Owner shall authorize and cause the Architect to provide those Additional Services described in

B141™-1997, requested by the Construction Manager which must necessarily be provided by the Architect for the Preconstruction and Construction Phases of the Work. Such services shall be provided in accordance with time schedules agreed to by the Owner, Architect and Construction Manager.

#### **§ 3.4 LEGAL REQUIREMENTS**

The Owner shall determine and advise the Architect and Construction Manager of any special legal requirements relating specifically to the Project which differ from those generally applicable to construction in the jurisdiction of the Project. The Owner shall furnish such legal services as are necessary to provide the information and services required under Section 3.1. Nothing stated in the Subparagraph shall absolve the Architect of its legal obligation to design the Project in compliance with applicable codes, laws, ordinances, etc.

### **ARTICLE 4 COMPENSATION AND PAYMENTS FOR PRECONSTRUCTION PHASE SERVICES**

The Owner shall compensate and make payments to the Construction Manager for Preconstruction Phase services as follows:

#### **§ 4.1 COMPENSATION**

**§ 4.1.1** For the services described in Sections 2.1 and 2.2, the Construction Manager's compensation shall be calculated as follows:

*(State basis of compensation, whether a stipulated sum, multiple of Direct Personnel Expense, actual cost, etc. Include a statement of reimbursable cost items as applicable.)*

**§ 4.1.2** Compensation for Preconstruction Phase Services shall be equitably adjusted if originally contemplated scope is significantly modified such services extend beyond the date of this Agreement or if the originally contemplated scope of services is significantly modified.

**§ 4.1.3** If compensation is based on a multiple of Direct Personnel Expense, Direct Personnel Expense is defined as the direct salaries of the Construction Manager's personnel engaged in the Project and the portion of the cost of their mandatory and customary contributions and benefits related thereto, such as employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions and similar contributions and benefits.

#### **§ 4.2 PAYMENTS**

**§ 4.2.1** Payments shall be made monthly in arrears following presentation of the Construction Manager's invoice and, where applicable, shall be in proportion to services performed.

**§ 4.2.2** Payments are due and payable Thirty ( 30 ) days from the date the Construction Manager's invoice is received by the Owner. Amounts unpaid after the date on which payment is due shall bear interest at the rate entered below prime or base rate of Bank of America or any successor thereto as published daily..

*(Insert rate of interest agreed upon.)*

*(Usury laws and requirements under the Federal Truth in Lending Act, similar state and local consumer credit laws and other regulations at the Owner's and Contractor's principal places of business, the location of the Project and elsewhere may affect the validity of this provision. Legal advice should be obtained with respect to deletions or modifications, and also regarding requirements such as written disclosures or waivers.)*

### **ARTICLE 5 COMPENSATION FOR CONSTRUCTION PHASE SERVICES**

The Owner shall compensate the Construction Manager for Construction Phase services as follows:

#### **§ 5.1 COMPENSATION**

**§ 5.1.1** For the Construction Manager's performance of the Work as described in Section 2.3, the Owner shall pay the Construction Manager in current funds the Contract Sum consisting of the Cost of the Work as defined in Article 6 and the Construction Manager's Fee determined as follows:

*(State a lump sum, percentage of actual Cost of the Work or other provision for determining the Construction Manager's Fee, and explain how the Construction Manager's Fee is to be adjusted for changes in the Work.)*

## § 5.2 GUARANTEED MAXIMUM PRICE

§ 5.2.1 The sum of the Cost of the Work and the Construction Manager's Fee are guaranteed by the Construction Manager not to exceed the amount provided in Amendment No. 1, subject to additions and deductions by changes in the Work as provided in the Contract Documents. Such maximum sum as adjusted by approved changes in the Work is referred to in the Contract Documents as the Guaranteed Maximum Price. Costs which would cause the Guaranteed Maximum Price to be exceeded shall be paid by the Construction Manager without reimbursement by the Owner.

*(Insert specific provisions if the Construction Manager is to participate in any savings.)*

## § 5.3 CHANGES IN THE WORK

§ 5.3.1 Adjustments to the Guaranteed Maximum Price on account of changes in the Work subsequent to the execution of Amendment No. 1 may be determined by any of the methods listed in Section 7.3.3 of A201™-1987 As amended for project.

§ 5.3.2 In calculating adjustments to subcontracts (except those awarded with the Owner's prior consent on the basis of cost plus a fee), the terms "cost" and "fee" as used in Section 7 of A201™-1987 and the terms "costs" and "a reasonable allowance for overhead and profit" as used in Section 7.3.6 of A201™-1987 shall have the meanings assigned to them in that document and shall not be modified by this Article 5. Adjustments to subcontracts awarded with the Owner's prior consent on the basis of cost plus a fee shall be calculated in accordance with the terms of those subcontracts.

§ 5.3.3 In calculating adjustments to the Contract, the terms "cost" and "costs" as used in the above-referenced provisions of A201™-1987 shall mean the Cost of the Work as defined in Article 6 of this Agreement, and the term "and a reasonable allowance for overhead and profit" shall mean the Construction Manager's Fee as defined in Section 5.1.1 of this Agreement.

§ 5.3.4 If no specific provision is made in Section 5.1.1 for adjustment of the Construction Manager's Fee in the case of changes in the Work, or if the extent of such changes is such, in the aggregate, that application of the adjustment provisions of Section 5.1.1 will cause substantial inequity to the Owner or Construction Manager, the Construction Manager's Fee shall be equitably adjusted on the basis of the Fee established for the original Work.

## ARTICLE 6 COST OF THE WORK FOR CONSTRUCTION PHASE

### § 6.1 COSTS TO BE REIMBURSED

§ 6.1.1 The term "Cost of the Work" shall mean costs necessarily incurred by the Construction Manager in the proper performance of the Work. Cost(s) shall be defined as either the actual price charged the Construction Manager or the Construction Manager's rate provided herein.

### § 6.1.2 LABOR COSTS

- .1 Wages of construction workers directly employed by the Construction Manager to perform the construction of the Work at the site or, with the Owner's agreement, at off-site workshops. Full cost defined as W-2 Gross Wages of construction workers directly employed by the Contractor in the performances or the Work times a multiplier. (This cost shall include sick, holiday, and vacation time, as well as all other employee benefits, payroll taxes, workers' compensation, and other payroll costs.) Full cost may be adjusted during the term of this agreement as a result of collective bargaining agreements.

.2 Cost of the Contractor's supervisory and administrative personnel when stationed at the site  
*(Paragraphs deleted)*

to the extent that such persons are involved in the prosecution of the work and the allocable portion of the gross wages of each member of the project team representing that individual's working time spent on matters directly and solely related to the project. When preparation or analysis of schedules, materials list, shop drawings, working details, periodic cost studies, Job Audits and similar services

are necessary to define the work and control its progress are performed by personnel located in the Contractor's principal or branch offices the Contractor's supervisory or administrative personnel are engaged at factories, workshops, or on the road in expediting the production or transportation of materials or equipment required for the work, the allocable portion of the cost of such personnel representing the individuals working time spent on matters directly and solely engaged in such duties, including, without limitation, the allocable time of estimators, the project manager, mechanical coordinator, detailer and job accounting clerk shall be included in the cost of the work. Cost of all supervisory and administrative personnel as here in stated will be defined as W-2 Gross Wages times multiplier of \_\_\_\_\_. The cost associated with sick, holiday, and vacation time as well as all other employee benefits, payroll taxes, workers' compensation, and other payroll costs, shall be included in the \_\_\_\_\_ multiplier, and will be charged to the project only to the extent of the allocable portion of such person's time spent on the project.

**Classification**

**Name**

### § 6.1.3 SUBCONTRACT COSTS

Payments made by the Construction Manager to Subcontractors in accordance with the requirements of the subcontracts.

### § 6.1.4 COSTS OF MATERIALS AND EQUIPMENT INCORPORATED IN THE COMPLETED CONSTRUCTION

- .1 Costs, including transportation, of materials and equipment incorporated or to be incorporated in the completed construction.
- .2 Costs of materials described in the preceding Section 6.1.4.1 in excess of those actually installed but required to provide reasonable allowance for waste and for spoilage. Unused excess materials, if any, shall be handed over to the Owner at the completion of the Work or, at the Owner's option, shall be sold by the Construction Manager; amounts realized, if any, from such sales shall be credited to the Owner as a deduction from the Cost of the Work.

### § 6.1.5 COSTS OF OTHER MATERIALS AND EQUIPMENT, TEMPORARY FACILITIES AND RELATED ITEMS

- .1 Costs, including transportation, installation, maintenance, dismantling and removal of materials, supplies, temporary facilities, machinery, dumpsters, equipment, and hand tools not customarily owned by the construction workers, which are provided by the Construction Manager at the site and fully consumed in the performance of the Work; and cost less salvage value on such items if not fully consumed, whether sold to others or retained by the Construction Manager. Cost for items previously used by the Construction Manager shall mean fair market value. The cost of small tools, including all items represented on the list below, will be included as part of the Cost of Work at the fixed lump sum amount, mutually agreed to by the Owner and Construction Manager. "Small Tools" will include, but not be limited to the following items: Rubber Boots, Gloves, Shovels, Picks, Brooms, Rakes, Hammers, Wrecking Bars, Crow Bars, Hammer Handles, Goggles, Hoses, Nozzles, Lines and Ropes, First-Aid Kits, Hard Hats, Fire Extinguishers, Drinking Cans, Cups and Dispensers, Light Bulbs, Locks, Bolt Cutters, Wheelbarrows, Wrenches, Hasps, Points, Chisels, Hand Levels, Staples, small tools, but reimbursable as part of the Cost of Work on a rental basis or job purchase, are items such as the following: Diamond Saw Blades, Temporary Heating Units, Staging Material, Acetylene Torches, Vibrators, Tarpaulins, Temporary Power and Lighting, Stud Drivers, Electric Drills, Chutes, Router Bits, Table Saws, Reproductions.
- .2 Rental charges for temporary facilities, machinery, dumpsters, equipment and tools exclusive of small tools which are provided by the Construction Manager at the site, whether rented from the Construction Manager or others, and costs of transportation, installation, minor repairs and replacements, dismantling and removal thereof. Rates and quantities of equipment rented shall be subject to the Owner's prior approval. Rental rates shall be at fair market value. Notwithstanding anything to the contrary, the Owner shall have the right at any time and from time to time to require the Contractor to purchase any item of equipment, machinery, tool or vehicle (i.e. rather than renting the same). If any such request gives rise to a cost in excess of the amount that would otherwise be

reimbursable pursuant to this Article 6, the difference shall be considered a Change in the Work and the purchase price of such item shall become part of the Cost of Work. In such event, the Contractor shall maintain such equipment, machinery, tool or vehicle in good working order and condition during the term of this Agreement (or, if requested by the Owner, upon completion of use of such items on the Project), The Contractor shall deliver the same, together with a warranty bill of sale and such other documents as may be necessary or desirable to legally transfer title free from all encumbrances and liens, to the Owner.

- .3 Costs of removal of debris from the site.
- .4 Reproduction costs, costs of telegrams, facsimile transmissions and long-distance telephone calls, postage and express delivery charges, telephone at the site and reasonable petty cash expenses of the site office. In the connection with the Work.
- .5 That portion of the reasonable travel and subsistence expenses of the Construction Manager's personnel incurred while traveling in discharge of duties connected with the Work.

#### § 6.1.6 MISCELLANEOUS COSTS

- .1 That portion directly attributable to this Contract of premiums for insurance and bonds.  
*(If charges for self-insurance are to be included, specify the basis of reimbursement.)*
- .2 Sales, use or similar taxes imposed by a governmental authority which are related to the Work and for which the Construction Manager is liable.
- .3 Fees and assessments for the building permit and for other permits, licenses and inspections for which the Construction Manager is required by the Contract Documents to pay.
- .4 Fees of testing laboratories for tests required by the Contract Documents, except those related to nonconforming Work other than that for which payment is permitted by Section 6.1.8.2.
- .5 Royalties and license fees paid for the use of a particular design, process or product required by the Contract Documents; the cost of defending suits or claims for infringement of patent or other intellectual property rights arising from such requirement by the Contract Documents; payments made in accordance with legal judgments against the Construction Manager resulting from such suits or claims and payments of settlements made with the Owner's consent; provided, however, that such costs of legal defenses, judgment and settlements shall not be included in the calculation of the Construction Manager's Fee or the Guaranteed Maximum Price and provided that such royalties, fees and costs are not excluded by the last sentence of Section 3.17.1 of A201™-1987 or other provisions of the Contract Documents.
- .6 Data processing costs related to the Work.
- .7 Deposits lost for causes other than the Construction Manager's negligence or failure to fulfill a specific responsibility to the Owner set forth in this Agreement.
- .8 Legal, mediation and arbitration costs, other than those arising from disputes between the Owner and Construction Manager, reasonably incurred by the Construction Manager in the performance of the Work and with the Owner's written permission, which permission shall not be unreasonably withheld.
- .9 Expenses incurred in accordance with Construction Manager's standard personnel policy for relocation and temporary living allowances of personnel required for the Work, in case it is necessary to relocate such personnel from distant locations.
- 10 The cost of a superintendent's job truck which will be reimbursed as a Cost of the Work in an amount mutually agreed to by the Owner and Construction Manager per month. The cost of a project manager car, which will be reimbursed as a Cost of the Work in an amount mutually agreed to by the Owner and Construction Manager per month.
11. Increased costs due to casualty losses to the Work and related expenses for which Construction Manager is not reimbursed by insurance (carried or required hereunder to be carried) or otherwise (including reimbursements received by way of settlement of claims or applicable portions thereof against third parties, provided such settlements are made with the written consent of the Owner), provided that such losses or expenses result from causes other than the negligence or wrongful acts or omissions of the Construction Manager or any Subcontractor. If any insurance whether carried by the Owner or the Contractor, is subject to a deductible amount, the risk portion of such loss equal to the deductible amount may be charged to the Contingency if and to the extent available, and the excess, if any, shall be borne by

the Construction Manager and shall not be part of the Cost of the Work and the Construction Manager may obtain his own insurance protection against such loss.

#### § 6.1.7 OTHER COSTS

- .1 Other costs incurred in the performance of the Work if and to the extent approved in advance in writing by the Owner. Such approval shall not be unreasonably withheld provided that such costs do not result from the negligence or wrongful acts or omissions of the Construction Manager or any Subcontractor.
- .2 Notwithstanding the breakdown or characterization of any Cost to be reimbursed under this Article 7 or elsewhere in the Contract Documents, there shall be no duplication of payment because a particular item for which reimbursement is requested can be characterized as falling into two or more reimbursable categories.

#### § 6.1.8 EMERGENCIES AND REPAIRS TO DAMAGED OR NONCONFORMING WORK

The Cost of the Work shall also include costs described in Section 6.1.1 which are incurred by the Construction Manager:

- .1 In taking action to prevent threatened damage, injury or loss in case of an emergency affecting the safety of persons and property, as provided in Section 10.6 of A201™-1987
- .2 In repairing or correcting damaged or nonconforming Work executed by the Construction Manager or the Construction Manager's Subcontractors or suppliers, provided that such damaged or nonconforming Work was not caused by the negligence or failure to fulfill a specific responsibility to the Owner set forth in this agreement of the Construction Manager or the Construction Manager's foremen, engineers or superintendents, or other supervisory, administrative or managerial personnel of the Construction Manager, or the failure of the Construction Manager's personnel to supervise adequately the Work of the Subcontractors or suppliers, and only to the extent that the cost of repair or correction is not recoverable by the Construction Manager from insurance, Subcontractors or suppliers.

§ 6.1.9 The costs described in Sections 6.1.1 through 6.1.8 shall be included in the Cost of the Work notwithstanding any provision of A201™-1987 or other Conditions of the Contract which may require the Construction Manager to pay such costs, unless such costs are excluded by the provisions of Section 6.2.

#### § 6.2 COSTS NOT TO BE REIMBURSED

§ 6.2.1 The Cost of the Work shall not include:

- .1 Salaries and other compensation of the Construction Manager's personnel stationed at the Construction Manager's principal office or offices other than the site office, except as specifically provided in Sections 6.1.2.2 and 6.1.2.3.
- .2 Expenses of the Construction Manager's principal office and offices other than the site office, except as specifically provided in Section 6.1.
- .3 Overhead and general expenses, except as may be expressly included in Section 6.1.
- .4 The Construction Manager's capital expenses, including interest on the Construction Manager's capital employed for the Work except to the extent expressly provided in Paragraph 6.1.5.2.
- .5 Rental costs of machinery and equipment, except as specifically provided in Section 6.1.5.2.
- .6 Except as provided in Section 6.1.8.2, costs due to the negligence of the Construction Manager or to the failure of the Construction Manager to fulfill a specific responsibility to the Owner set forth in this Agreement.
- .7 Costs incurred in the performance of Preconstruction Phase Services.
- .8 Except as provided in Section 6.1.7.1, any cost not specifically and expressly described in Section 6.1.
- .9 Costs which would cause the Guaranteed Maximum Price to be exceeded.

#### § 6.3 DISCOUNTS, REBATES AND REFUNDS

§ 6.3.1 Cash discounts obtained on payments made by the Construction Manager shall accrue to the Owner if (1) before making the payment, the Construction Manager included them in an Application for Payment and received payment therefor from the Owner, or (2) the Owner has deposited funds with the Construction Manager with which to make payments; otherwise, cash discounts shall accrue to the Construction Manager. Trade discounts, rebates,

refunds and amounts received from sales of surplus materials and equipment shall accrue to the Owner, and the Construction Manager shall make provisions so that they can be secured.

§ 6.3.2 Amounts which accrue to the Owner in accordance with the provisions of Section 6.3.1 shall be credited to the Owner as a deduction from the Cost of the Work.

#### § 6.4 ACCOUNTING RECORDS

§ 6.4.1 The Construction Manager shall keep full and detailed accounts and exercise such controls as may be necessary for proper financial management under this Contract; the accounting and control systems shall be satisfactory to the Owner. The Owner and the Owner's accountants shall be afforded access to the Construction Manager's records, books, correspondence, instructions, drawings, receipts, subcontracts, purchase orders, vouchers, memoranda and other data relating to this Project, and the Construction Manager shall preserve these for a period of three years after final payment, or for such longer period as may be required by law.

### ARTICLE 7 CONSTRUCTION PHASE PAYMENTS

#### § 7.1 PROGRESS PAYMENTS

§ 7.1.1 Based upon Applications for Payment submitted to the Architect by the Construction Manager and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Construction Manager as provided below and elsewhere in the Contract Documents.

§ 7.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

§ 7.1.3 Provided an Application for Payment is received by the Architect not later than the 30th day of a month, the Owner shall make payment to the Construction Manager not later than the 30th day of the following month. If an Application for Payment is received by the Architect after the application date fixed above, payment shall be made by the Owner not later than thirty ( 30 ) days after the Architect receives the Application for Payment.

§ 7.1.4 With each Application for Payment, the Construction Manager shall submit payrolls, petty cash accounts, receipted invoices or invoices with check vouchers attached and any other evidence required by the Owner or Architect to demonstrate that cash disbursements already made by the Construction Manager on account of the Cost of the Work equal or exceed (1) progress payments already received by the Construction Manager; less (2) that portion of those payments attributable to the Construction Manager's Fee; plus (3) payrolls for the period covered by the present Application for Payment.

§ 7.1.5 Each Application for Payment shall be based upon the most recent schedule of values submitted by the Construction Manager in accordance with the Contract Documents. The schedule of values shall allocate the entire Guaranteed Maximum Price among the various portions of the Work, except that the Construction Manager's Fee shall be shown as a single separate item. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect may require. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Construction Manager's Applications for Payment.

§ 7.1.6 Applications for Payment shall show the percentage completion of each portion of the Work as of the end of the period covered by the Application for Payment. The percentage completion shall be the lesser of (1) the percentage of that portion of the Work which has actually been completed or (2) the percentage obtained by dividing (a) the expense which has actually been incurred by the Construction Manager on account of that portion of the Work for which the Construction Manager has made or intends to make actual payment prior to the next Application for Payment by (b) the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values.

§ 7.1.7 Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

- .1 Take that portion of the Guaranteed Maximum Price properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Guaranteed Maximum Price allocated to that portion of the Work in the schedule of values. Pending



final determination of cost to the Owner of changes in the Work, amounts not in dispute may be included as provided in Section 7.3.8 of A201™-1987 even though the Guaranteed Maximum Price has not yet been adjusted by Change Order.

- .2 Add that portion of the Guaranteed Maximum Price properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing.
- .3 Add the Construction Manager's Fee, and any portion of the contingency requested by the Construction Manager per Article 2.2.3 The Construction Manager's Fee shall be computed upon the Cost of the Work described in the two preceding Sections at the rate stated in Section 5.1.1 or, if the Construction Manager's Fee is stated as a fixed sum in that Section, shall be an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work in the two preceding Sections bears to a reasonable estimate of the probable Cost of the Work upon its completion.
- .4 Subtract the aggregate of previous payments made by the Owner.
- .5 Subtract the shortfall, if any, indicated by the Construction Manager in the documentation required by Section 7.1.4 to substantiate prior Applications for Payment, or resulting from errors subsequently discovered by the Owner's accountants in such documentation.
- .6 Subtract amounts, if any, for which the Architect has withheld or nullified a Certificate for Payment as provided in Section 9.5 of A201™-1987.

**§ 7.1.8** Except with the Owner's prior approval, payments to Subcontractors shall be subject to retention of not less than 10 percent ( 10% ). The Owner and the Construction Manager shall agree upon a mutually acceptable procedure for review and approval of payments and retention for subcontracts retained as appropriate or agreed to by Owner and Construction Manager.

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

**§ 7.1.10** In taking action on the Construction Manager's Applications for Payment, the Architect shall be entitled to rely on the accuracy and completeness of the information furnished by the Construction Manager and shall not be deemed to represent that the Architect has made a detailed examination, audit or arithmetic verification of the documentation submitted in accordance with Section 7.1.4 or other supporting data, that the Architect has made exhaustive or continuous on-site inspections or that the Architect has made examinations to ascertain how or for what purposes the Construction Manager has used amounts previously paid on account of the Contract. Such examinations, audits and verifications, if required by the Owner, will be performed by the Owner's accountants acting in the sole interest of the Owner.

## **§ 7.2 FINAL PAYMENT**

**§ 7.2.1** Final payment shall be made by the Owner to the Construction Manager when (1) the Contract has been fully performed by the Construction Manager except for the Construction Manager's responsibility to correct nonconforming Work, as provided in Section 12.2.2 of A201™-1987, and to satisfy other requirements, if any, which necessarily survive final payment; (2) a final Application for Payment and a final accounting for the Cost of the Work have been submitted by the Construction Manager and reviewed by the Owner's accountants; and (3) a final Certificate for Payment has then been issued by the Architect; such final payment shall be made by the Owner not more than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

**§ 7.2.2** The amount of the final payment shall be calculated as follows:

- .1 Take the sum of the Cost of the Work substantiated by the Construction Manager's final accounting and the Construction Manager's Fee, but not more than the Guaranteed Maximum Price.
- .2 Subtract amounts, if any, for which the Architect withholds, in whole or in part, a final Certificate for Payment as provided in Section 9.5.1 of A201™-1987 or other provisions of the Contract Documents.
- .3 Subtract the aggregate of previous payments made by the Owner.

If the aggregate of previous payments made by the Owner exceeds the amount due the Construction Manager, the Construction Manager shall reimburse the difference to the Owner.

§ 7.2.3 The Owner's accountants will review and report in writing on the Construction Manager's final accounting within 30 days after delivery of the final accounting to the Architect by the Construction Manager. Based upon such Cost of the Work as the Owner's accountants report to be substantiated by the Construction Manager's final accounting, and provided the other conditions of Section 7.2.1 have been met, the Architect will, within seven days after receipt of the written report of the Owner's accountants, either issue to the Owner a final Certificate for Payment with a copy to the Construction Manager or notify the Construction Manager and Owner in writing of the Architect's reasons for withholding a certificate as provided in Section 9.5.1 of A201™-1987. The time periods stated in this Section 7.2 supersede those stated in Section 9.4.1 of A201™-1987.

§ 7.2.4 If the Owner's accountants report the Cost of the Work as substantiated by the Construction Manager's final accounting to be less than claimed by the Construction Manager, the Construction Manager shall be entitled to proceed in accordance with Article 9 without a further decision of the Architect. Unless agreed to otherwise, a demand for mediation or arbitration of the disputed amount shall be made by the Construction Manager within 60 days after the Construction Manager's receipt of a copy of the Architect's final Certificate for Payment. Failure to make such demand within this 60-day period shall result in the substantiated amount reported by the Owner's accountants becoming binding on the Construction Manager. Pending a final resolution of the disputed amount, the Owner shall pay the Construction Manager the amount certified in the Architect's final Certificate for Payment.

§ 7.2.5 If, subsequent to final payment and at the Owner's request, the Construction Manager incurs costs described in Section 6.1 and not excluded by Section 6.2 (1) to correct nonconforming Work or (2) arising from the resolution of disputes, the Owner shall reimburse the Construction Manager such costs and the Construction Manager's Fee, if any, related thereto on the same basis as if such costs had been incurred prior to final payment, but not in excess of the Guaranteed Maximum Price. If the Construction Manager has participated in savings, the amount of such savings shall be recalculated and appropriate credit given to the Owner in determining the net amount to be paid by the Owner to the Construction Manager.

## ARTICLE 8 INSURANCE AND BONDS

### § 8.1 INSURANCE REQUIRED OF THE CONSTRUCTION MANAGER

During both phases of the Project, the Construction Manager shall purchase and maintain insurance as set forth in Section 11.1 of A201™-1987. Such insurance shall be written for not less than the following limits, or greater if required by law:

§ 8.1.1 Workers' Compensation and Employers Liability meeting statutory limits mandated by state and federal laws. If (1) limits in excess of those required by statute are to be provided, or (2) the employer is not statutorily bound to obtain such insurance coverage or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

§ 8.1.2 Commercial General Liability including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground hazards):

Each Occurrence  
General Aggregate  
Personal and Advertising Injury  
Products-Completed Operations Aggregate

- .1 The policy shall be endorsed to have the General Aggregate apply to this Project only.
- .2 Products and Completed Operations insurance shall be maintained for a minimum period of at least ( 2 ) year(s) after either 90 days following Substantial Completion or final payment, whichever is earlier.
- .3 The Contractual Liability insurance shall include coverage sufficient to meet the obligations in Section 3.18 of A201™-1987.

§ 8.1.3 Automobile Liability (owned, non-owned and hired vehicles) for bodily injury and property damage:  
Each Accident

Init.

§ 8.1.4 Other coverage:

*(If Umbrella Excess Liability coverage is required over the primary insurance or retention, insert the coverage limits. Commercial General Liability and Automobile Liability limits may be attained by individual policies or by a combination of primary policies and Umbrella and/or Excess Liability policies. If Project Management Protective Liability Insurance is to be provided, state the limits here.)*

**§ 8.2 INSURANCE REQUIRED OF THE OWNER**

During both phases of the Project, the Owner shall purchase and maintain liability and property insurance, including waivers of subrogation, as set forth in Sections 11.2 and 11.4 of A201™–1987. Such insurance shall be written for not less than the following limits, or greater if required by law:

**§ 8.2.1 Property Insurance:**

Deductible Per Occurrence  
Aggregate Deductible

**§ 8.2.2 Boiler and Machinery insurance with a limit of:** Full replacement cost .  
*(If not a blanket policy, list the objects to be insured.)*

**§ 8.3 PERFORMANCE BOND AND PAYMENT BOND**

**§ 8.3.1** The Construction Manager shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through the Construction Manager's usual source, and the cost thereof shall be included in the Cost of the Work. The amount of each bond shall be equal to One Hundred Percent ( 100% ) of the Contract Sum.

**§ 8.3.2** The Construction Manager shall deliver the required bonds to the Owner at least three days before the commencement of any work to be completed by the Construction Manager or any subcontractor from whom bonds are required.

**ARTICLE 9 MISCELLANEOUS PROVISIONS**

**§ 9.1 DISPUTE RESOLUTION**

**§ 9.1.1** Claims, disputes or other matters in question between the parties to this Agreement which arise prior to the commencement of the Construction Phase or which relate solely to the Preconstruction Phase services of the Construction Manager or to the Owner's obligation to the Construction Manager during the Preconstruction Phase, shall be resolved by mediation.

**§ 9.1.2** Any mediation conducted pursuant to this Paragraph 9.1 shall be held in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect, unless the parties mutually agree otherwise. Demand for mediation shall be filed in writing with the other party to the agreement and with the American Arbitration Association. Any demand for mediation shall be made within a reasonable time after the claim, dispute or other matter in question has arisen. In no event shall the demand for mediation be made after the date when institution of legal or equitable proceedings based upon such claim, dispute or other matter in question would be barred by the applicable statute of limitations.

**§ 9.2 DISPUTE RESOLUTION FOR THE CONSTRUCTION PHASE**

**§ 9.2.1** Any other claim, dispute or matter in question arising out of or related to this Agreement or breach thereof shall be settled in accordance with Article 4 of AIA Document 201. The parties shall endeavor to settle disputes by mediation in accordance with the Construction Industry Mediation Rules of the American Arbitration Association currently in effect unless the parties mutually agree otherwise. Any mediation arising under this Paragraph shall be conducted in accordance with the provisions of Subparagraph 9.1.2 and 9.1.3.

**§ 9.3 OTHER PROVISIONS**

Init.

§ 9.3.1 Unless otherwise noted, the terms in this Agreement shall have the same meaning as those in A201 1987, *General Conditions of the Contract for Construction as amended*.

#### § 9.3.2 EXTENT OF CONTRACT

This Contract, which includes this Agreement and the other documents incorporated herein by reference, represents the entire and integrated agreement between the Owner and the Construction Manager and supersedes all prior negotiations, representations or agreements, either written or oral. This Agreement may be amended only by written instrument signed by both the Owner and Construction Manager. If anything in any document incorporated into this Agreement is inconsistent with this Agreement, this Agreement shall govern.

#### § 9.3.3 OWNERSHIP AND USE OF DOCUMENTS

The Drawings, Specifications and other documents prepared by the Architect, and copies thereof furnished to the Construction Manager, are for use solely with respect to this Project. They are not to be used by the Construction Manager, Subcontractors, Sub-subcontractors or suppliers on other projects, or for additions to this Project outside the scope the Work, without the specific written consent of the Owner and Architect. The Construction Manager, Subcontractors, Sub-subcontractors and suppliers are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications, and other documents prepared by the Architect appropriate to and for use in the execution of their Work under the Contract Documents.

#### § 9.3.4 GOVERNING LAW

The Contract shall be governed by the law of the state of Maine.

#### § 9.3.5 ASSIGNMENT

The Owner and Construction Manager respectively bind themselves, their partners, successors, assigns and legal representatives to the other party hereto and to partners, successors, assigns and legal representatives of such other party in respect to covenants, agreements and obligations contained in the Contract Documents. Neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make such an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

*(Paragraphs deleted)*

### ARTICLE 10 TERMINATION OR SUSPENSION

#### § 10.1 TERMINATION PRIOR TO ESTABLISHING GUARANTEED MAXIMUM PRICE

§ 10.1.1 Prior to execution by both parties of Amendment No. 1 establishing the Guaranteed Maximum Price, the Owner may terminate this Contract at any time without cause, and the Construction Manager may terminate this Contract for any of the reasons described in Section 14.1.1 of A201<sup>TM</sup>-1987

§ 10.1.2 If the Owner or Construction Manager terminates this Contract pursuant to this Section 10.1 prior to commencement of the Construction Phase, the Construction Manager shall be equitably compensated for Preconstruction Phase Services performed prior to receipt of notice of termination; provided, however, that the compensation for such services shall not exceed the compensation set forth in Section 4.1.1 based upon percentage complete

§ 10.1.3 If the Owner or Construction Manager terminates this Contract pursuant to this Section 10.1 after commencement of the Construction Phase, the Construction Manager shall, in addition to the compensation provided in Section 10.1.2, be paid an amount calculated as follows:

- .1 Take the Cost of the Work incurred by the Construction Manager based upon the percentage of work completed at the time as certified by the Architect
- .2 Add the Construction Manager's Fee computed upon the Cost of the Work to the date of termination at the rate stated in Section 5.1 or, if the Construction Manager's Fee is stated as a fixed sum in that Section, an amount which bears the same ratio to that fixed-sum Fee as the Cost of the Work at the time of termination bears to a reasonable estimate of the probable Cost of the Work upon its completion.
- .3 Subtract the aggregate of previous payments made by the Owner on account of the Construction Phase.

The Owner shall also pay the Construction Manager fair compensation, either by purchase or rental at the election of the Owner, for any equipment owned by the Construction Manager which the Owner elects to retain and which is not otherwise included in the Cost of the Work under Section 10.1.3.1. To the extent that the Owner elects to take legal assignment of subcontracts and purchase orders (including rental agreements), the Construction Manager shall, as a condition of receiving the payments referred to in this Article 10, execute and deliver all such papers and take all such steps, including the legal assignment of such subcontracts and other contractual rights of the Construction Manager, as the Owner may require for the purpose of fully vesting in the Owner the rights and benefits of the Construction Manager under such subcontracts or purchase orders.

Subcontracts, purchase orders and rental agreements entered into by the Construction Manager with the Owner's written approval prior to the execution of Amendment No. 1 shall contain provisions permitting assignment to the Owner as described above. If the Owner accepts such assignment, the Owner shall reimburse or indemnify the Construction Manager with respect to all costs arising under the subcontract, purchase order or rental agreement except those which would not have been reimbursable as Cost of the Work if the contract had not been terminated. If the Owner elects not to accept the assignment of any subcontract, purchase order or rental agreement which would have constituted a Cost of the Work had this agreement not been terminated, the Construction Manager shall terminate such subcontract, purchase order or rental agreement and the Owner shall pay the Construction Manager the costs necessarily incurred by the Construction Manager by reason of such termination.

**§ 10.2 TERMINATION SUBSEQUENT TO ESTABLISHING GUARANTEED MAXIMUM PRICE**

Subsequent to execution by both parties of Amendment No. 1, the Contract may be terminated as provided in Article 14 of A201™-1987

**§ 10.2.1** In the event of such termination by the Owner, the amount payable to the Construction Manager pursuant to Section 14.1.3 of A201™-1987 shall not exceed the amount the Construction Manager would have been entitled to receive pursuant to Sections 10.1.2 and 10.1.3 of this Agreement.

**§ 10.2.2** In the event of such termination by the Construction Manager, the amount to be paid to the Construction Manager under Section 14.1.3 of A201™-1987 shall not exceed the amount the Construction Manager would have been entitled to receive under Sections 10.1.2 and 10.1.3 above.

**§ 10.3 SUSPENSION**

The Work may be suspended by the Owner as provided in Article 14 of A201™-1997; in such case, the Guaranteed Maximum Price, if established, shall be increased as provided in Section 14.3.2 of A201™-1997 except that the term "cost of performance of the Contract" in that Section shall be understood to mean the Cost of the Work and the term "profit" shall be understood to mean the Construction Manager's Fee as described in Sections 5.1.1 and 5.3.4 of this Agreement.

**ARTICLE 11 OTHER CONDITIONS AND SERVICES**

References to the AIA A201-1987 Edition shall refer to that version agreed to by the parties dated 5-16-2001.

Date of this Contract as indicated by Maine Medical Center

This Agreement entered into as of the day and year first written below by Maine Medical Center

**OWNER**

**CONSTRUCTION MANAGER**

**Maine Medical Center**

**Hebert Construction, LLC**

*(Signature)*

*(Signature)*

*(Printed name and title)*

*(Printed name and title)*

**Date**

**Date**

**ATTEST**

**ATTEST**

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



**AIA**<sup>®</sup>

# Document A312™ – 1984

## Performance Bond

**CONTRACTOR** (Name and Address):

Hebert Construction, LLC  
9 Gould Street  
Lewiston, Maine 04240

**OWNER** (Name and Address):

Maine Medical Center  
22 Brahmall Street  
Portland, ME 04102

### CONSTRUCTION CONTRACT

Date:

Amount:

Description (Name and Location):

### BOND

Date (Not earlier than Construction Contract Date):

Amount:

Modifications to this Bond:  None  See Section 13

### CONTRACTOR AS PRINCIPAL

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

(Any additional signatures appear on the last page)

### SURETY

Company: \_\_\_\_\_ (Corporate Seal)

Signature: \_\_\_\_\_

Name and

Title:

(FOR INFORMATION ONLY - Name, Address and Telephone)

**AGENT or BROKER:**

**OWNER'S REPRESENTATIVE**

(Architect, Engineer or other party):

### ADDITIONS AND DELETIONS:

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

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

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

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

§ 2 If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except to participate in conferences as provided in Section 3.1.

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

§ 3.1 The Owner has notified the Contractor and the Surety at its address described in Section 10 below that the Owner is considering declaring a Contractor Default and has requested and attempted to arrange a conference with the Contractor and the Surety to be held not later than fifteen days after receipt of such notice to discuss methods of performing the Construction Contract. If the Owner, the Contractor and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement shall not waive the Owner's right, if any, subsequently to declare a Contractor Default; and

§ 3.2 The Owner has declared a Contractor Default and formally terminated the Contractor's right to complete the contract. Such Contractor Default shall not be declared earlier than twenty days after the Contractor and the Surety have received notice as provided in Section 3.1; and

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

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

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

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

§ 4.3 Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and the contractor selected with the Owner's concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Section 6 in excess of the Balance of the Contract Price incurred by the Owner resulting from the Contractor's default; or

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

- .1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, tender payment therefor to the Owner; or
- .2 Deny liability in whole or in part and notify the Owner citing reasons therefor.

§ 5 If the Surety does not proceed as provided in Section 4 with reasonable promptness, the Surety shall be deemed to be in default on this Bond fifteen days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Section 4.4, and the Owner refuses the payment tendered or the Surety has denied liability, in whole or in part, without further notice the Owner shall be entitled to enforce any remedy available to the Owner.

§ 6 After the Owner has terminated the Contractor's right to complete the Construction Contract, and if the Surety elects to act under Section 4.1, 4.2, or 4.3 above, then the responsibilities of the Surety to the Owner shall not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety shall not be greater than those of the Owner under the Construction Contract. To the limit of the amount of this Bond, but subject to commitment by the Owner of the Balance of the Contract Price to mitigation of costs and damages on the Construction Contract, the Surety is obligated without duplication for:



§ 6.1 The responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;

§ 6.2 Additional legal, design professional and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Section 4; and

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

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

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

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

§ 10 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page.

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

## § 12 DEFINITIONS

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

§ 12.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

§ 12.3 Contractor Default: Failure of the Contractor, which has neither been remedied nor waived, to perform or otherwise to comply with the terms of the Construction Contract.

§ 12.4 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

§ 13 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

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

**CONTRACTOR AS PRINCIPAL**

Company: (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title:  
Address:

**SURETY**

Company: (Corporate Seal)

Signature: \_\_\_\_\_  
Name and Title:  
Address:

# Payment Bond

**CONTRACTOR** (Name and Address):

**SURETY** (Name and Principal Place of Business):

**OWNER** (Name and Address):

## CONSTRUCTION CONTRACT

Date:

Amount:

Description (Name and Location):

## BOND

Date (Not earlier than Construction Contract Date):

Amount:

Modifications to this Bond:  None  See Section 16

## CONTRACTOR AS PRINCIPAL

Company: (Corporate Seal)

## SURETY

Company: (Corporate Seal)

Signature: \_\_\_\_\_

Name and Title:

(Any additional signatures appear on the last page)

Signature: \_\_\_\_\_

Name and Title:

(FOR INFORMATION ONLY - Name, Address and Telephone)

**AGENT or BROKER:**

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

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

§ 2 With respect to the Owner, this obligation shall be null and void if the Contractor:

§ 2.1 Promptly makes payment, directly or indirectly, for all sums due Claimants, and

§ 2.2 Defends, indemnifies and holds harmless the Owner from claims, demands, liens or suits by any person or entity whose claim, demand, lien or suit is for the payment for labor, materials or equipment furnished for use in the performance of the Construction Contract, provided the Owner has promptly notified the Contractor and the Surety (at the address described in Section 12) of any claims, demands, liens or suits and tendered defense of such claims, demands, liens or suits to the Contractor and the Surety, and provided there is no Owner Default.

§ 3 With respect to Claimants, this obligation shall be null and void if the Contractor promptly makes payment, directly or indirectly, for all sums due.

§ 4 The Surety shall have no obligation to Claimants under this Bond until:

§ 4.1 Claimants who are employed by or have a direct contract with the Contractor have given notice to the Surety (at the address described in Section 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and, with substantial accuracy, the amount of the claim.

§ 4.2 Claimants who do not have a direct contract with the Contractor:

- .1 Have furnished written notice to the Contractor and sent a copy, or notice thereof, to the Owner, within 90 days after having last performed labor or last furnished materials or equipment included in the claim stating, with substantial accuracy, the amount of the claim and the name of the party to whom the materials were furnished or supplied or for whom the labor was done or performed; and
- .2 Have either received a rejection in whole or in part from the Contractor, or not received within 30 days of furnishing the above notice any communication from the Contractor by which the Contractor has indicated the claim will be paid directly or indirectly; and
- .3 Not having been paid within the above 30 days, have sent a written notice to the Surety (at the address described in Section 12) and sent a copy, or notice thereof, to the Owner, stating that a claim is being made under this Bond and enclosing a copy of the previous written notice furnished to the Contractor.

§ 5 If a notice required by Section 4 is given by the Owner to the Contractor or to the Surety, that is sufficient compliance.

§ 6 When the Claimant has satisfied the conditions of Section 4, the Surety shall promptly and at the Surety's expense take the following actions:

§ 6.1 Send an answer to the Claimant, with a copy to the Owner, within 45 days after receipt of the claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed.

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

§ 7 The Surety's total obligation shall not exceed the amount of this Bond, and the amount of this Bond shall be credited for any payments made in good faith by the Surety.

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

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

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

§ 11 No suit or action shall be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the location in which the work or part of the work is located or after the expiration of one year from the date (1) on which the Claimant gave the notice required by Section 4.1 or Section 4.2.3, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this Paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit shall be applicable.

§ 12 Notice to the Surety, the Owner or the Contractor shall be mailed or delivered to the address shown on the signature page. Actual receipt of notice by Surety, the Owner or the Contractor, however accomplished, shall be sufficient compliance as of the date received at the address shown on the signature page.

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

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

#### § 15 DEFINITIONS

§ 15.1 Claimant: An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials or equipment for use in the performance of the Contract. The intent of this Bond shall be to include without limitation in the terms "labor, materials or equipment" that part of water, gas, power, light, heat, oil, gasoline, telephone service or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor's subcontractors, and all other items for which a mechanic's lien may be asserted in the jurisdiction where the labor, materials or equipment were furnished.

§ 15.2 Construction Contract: The agreement between the Owner and the Contractor identified on the signature page, including all Contract Documents and changes thereto.

§ 15.3 Owner Default: Failure of the Owner, which has neither been remedied nor waived, to pay the Contractor as required by the Construction Contract or to perform and complete or comply with the other terms thereof.

#### § 16 MODIFICATIONS TO THIS BOND ARE AS FOLLOWS:

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

#### CONTRACTOR AS PRINCIPAL

Company: \_\_\_\_\_  
*(Corporate Seal)*

**Hebert Construction,  
LLC**

Signature: \_\_\_\_\_  
Name and Title:  
Address:

#### SURETY

Company: \_\_\_\_\_  
*(Corporate Seal)*

Signature: \_\_\_\_\_  
Name and Title:  
Address:

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



# AIA Document G702™ - 1992

## Application and Certificate for Payment

**TO OWNER:** Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

**PROJECT:** Maine Medical Center Pavilion 6 Renovation

**APPLICATION NO:** 001

**PERIOD TO:**

**FROM:** Hebert Construction, LLC  
9 Gould Street  
Lewiston, Maine 04240

**VIA ARCHITECT:** MorrisSwitzer~Environments for Health, LLC  
1 Dana Street  
Portland, ME 04101

**CONTRACTOR:** General Construction

**CONTRACT DATE:** / /

**PROJECT NOS:** / /

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

### CONTRACTOR'S APPLICATION FOR PAYMENT

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

- 1. ORIGINAL CONTRACT SUM ..... \$ 0.00
- 2. NET CHANGE BY CHANGE ORDERS ..... \$ 0.00
- 3. CONTRACT SUM TO DATE (Line 1 ± 2) ..... \$ 0.00
- 4. TOTAL COMPLETED & STORED TO DATE (Column G on G703) ..... \$ 0.00

#### 5. RETAINAGE:

- a. 0 % of Completed Work (Column D + E on G703) \$ 0.00
- b. 0 % of Stored Material (Column F on G703) \$ 0.00

Total Retainage (Lines 5a + 5b or Total in Column I of G703) ..... \$ 0.00

6. TOTAL EARNED LESS RETAINAGE ..... \$ 0.00  
(Line 4 Less Line 5 Total)

7. LESS PREVIOUS CERTIFICATES FOR PAYMENT ..... \$ 0.00  
(Line 6 from prior Certificate)

8. CURRENT PAYMENT DUE ..... \$ 0.00

9. BALANCE TO FINISH, INCLUDING RETAINAGE (Line 3 less Line 6) \$ 0.00

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

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

#### CONTRACTOR:

By: \_\_\_\_\_ Date: \_\_\_\_\_

State of: \_\_\_\_\_  
County of: \_\_\_\_\_  
Subscribed and sworn to before me this \_\_\_\_\_ day of \_\_\_\_\_

#### Notary Public:

My Commission expires: \_\_\_\_\_

### ARCHITECT'S CERTIFICATE FOR PAYMENT

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

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

#### ARCHITECT:

By: \_\_\_\_\_ Date: \_\_\_\_\_

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

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



## Continuation Sheet

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

APPLICATION NO: 001

APPLICATION DATE:

PERIOD TO:

ARCHITECT'S PROJECT NO: 28034

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

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



AIA®

# Document G704™ – 2000

## Certificate of Substantial Completion

**PROJECT:**  
*(Name and address):*  
Maine Medical Center  
Pavillion 6

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

**OWNER:**   
**ARCHITECT:**   
**CONTRACTOR:**   
**FIELD:**   
**OTHER:**

**TO OWNER:**  
*(Name and address):*  
  
Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

**TO CONTRACTOR:**  
*(Name and address):*  
Hebert Construction , LLC  
9 Gould Street  
Lewiston, Maine 04240

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

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

**Warranty**

**Date of Commencement**

\_\_\_\_\_  
**ARCHITECT**

\_\_\_\_\_  
**BY**

\_\_\_\_\_  
**DATE OF ISSUANCE**

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

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

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

\_\_\_\_\_  
**CONTRACTOR**

\_\_\_\_\_  
**BY**

\_\_\_\_\_  
**DATE**

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

\_\_\_\_\_  
**OWNER**

\_\_\_\_\_  
**BY**

\_\_\_\_\_  
**DATE**

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

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

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



**AIA**<sup>®</sup>

# Document G706™ – 1994

## Contractor's Affidavit of Payment of Debts and Claims

**PROJECT:** *(Name and address)*

Maine Medical Center  
Pavilion 6 Renovation

**ARCHITECT'S PROJECT NUMBER:**

28034

OWNER:

ARCHITECT:

CONTRACTOR:

SURETY:

OTHER:

**TO OWNER:** *(Name and address)*

Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

**CONTRACT FOR:** General Construction

**CONTRACT DATED:**

**STATE OF:**

**COUNTY OF:**

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

**EXCEPTIONS:**

**SUPPORTING DOCUMENTS ATTACHED HERETO:**

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

Indicate Attachment       Yes       No

**CONTRACTOR:** *(Name and address)*

Hebert Construction, LLC  
9 Gould Street  
Lewiston, Maine 04240

BY: \_\_\_\_\_

*(Signature of authorized representative)*

\_\_\_\_\_  
*(Printed name and title)*

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

- Contractor's Release or Waiver of Liens, conditional upon receipt of final payment.
- Separate Releases or Waivers of Liens from Subcontractors and material and equipment suppliers, to the extent required by the Owner, accompanied by a list thereof.
- Contractor's Affidavit of Release of Liens (AIA Document G706A).

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



# AIA<sup>®</sup> Document G706A<sup>™</sup> – 1994

## Contractor's Affidavit of Release of Liens

**PROJECT:** *(Name and address)*

Maine Medical Center  
Pavilion 6 Renovation

**ARCHITECT'S PROJECT NUMBER:**

28034

OWNER:

ARCHITECT:

**CONTRACT FOR:** General  
Construction

CONTRACTOR:

**TO OWNER:** *(Name and address)*

Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

**CONTRACT DATED:**

SURETY:

OTHER:

**STATE OF:**  
**COUNTY OF:**

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

**EXCEPTIONS:**

**SUPPORTING DOCUMENTS ATTACHED HERETO:**

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

**CONTRACTOR:** *(Name and address)*

Hebert Construction, LLC  
9 Gould Street  
Lewiston, Maine 04240

BY:

\_\_\_\_\_  
*(Signature of authorized representative)*

\_\_\_\_\_  
*(Printed name and title)*

Subscribed and sworn to before me on this date:

Notary Public:

My Commission Expires:

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034





# AIA<sup>®</sup> Document G707<sup>™</sup> – 1994

## Consent Of Surety to Final Payment

**PROJECT:** *(Name and address)*  
Maine Medical Center Pavilion 6 Renovation

**ARCHITECT'S PROJECT NUMBER:** 28034

OWNER:

**CONTRACT FOR:** General Construction

ARCHITECT:

**TO OWNER:** *(Name and address)*  
Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

**CONTRACT DATED:**

CONTRACTOR:

SURETY:

OTHER:

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

on bond of  
*(Insert name and address of Contractor)*

Hebert Construction, LLC  
9 Gould Street  
Lewiston, Maine 04240

, SURETY,

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

Maine Medical Center  
22 Bramhall Street  
Portland, Maine 04102

, CONTRACTOR,

as set forth in said Surety's bond.

, OWNER,

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

\_\_\_\_\_  
*(Surety)*

\_\_\_\_\_  
*(Signature of authorized representative)*

\_\_\_\_\_  
*(Printed name and title)*

Attest:  
*(Seal):*

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034



# AIA<sup>®</sup> Document G707A<sup>™</sup> – 1994

## Consent of Surety to Reduction in or Partial Release of Retainage

**PROJECT:** *(Name and address)*  
Maine Medical Center Pavilion 6  
Renovation

**ARCHITECT'S PROJECT NUMBER:** 28034

OWNER:

ARCHITECT:

**CONTRACT FOR:** General Construction

CONTRACTOR:

**TO OWNER:** *(Name and address)*  
Maine Medical Center  
22 Bramhall Street  
Portland, ME 04102

**CONTRACT DATED:**

SURETY:

OTHER:

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

on bond of  
*(Insert name and address of Contractor)*

, SURETY,

Hebert Construction, LLC  
9 Gould Street  
Lewiston, Maine 04240

, CONTRACTOR,

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

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

Maine Medical Center  
22 Bramhall Street  
Portland, Maine 04102

, OWNER,

as set forth in said Surety's bond.

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

\_\_\_\_\_  
*(Surety)*

\_\_\_\_\_  
*(Signature of authorized representative)*

Attest:  
(Seal):

\_\_\_\_\_  
*(Printed name and title)*

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034

**EXHIBIT "A"**  
**SCHEDULE OF MEETINGS AND ATTENDEES**

	Meeting	Attendees
1	Pre-Bid Conference	OR, GCPM, PA plus Bidders
2	Bid Review with Owner	OR, GCPE, GCPM, GCS, PA
3	Pre-Construction Conference	OR, GCPM, GCS, PA, Subs
4	Weekly Job Meetings	OR, GCPM, GCS, PA, Subs
5	Monthly Project Meetings	OR, GCPE(1), GCPM, GCS, PA, SE(4), MPE(6), EE(4), CE(3), LSA(5), Subs(1,2)
6	Pre-Installation Meetings	OR, GCPM, GCS, PA, Subs
7	Substantial Completion	OR, GCPM, GCS, PA, Subs
8	Building System Training for Owner	OR, GCS, MPE, EE, BT, Subs
9	Final Inspection	OR, GCPM, GCS, PA, MPE, EE, CE, LSA, Subs
10	Final Inspection (Tenants)	OR, GCPM, GCS, PA, MPE, EE, BT, Subs
11	Inspection of Punch List	OR, GCS, PA, MPE, EE, Others as appropriate

**ATTENDEES:**

OR - Owner's Representatives

GCPE - General Contractors Project Executive

GCPM - General Contractor's Project Manager

GCS - General Contractor's Superintendent

PA - Project Architect

SE - Structural Engineer

MPE - Mechanical, Plumbing Engineer

EE - Electrical Engineer

CE - Civil Engineer

LSA - Landscape Architect

BT - Building Tenants/Occupants

Subs - Various Subcontractors

**FOOTNOTES:**

(1) - Present at various times depending upon issues

(2) - Present at various times appropriate to stages of development/construction

(3) - Present at least 4 times appropriate to stages of construction

(4) - Present at least 6 times appropriate to stages of construction

(5) - Present at least 2 times appropriate to stages of construction

(6) - Present at least 9 times appropriate to stages of construction

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**EXHIBIT "B"**  
**MMC (Project Name)**  
**LIEN WAIVER SUMMARY FORM**

Contractor \_\_\_\_\_ Requisition Number \_\_\_\_\_

Project Number \_\_\_\_\_ Page \_\_\_\_\_ of \_\_\_\_\_

Date \_\_\_\_\_

Schedule of Values	General Contractor	Sub-Contractor	Sub-Contractor	Sub-Contractor	Major Supplier	Major Supplier	Major Supplier	Totals - This Req.	Totals - To Date
General Conditions									
Value #2									
Value #3									
Value #4									
Value #5									
Value #6									
Value #7									
Value #8									
Value #9									
Value #10									
Value #11									
Value #12									
Value #13									
Value #14									
Change Order #1									
Change Order #2									
Requisition Amount	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Retainage	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
No Retainage									
Lien Waiver Amount	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Lien Waiver Number									

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**EXHIBIT "C"****Smoke-Free (Tobacco-Free) Policy****POLICY STATEMENT:**

Smoking and the use of tobacco products is prohibited in Maine Medical Center buildings and vehicles, on all Medical Center property and grounds, except in designated locations, and within 50 feet of any entrance or commonly used passage way. At the Bramhall campus designated site(s) are established on hospital property, remote from building entrances and minimally visible.

**RATIONALE:**

Maine Medical Center is committed to the prevention of disease, the promotion of health and healing. Tobacco use, smoking and Environmental Tobacco Smoke (ETS) pose serious health/safety risks and undermine medical treatment.

**SCOPE:**

This policy applies to patients, employees, volunteers, visitors, contracted workers and medical staff.

**RESPONSIBILITY/ENFORCEMENT:**

- It is the responsibility of physicians to educate patients about the smoke-free policy before they are admitted to the hospital.
- It is the responsibility of managers to enforce the policy with employees. Employees are subject to disciplinary action if this policy is disregarded.
- It is the responsibility of all employees, including security, to enforce the policy with visitors. Security Officers will identify and document willful employee violation of this policy and so notify them and their managers.
- It is the responsibility of the Admitting Office and Emergency personnel to review this policy with any patients at the time of admission or pre-admission to the hospital.

**PREVENTION:**

Maine Medical Center will not sell tobacco products and supports efforts to protect everyone from Environmental Tobacco Smoke and reduce youth use of tobacco products.

### **WITHDRAWAL/CESSATION RESOURCES:**

Patients are to be offered information, withdrawal medications and cessation assistance as appropriate. Employee tobacco cessation efforts will be supported through institutional insurance programs and other promotional and counseling programs.

EOC Committee Chair

Approval: \_\_\_\_\_  
Print Name Title Signature

Administrative

Approval: \_\_\_\_\_  
Print Name Title Signature

Original Date: January, 1999  
Revised Date: March, 2002, June 2005

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**EXHIBIT "D"**  
**ASSIGNMENT OF COST CATEGORIES MATRIX**

	Description	Fee	GC	Cost of the Work	Owner Supplied	Comments
1	Officer's salaries & benefits	X				*1
2	Home office rent & utilities	X				
3	Home office automobile & travel	X				
4	Home office overhead (purchasing, accounting and clerical)	X				
5	Project Manager(s) salary & benefits		X			
6	Profit	X				
7	Preparation of conceptual schematic & design development estimates		X			
8	Preparation & updating project schedules		X			
9	Subcontractor bid solicitation & negotiation		X			
10	Computer time		X			
11	Preparation of monthly pay requests		X			
12	Conducting of job progress meetings		X			
13	Contractors' liability insurance		X			
14	Fire insurance/builder's risk insurance				X	
15	Construction drawings and specifications		X		X	*3
16	Record drawings		X			
17	Permit and fees		X			*2
18	Initial site survey				X	
19	Geotechnical investigation				X	
20	Base line & control engineering		X			
21	Building layout & engineering		X			
22	Construction fence		X			
23	Engineering for site work subcontractor		X			
24	General superintendent		X			
25	Project superintendent		X			
26	Site office & sheds		X			
27	Site office supplies & equipment		X			
28	Sanitary facilities		X			
29	Telephone, telegraph, messenger		X			
30	Travel expenses		X			
31	Guardrails & protection at interior openings		X			
32	Temporary protection		X	X		*4
33	Clean building		X			
34	Clean glass		X			
35	Rubbish removal		X	X		*4
36	Temporary heat equipment		X	X		*4
37	Temporary heat fuel		X	X		*4
38	Temporary electrical power		X	X		*4
39	Temporary water		X			
40	Labor/insurance/tax benefits of G.C. labor		X			
41	GL/PD insurance		X			
42	Owner purchased items				X	
43	Equipment rentals		X	X		*4
44	Subcontracts			X		
45	Tools and consumables		X			
46	Sales taxes		X			
47	Winter conditions & temporary enclosures		X			
48	Bonding costs		X			
49	Staging & hoisting		X			
50	HVAC test and balance		X			
51	Construction period materials testing				X	

**COMMENTS**

- \*1 Personnel only while performing services directly in conjunction with the project are included in General Conditions
- \*2 Amounts are subject to an Allowance.
- \*3 Refer to Article 2.2.5 of the Modified General Conditions.
- \*4 May be Cost of the Work provided by Subcontractor, Sub-subcontractor or Vendor.

**KEY**

Fee = General Contractors OH & Profit  
GC = General Conditions

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## SECTION 010100

### SUMMARY

#### PART 1 GENERAL

##### 1.01 PROJECT

- A. Project Name: Pavilion 6 Renovations
- B. Owner's Name: Maine Medical Center
- C. The Project consists of demolition, renovations and an infill addition to an existing psychiatric unit.

##### 1.02 CONTRACT DESCRIPTION

- A. Contract Type: Subcontractor contract with the Construction Manager based on a Stipulated Price for the area of Work involved.
- B. Subcontractors shall purchase and maintain liability insurance to protect the Construction Manager and Owner from claims for not less than the limits of liability that the Construction Manager is required to provide the Owner.

##### 1.03 DEFINITIONS

- A. Approved: The term approved, when used in conjunction with the Architect's action on the Contractor's submittals, applications, and requests, is limited to the Architect's duties and responsibilities as stated in the Conditions of the Contract.
- B. Directed: Terms such as directed, requested, authorized, selected, approved, required, and permitted mean directed by the Architect, requested by the Architect, and similar phrases.
- C. Furnish: The term furnish means supply and deliver to the Project site, unloaded, unpacked, inspected for damage, and ready for assembly, installation, and similar operations.
- D. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or other Paragraphs or Schedules in the Specifications, and similar requirements in the Contract Documents. Terms such as shown, noted, scheduled, and specified are used to help the reader locate the reference. There is no limitation on location.
- E. Install: The term install describes operations at the Project site including the actual assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- F. Installer: An Installer is the Contractor or another entity engaged by the Contractor, either as an employee, subcontractor, or contractor of lower tier, to perform a particular construction activity, including installation, erection, application, and similar operations. Installers are required to be experienced in the operations they are engaged to perform, having a minimum of five previous projects similar in size and scope to this Project, being familiar with the special requirements indicated, and having complied with requirements of the authority having jurisdiction.
- G. Products: Means new material, machinery, components, equipment, fixtures, and systems forming the Work, but does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Work. Products may also include existing materials or components required for reuse.
- H. Project site is the space available to the Contractor for performing construction activities either exclusively or in conjunction with others performing other work as part of the Project. The extent of the Project site is shown on the Drawings and may or may not be identical with the description of the land on which the Project is to be built.
- I. Provide: The term provide means to furnish and install, complete and ready for the intended

- J. Testing Agencies: A testing agency is an independent entity engaged to perform specific inspections or tests, either at the Project site or elsewhere, and to report on and, if required, to interpret results of those inspections or tests.

#### **1.04 EXISTING CONDITIONS & MEASUREMENTS**

- A. Information pertaining to the project site has been obtained through casual field observations and existing record documents and is indicated on the Drawings and in the Project Manual. This information has been gathered with reasonable care but is of a schematic nature and is not warranted. Verify all dimensions in the field prior to ordering materials or construction.
- B. Be alert to any indication or evidence of existing building conditions not indicated in the Contract Documents. Measurements shall be verified from actual observation at the project site. If unexpected existing conditions are encountered, cease operations immediately and notify the Architect.
- C. Cost of unavoidable initial damage and such supplemental and remedial work that is ordered by the Architect shall be borne by the Owner in accord with the General Conditions.
- D. The Contractor shall bear the cost of damage resulting from his failure to exercise reasonable care in his work or from continuing operations without notifying the Architect.

#### **1.05 DESCRIPTION OF RENOVATION WORK**

- A. Scope of demolition and removal work is shown on drawings and specified in Section 024100.
- B. Scope of renovation work is shown on drawings.
- C. Plumbing: Alter existing system and add new construction, keeping existing in operation.
- D. HVAC: Alter existing system and add new construction, keeping existing in operation.
- E. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.
- F. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.
- G. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.
- H. Telephone: Alter existing system and add new construction, keeping existing in operation.
- I. Communications Systems: Alter existing system and add new construction, keeping existing in operation.

#### **1.06 WORK BY OWNER**

- A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion.
- B. Owner will supply the following for installation by Contractor:
  - 1. Toilet accessories as listed.
  - 2. Owner's Responsibilities:
    - a. Arrange for and deliver Owner approved shop drawings, product data, and samples, to the Contractor.
    - b. Arrange and pay for product delivery to site.
    - c. On delivery, inspect products jointly with the Contractor.
    - d. Submit claims for transportation damage and replace damaged, defective, or deficient items.
    - e. Arrange for manufacturer's warranties, inspections and service.
  - 3. Contractor's Responsibilities:
    - a. Review Owner approved shop drawings, product data, and samples.

- b. Receive and unload products at the site, inspect for completeness or damage jointly with the Owner.
- c. Handle, store, install and finish products.
- d. Repair or replace items damaged after receipt.

### **1.07 FUTURE WORK**

- A. Project is designed for future vertical expansion.

### **1.08 OWNER OCCUPANCY**

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period. The entire area of the work itself will be vacated during construction.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner operations.
- E. Temporary spaces where patients and staff were relocated to, will be refurbished back to their original conditions for new returning occupants.
- F. Tentative Phasing Schedule of the Work:
  1. December 9<sup>th</sup> 2009 - R2/P2A Renovations for moving R2 Lounge to R2, REMIS relocation and renovations to move AIM Office/On Call Room.
  2. January 10, 2010 – P2A Cardiac Space Renovations.
  3. February 10, 2010 – P2A Bi-Pass Corridor closed for renovations with Owner Furnished demountable partitions.
  4. December 9 thru February 10, 2010 – Ambulatory Care Unit Renovations (3 Patient Rooms every 12 days)
  5. April 10, 2010 – P2CD Shared Space Renovations for P6 relocation.
  6. January 11, 2011 – Substantial Completion of Pavilion 6. Renovations begin to refurbish temporary spaces of P2A and P2CD back for occupancy after P6 Patients leave.

### **1.09 CONTRACTOR USE OF SITE AND PREMISES**

- A. Construction Operations: Limited to areas as defined by Owner and Construction Manager.
- B. Arrange use of site and premises to allow:
  1. Owner occupancy.
  2. Work by Others.
  3. Work by Owner.
  4. Use of adjacent portions of the site and premises by the public.
- C. Provide access to and from site as required by law and by Owner:
  1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
  2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- D. Use of the Existing Building:
  1. Maintain the existing building in a weather tight condition throughout the construction period. Repair damage caused by construction operations. Take all precautions necessary to protect the building and its occupants during the construction period.
  2. Existing building spaces (outside of the construction limits) may not be used for storage.

- E. Time Restrictions:
1. Limit conduct of especially noisy exterior work to the hours of 8:00 a.m. to 5:00 p.m.
  2. Sensitive medical operations are located directly adjoining the project site. Contractors may be required to stop or limit work at certain times based on Owner operations.
    - a. Limit conduct of especially noisy interior work to the times of day acceptable to the Owner.
    - b. Contact Owner's Representative prior to beginning especially noisy work.
  3. Contractors shall perform certain work at times as necessary to minimize disruptions of the Owner's facility, including evenings, nights and weekends.
    - a. For additional work required to keep disruptions of the Owner's existing facility to a minimum as requested by the Owner, the Owner will pay only for the additional cost above the normal rates for premium time required to complete the work.
  4. Perform additional work required to meet established Contract time limits after regular working hours (7:00 AM to 5:00 PM) or, after notification of the Owner, on Sundays or on legal holidays as necessary. Deviations from this restriction require approval in writing from the Owner.
- F. Utility Outages and Shutdown:
1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
  2. Limit shutdown of utility services to 4 hours at a time, arranged at least 96 hours in advance with Owner.
  3. Prevent accidental disruption of utility services to other facilities.
- G. Smoking Policy:
1. All construction personnel and employees of the Contractor shall strictly observe the Owner's smoking policy. Smoking shall be prohibited in or adjacent to all construction areas by all personnel.

#### **1.10 WORK SEQUENCE**

- A. Construct Work in stages during the construction period as developed by Construction Manager
- B. Coordinate construction schedule and operations with Construction Manager and Owner.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION**

##### **3.01 TRAINING**

- A. The Contractor shall train each worker with materials provided by the Owner and will provide to the Owner documentation, signed by each worker, that the material has been read and understood. Materials include fire safety and life safety measures, infection control measures, smoking policy, etc.

**END OF SECTION**



**SECTION 010270  
APPLICATIONS FOR PAYMENT**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements governing the Contractor's Applications for Payment.

1.02 FORMAT

- A. AIA G702 - Application and Certificate for Payment including continuation sheets when required.
- B. For each item, provide a column for listing: item number; description of work; scheduled value, previous applications: work in place and stored materials under this application: authorized change orders; total completed and stored to date of application; percentage of completion; balance to finish; and retainage.

1.03 SCHEDULE OF VALUES

- A. Coordinate preparation of the Schedule of Values with preparation of the Contractor's Construction Schedule (refer to Section 013100 and 013200).

1.04 PREPARATION OF APPLICATIONS

- A. Present required information in typewritten form.
- B. Certification by signature of authorized officer must be notarized.
- C. Use data from approved schedule of values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- D. List each authorized change order as an extension on continuation sheet, listing change order number and dollar amount as for an original item of Work.

1.05 SUBMITTAL PROCEDURES

- A. Submit five copies of each Application for Payment.
- B. Submit an updated construction schedule with each Application for Payment.
- C. Payment Application Times: Each progress payment date is as indicated in the Agreement. The period of construction Work covered by each Application or Payment is the period indicated in the Agreement.
- D. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of the first Application for Payment include the following:
  - 1. List of subcontractors.
  - 2. List of principal suppliers and fabricators.
  - 3. Schedule of Values.
  - 4. Contractor's Construction Schedule (preliminary if not final).
  - 5. Schedule of principal products.
  - 6. Schedule of unit prices.

7. Submittal Schedule (preliminary if not final).
  8. List of Contractor's staff assignments.
  9. List of Contractor's principal consultants.
  10. Copies of building permits
  11. Copies of authorizations and licenses from governing authorities for performance of the Work.
  12. Initial progress report.
  13. Report of pre-construction meeting.
  14. Certificates of insurance and insurance policies.
- E. Application for Payment at Substantial Completion: Following issuance of the Certificate of Substantial Completion, submit an Application for Payment; this application shall reflect any Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work. Administrative actions and submittals that shall proceed or coincide with this application include:
1. Occupancy permits and similar approvals.
  2. Warranties (guarantees) and maintenance agreements (refer to Section 017400),
  3. Test/adjust/balance records.
  4. Maintenance instructions (refer to Section 017300).
  5. Meter readings.
  6. Start-up performance reports.
  7. Change-over information related to Owner's occupancy, use, operation and maintenance.
  8. Final cleaning (refer to Section 017100).
  9. Application for reduction of retainage, and consent of surety.
  10. Advice on shifting insurance coverages.
  11. List of incomplete Work, recognized as exceptions to Architect's Certificate of Substantial Completion.
- F. Final Payment Application: Administrative actions and submittals which must precede or coincide with submittal of the final payment Application for Payment include the following:
1. Completion of Project closeout requirements (refer to Section 017000).
  2. Completion of items specified for completion after Substantial Completion.
  3. Assurance that unsettled claims will be settled.
  4. Assurance that Work not complete and accepted will be completed without undue delay.
  5. Transmittal of required Project construction records to Owner (refer to Section 017200).
  6. Proof that taxes, fees and similar obligations have been paid.
  7. Removal of temporary facilities and services (refer to Section 015000 & 151000).
  8. Removal of surplus materials, rubbish and similar elements.
  9. Completion and acceptance of Commissioning Agent's report and recommendations.

#### 1.06 SUBSTANTIATING DATA

- A. When the Architect requires substantiating information, submit data justifying dollar amounts in question.
- B. Provide one copy of data with cover letter for each copy of submittal. Indicate application number and date, and line item by number and description.

#### 1.07 MECHANICS LIENS

- A. Waivers of Mechanics Lien: With each Application for Payment submit waivers of mechanics liens from all subcontractors or sub-subcontractors and suppliers for the construction period covered by the application.
  1. Submit partial waivers on each item for the amount requested, prior to deduction for retainage, on each item.

2. When an application shows completion of an item, submit final or full waivers.
3. The Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit waivers of lien on forms, and executed in a manner, acceptable to Owner.

**END OF SECTION**

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**SECTION 010280  
SCHEDULE OF VALUES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Schedule of values allocated to the various portions of the Work, submitted within ten days after award of contract.
- B. Upon request of the Architect, support the values with data which will substantiate their correctness.
- C. The Schedule of Values, unless objected to by the Architect, forms the basis for the Contractor's applications for payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on 8-1/2" x 11" white paper; Contractor's standard forms and automated printout will be considered by Architect upon Contractor's request. Identify schedule with:
  - 1. Title of project and location
  - 2. Architect and project number
  - 3. Name and address of Contractor
  - 4. Contract designation
  - 5. Date of submission
- B. List the installed value of the component parts of the Work (broken down into labor and material) in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Follow the table of contents of the project manual as the format for listing component items.
  - 1. Identify each line item with the number and title of the respective major section of the specifications.
- D. For each major line item list sub-values of major products or operations under the item.
- E. For the various portions of the work:
  - 1. Include a directly proportional amount of the Contractor's overhead and profit for each item.
  - 2. For items on which progress payments will be requested for stored materials, break down the value into:
    - a. The cost of the materials, delivered and unloaded, with taxes paid.
    - b. The total installed value.
  - 3. Submit a subschedule for each separate stage of work specified in Section 010100.
- F. The sum of values listed in the schedule shall equal the total Contract sum.

1.03 SUB-SCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a sub-schedule of unit costs and quantities for:
  - 1. Products specified under a unit cost allowance in Section 010290.
  - 2. Products on which progress payments will be requested for stored products.
- B. The form of submittal shall parallel that of the schedule of values, with each item identified the same as the line item in the schedule of values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.

- D. Provide unit values for the materials as follows:
  - 1. Cost of the material, delivered and unloaded at the site, with taxes paid.
  - 2. Installation costs, including Contractor's overhead and profit.
  
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

**END OF SECTION**

**SECTION 010290  
UNIT PRICES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements for unit prices.
  - 1. A unit price is an amount proposed by Bidders and stated on the Bid Form as a price per unit of measurement for materials or services that will be added to or deducted from the Contract Sum by Change Order in the event the estimated quantities of Work required by the Contract Documents are increased or decreased.
  - 2. Unit prices include all necessary material, overhead, profit and applicable taxes.

1.02 REQUIREMENTS

- A. Significantly unbalanced unit prices which are a potential detriment to the owner shall be considered irregular and may be rejected as non-responsive, whichever is in the best interest of the owner.
- B. Unit prices identified in the Owner-Contractor Agreement will be the basis for adds and deducts to the cost of the Work for the items that the unit prices affect.
- C. Refer to individual Specification Sections for construction activities requiring the establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.

1.03 SCHEDULE OF UNIT PRICES

1. Acoustical Ceiling Tile (Type 1) (s.f.)	\$ _____
2. Suspended Ceiling Grid, installed (s.f.)	\$ _____
3. Carpet (sq.yd.), installed	\$ _____
4. Sheet vinyl (sq.ft.), installed	\$ _____
5. VCT (sq.ft.), installed	\$ _____
6. Rubber (sq.ft.), installed	\$ _____

**END OF SECTION**

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**SECTION 010300  
ALTERNATES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Alternates
- B. Submission procedures

1.02 REQUIREMENTS

- A. Alternates quoted on the bid form will be reviewed and accepted or rejected at the Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

1.03 SELECTION AND AWARD OF ALTERNATES

- A. Indicate price for alternates described below and identify in the correct location on the bid form.
- B. The bid will be evaluated on the basis of base bid and alternates. The Owner will accept the combination that is in the Owner's best interest.

1.04 SCHEDULE OF ALTERNATES

**Alternate No. 1 (P6 A & C) – Aluminum Windows:** Furnish and install new fixed aluminum windows with safety glazing. Insulate and seal around new windows. The Base Bid includes removing existing (lockable) metal safety screens and installing new safety glazing in existing aluminum frames.

**Alternate No. 2 (P6C) – Exterior Walls:** Remove all exterior plaster and terracotta walls to the masonry structure. Insulate and fur wall and install new gypsum wall board. The Base Bid includes leaving the existing exterior plaster and terracotta walls and patching areas where heating units are removed and other cutting and demolition work occurs. New solid surface window sills are in the base bid, sill depth decreases with this alternate.

**Alternate No. 3 (P6C) – Skylights:** Furnish and install two new skylights, including structural support, insulation and roof flashing in new and existing roof areas. The base bid includes a raised wood ceiling above an indirect lighting cove.

**Alternate No. 4 (P6A) – P6A HVAC (DEDUCT):** Remove all new HVAC, including all electrical support work, as specified in the Base Bid for Pavilion 6A.

**Alternate No. 5 (P6A & C) – DX Condensing System (DEDUCT):** Furnish and install direct expansion split style rooftop air handlers in lieu of the chilled water system. This deduct alternate removes the rooftop chiller package and all associated piping and electrical work, including all structural steel support, and adds in two rooftop DX condensing units and their required electrical, structural and roof work.

**Alternate No. 6 (P6C) – Low Voltage Controls (DEDUCT):** Delete electrical low voltage control panel at Nurse Station to shut off power in the Patient Rooms.

**Alternate No. 7 (P2A) – Sprinkler System Extension (ADD):** Furnish and install additional sprinkler lines and heads to extend into areas of Pavilion 2A (only) that are shaded as not being part of the Base Bid Contract. This would include extending sprinkler pipe from Corridors GC-216 and DC-2MAT8

the following rooms: 2200, 2203 (including the two toilet rooms within the Locker Room, Stair ST-

224, 2216, 2219, 2221, 2223, 2224 (including two toilet rooms within Pediatric Resident Room),  
2225, 2227, 2228 (including toilet room within Barbara Bush Pediatrics), 2229, 2230, 2231, 2232.

**Alternate No. 8 (P2A) – Acoustical Ceiling Tile:** Furnish and install new acoustical ceiling tile in the existing grid (as modified in Base Bid) for all spaces and Corridor in existing Bi-Pass Corridor as specified in the Room Finish Schedule.

**END OF SECTION**

**SECTION 010350  
MODIFICATION PROCEDURES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Promptly implement Change Order procedures.
  - 1. Provide full written data required to evaluate changes.
  - 2. Maintain detailed records of work done on a time and material/ force account basis.
  - 3. Provide full documentation to the Architect on request.
- B. Designate in writing the member of the Contractor's organization authorized to accept Changes in the Work.
- C. The Owner will designate in writing the person who is authorized to execute Change Orders.

1.02 PRELIMINARY PROCEDURES

- A. The Owner or the Architect may initiate changes by submitting a Change Order Proposal (COP) Request to the Contractor. Request will include:
  - 1. Detailed description of the change, products, and location of the change in the Project.
  - 2. Supplementary or revised drawings and specifications.
  - 3. The projected time span for making the change, and a specific statement as to whether overtime work is, or is not, authorized.
  - 4. A specific period of time during which the requested price will be considered valid.
  - 5. Such request is for information only, and is not an instruction to execute the changes, nor to stop work in progress.
- B. Contractor may initiate changes by submitting a written notice to the Architect containing:
  - 1. Description of the proposed changes.
  - 2. Statement of the reason for making the changes.
  - 3. Statement of the effect on the Contract Sum and the Contract Time.
  - 4. Statement of the effect on the work of separate contractors.
  - 5. Documentation supporting change in Contract Sum, as appropriate.
  - 6. Documentation supporting change in Contract Time shall be in accordance with Section 01320.

1.03 CONSTRUCTION CHANGE DIRECTIVE

- A. In lieu of Proposal Request, the Architect may issue a Construction Change Directive for the Contractor to proceed with a change for subsequent inclusion in a Change Order.
- B. The Construction Change Directive will describe changes in the Work, both additions and deletions, with attachments of revised Contract Documents to define details of the change, and will designate the method of determining a change in the Contract Sum and change in the Contract Time.
- C. The Owner and the Architect will sign and date the Construction Change Directive as authorization for the Contractor to proceed with changes.
- D. At completion of the change, submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.
- E. The Architect will determine the allowable cost of such work, as provided in the General Conditions and Supplementary Conditions.

- F. The Architect will sign and date the Change Order to establish the change in the Contract Sum and in the Contract Time.
- G. The Owner and the Contractor will sign and date the Change Order to indicate their agreement.

#### 1.04 DOCUMENTATION OF PROPOSALS AND CLAIMS

- A. Support each quotation for a lump-sum proposal, and for each unit price which has not previously been established, with sufficient substantiating data to allow the Architect to evaluate the quotation.
- B. On request provide additional data to support time and cost computations:
  - 1. Labor required.
  - 2. Equipment required.
  - 3. Products required.
    - a. Recommended source of purchase and unit cost.
    - b. Quantities required.
  - 4. Taxes, insurance and bonds.
  - 5. Credit for work deleted from Contract, similarly documented.
  - 6. Overhead and profit.
  - 7. Justification for change in Contract Time shall be demonstrated by using Contemporaneous Period Analysis and Critical Path Method Scheduling Techniques, in accordance with Section 01320.
- C. Support each claim for additional costs, and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information:
  - 1. Name of the Owner's authorized agent who ordered the work, and date of the order.
  - 2. Dates and times work was performed, and by whom.
  - 3. Time record, summary of hours worked, and hourly rates paid.
  - 4. Receipts and invoices for:
    - a. Equipment used, listing dates and times of use.
    - b. Products used, listing of quantities.
    - c. Subcontracts.

#### 1.05 PREPARATION OF CHANGE ORDER PROPOSALS AND CHANGE ORDERS.

- A. The Contractor shall prepare Change Order Proposals on a form prepared by the Contractor and approved by the Architect and the Owner.
- B. The Contractor shall prepare each change order using AIA Document G701.
- C. Change Order Proposals will describe changes in the Work, both additions and deletions, Documentation supporting changes in cost and Contract Time shall be attached to each COP.
- D. Change Orders will be periodic submissions of a group of Change Order Proposals. Change Orders will provide an accounting of the adjustment in Contract Sum and in the Contract Time.

#### 1.06 LUMP-SUM/FIXED PRICE CHANGE ORDER PROPOSALS

- A. Content of Change Order proposals will be based on either:
  - 1. Architect Proposal Request and Contractor's responsive Proposal as mutually agreed between the Owner and the Contractor.
  - 2. Contractor's Change Order Proposal for a change, as recommended by the Architect.

- B. The Owner and the Architect will sign and date the COP as authorization for the Contractor to proceed with the changes.
- C. Contractor may sign and date the COP to indicate agreement with the terms therein.

#### 1.07 UNIT PRICE CHANGE ORDER PROPOSALS

- A. The content of the COP's will be based on either:
  - 1. The Architect's definition of the scope of the required changes.
  - 2. The Contractor's Change Order Proposal for a change, as recommended by the Architect.
  - 3. Survey of completed work.
- B. The amounts of the unit prices to be:
  - 1. Those stated in the Agreement.
  - 2. Those mutually agreed upon between the Owner and the Contractor.
- C. When quantities of each of the items affected by the COP be determined prior to start of the work:
  - 1. The Owner and the Architect will sign and date the COP as authorization for the Contractor to proceed with the changes.
  - 2. The Contractor may sign and date the COP to indicate agreement with the terms therein.
- D. When quantities of the items cannot be determined prior to start of the work:
  - 1. The Architect or the Owner will issue a construction change directive directing the contractor to proceed with the change on the basis of unit prices, and will cite the applicable unit prices.
  - 2. At completion of the change, the Architect will determine the cost of such work based on the unit prices and quantities used.
  - 3. Submit documentation to establish the number of units of each item and claims for a change in contract time.
  - 4. The Architect will sign and date the change order to establish the change in contract sum and in contract time.
  - 5. The Owner and the Contractor will sign and date the change order to indicate their agreement with the terms.

#### 1.08 CORRELATION WITH CONTRACTOR'S SUBMITTALS

- A. Revise schedule of values and request for payment forms to record each Change Order as a separate item of work, and to record the adjusted contract sum.
- B. Revise the construction schedule to reflect each change in contract time. Revise sub-schedules to show changes for other items of work affected by the changes.
- C. Upon completion of work under a Change Order, enter pertinent changes in record documents.

**END OF SECTION**

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**SECTION 010440  
CONTRACTOR'S REQUESTS FOR INFORMATION**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. This Section specifies administrative requirements for Requests for Information (RFI).

1.02 DEFINITIONS

- A. Requests for information:
1. A document (RFI) submitted by the Contractor requesting clarification of a portion of the Contract Documents.
  2. A properly prepared RFI shall include a detailed written statement that indicates the specific drawing or specification in need of clarification and the nature of the clarification requested.
    - a. Drawings shall be identified by drawing number and location on the drawing sheet.
    - b. Specifications shall be identified by Section number, page and paragraph.
- B. Improper RFI's:
1. RFI's that are not properly prepared and are not clearly indicated on the Contract Documents.
  2. Improper RFI's will be processed by the Architect at the Architect's standard hourly rate and the Architect will charge the Owner; such costs will be deducted from monies still due the Contractor. The Contractor will be notified by the Architect prior to the processing of improper RFI's.

1.03 CONTRACTOR'S REQUESTS FOR INFORMATION

- A. When the Contractor is unable to determine from the Contract Documents, the material, process or system to be installed, the Architect will be requested to make a clarification of the indeterminate item.
1. Whenever possible, such clarification shall be requested at the next appropriate project meeting, with the response entered into the meeting minutes. When clarification at the meeting is not possible, either because of the urgency of the need, or the complexity of the item, the Contractor shall prepare and submit an RFI to the Architect.
- B. The Contractor shall endeavor to keep the quantity of RFI's to a minimum. In the event that the process becomes unwieldy, in the opinion of the Architect, because of the quantity and frequency of RFI's submitted, the Architect may require the Contractor to abandon the process and submit future requests as either submittals, substitutions or requests for change.
- C. RFI's shall be submitted on a form acceptable to the Architect. Forms shall be completely filled in, and if prepared by hand, shall be fully legible after photocopying or transmission by facsimile (fax). Each page of attachments to RFI's shall bear the RFI number in the lower right corner.
- D. RFI's shall be originated by the Contractor.
1. RFI's from subcontractors or material suppliers shall be submitted through, reviewed by and signed by the Contractor prior to submittal to the Architect.
  2. RFI's sent directly to the Architect or the Architect's consultants shall not be accepted and will be returned unanswered.
- E. The Contractor shall carefully study the Contract Documents to assure that the requested information is not available there. RFI's which request information available in the Contract Documents will be deemed wither "improper" or "frivolous" as noted above.

- F. In cases where RFI's are issued to request clarification of coordination issues, for example, pipe and duct routing, clearances, specific locations of work shown diagrammatically and similar items, the Contractor shall fully lay out a suggested solution using drawings or sketches drawn to scale, and submit with the RFI. RFI's which fail to include a suggested solution will be returned unanswered with a requirement that the Contractor submit a complete request.
- G. RFI's shall not be used for the following purposes:
  - 1. To request approval of submittals.
  - 2. To required approval of substitutions.
  - 3. To request changes which entail additional cost or credit.
  - 4. To request different methods of performing work than those drawn or specified.
- H. In the event the Contractor believes that a clarification by the Architect results in additional cost or time, the Contractor shall not proceed with the work indicated by the RFI until a COP is prepared and approved. RFI's shall not automatically justify a cost increase in the work or a change in the project schedule.
  - 1. Answered RFI's shall not be construed as approval to perform extra work.
  - 2. Unanswered RFI's will be returned with a stamp or notation: Not Reviewed.
- I. The Contractor shall prepare and maintain a log of RFI's, and at any time requested by the Architect, the Contractor shall furnish copies of the log indicating outstanding RFI's. The Contractor shall not unanswered RFI's in the log.
- J. The Contractor shall indicate a response date required for the RFI. The Contractor shall submit each RFI in time to allow the Architect to adequately review the documents and respond appropriately.

#### 1.04 ARCHITECT'S RESPONSE TO RFI'S

- A. The Architect will respond to RFI's on one of the following forms:
  - 1. Properly prepared RFI's:
    - a. Architect's Supplemental Instruction.
    - b. Request for Proposal.
  - 2. Improper or Frivolous RFI's.
    - a. Notification of Processing Fee(s).
    - b. Unanswered RFI's will be returned with a stamp or notation: Not Reviewed.
  - 3. Answers to properly prepared RFI's will not be made directly on the RFI form.
- B. The Architect may opt to retain RFI's for discussion during regularly scheduled project meetings for inclusion of responses in meeting minutes in lieu of responding on a written form.

#### END OF SECTION



**SECTION 012000  
PROJECT MEETINGS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements for project meetings including but not limited to:
  - 1. Pre-Construction Conference.
  - 2. Pre-Installation Conferences.
  - 3. Progress Meetings.
  - 4. Coordination Meetings
  - 5. Owner's Meetings
  - 6. Schedule Meetings

1.02 CONTRACTOR'S RESPONSIBILITY

- A. Schedule and administer pre-construction meeting, periodic progress meetings, and specially called meetings throughout progress of the work.
  - 1. Prepare agenda for meetings.
  - 2. Distribute written notice of each meeting four days in advance of meeting date.
  - 3. Make physical arrangements for meetings.
  - 4. Preside at meetings.
  - 5. Record the minutes; include significant proceedings and decisions.
  - 6. Reproduce and distribute copies of minutes within three days after each meeting:
    - a. To participants in the meeting.
    - b. To parties affected by decisions made at the meeting.
    - c. Furnish three copies of minutes to Architect.
- B. Representatives of Contractors, Subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. The Architect and the Owner's Representative may attend meetings to ascertain that Work is expedited consistent with Contract Documents and construction schedules.

1.03 PRE-CONSTRUCTION MEETING

- A. Schedule a pre-construction conference and organizational meeting at the Project site or other convenient location no later than 15 days after execution of the Agreement and prior to commencement of construction activities. Conduct the meeting to review responsibilities and personnel assignments.
- B. Attendance:
  - 1. Owner's Representative.
  - 2. Architect and his professional consultants (optional).
  - 3. Resident Project Representative.
  - 4. Contractor's Superintendent.
  - 5. Major subcontractors.
  - 6. Major suppliers.
  - 7. Others as appropriate.
- C. Agenda: Discuss items of significance that could affect progress including such topics as:
  - 1. Tentative construction schedule.

2. Critical Work sequencing.
3. Designation of responsible personnel.
4. Procedures for processing field decisions and Change Orders.
5. Procedures for processing Applications for Payment.
6. Distribution of Contract Documents.
7. Submittal of Shop Drawings, Product Data and Samples.
8. Use of the premises and access to site.
9. Office, Work and storage areas.
10. Equipment deliveries and priorities, including Owner supplied items.
11. Working hours.
12. Major equipment deliveries and priorities.
13. Procedures for maintaining Record Documents.
14. Construction facilities, controls and construction aids.
15. Temporary utilities.
16. Safety and first-aid procedures.
17. Security procedures.
18. Housekeeping procedures.
19. Procedures for communication and information flow.

#### 1.04 PROGRESS MEETINGS

- A. Conduct weekly progress meetings at the Project site. Notify the Owner and Architect of scheduled meeting dates. Coordinate dates of meetings with preparation of the payment request.
- B. Attendance:
  1. Architect and Owner, and their professional consultants as needed.
  2. Subcontractors as appropriate to the agenda.
  3. Suppliers as appropriate to the agenda.
  4. Others, as required.
  5. Owner's Representative(s).
- C. Agenda: Review and correct or approve minutes of the previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to the current status of the Project.
  1. Contractor's Construction Schedule: Review progress since the last meeting. Determine where each activity is in relation to the Contractor's Construction Schedule, whether on time or ahead or behind schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.
  2. Review the present and future needs of each entity present, including such items as:
    - a. Interface requirements.
    - b. Time and Schedules.
    - c. Sequences.
    - d. Deliveries.
    - e. Off-site fabrication problems.
    - f. Access.
    - g. Site utilization.
    - h. Temporary facilities and services.
    - i. Hours of Work.
    - j. Hazards and risks.
    - k. Housekeeping.
    - l. Quality and Work standards.
    - m. Change Orders.
    - n. Documentation of information for payment requests.

- D. Reporting: No later than 3 days after each progress meeting date, distribute copies of minutes of the meeting to each party present and to other parties who should have been present. Include a brief summary, in narrative form, of progress since the previous meeting and report.
- E. Schedule Updating: Revise the construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue the revised schedule concurrently with the report of each meeting.

#### 1.05 PRE-INSTALLATION CONFERENCES

- A. Conduct a pre-installation conference at the site before each construction activity that requires coordination with other construction. The Installer and representatives of manufacturers and fabricators involved in or affected by the installation, and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise the Architect of scheduled meeting dates.
- B. Review the progress of other construction activities and preparations for the particular activity under consideration at each pre-installation conference, including requirements for the following:
  - 1. Contract Documents.
  - 2. Related Change Orders.
  - 3. Shop Drawings, Product Data, and Quality Control Samples.
  - 4. Possible conflicts.
  - 5. Manufacturer's recommendations.
  - 6. Warranty requirements.
  - 7. Compatibility of materials.
  - 8. Acceptability of substrates.
  - 9. Inspecting and testing requirements.
  - 10. Required performance results.
  - 11. Protection.
- C. Record results of each conference with an approved schedule. Promptly distribute the record of the meeting to everyone concerned, including the Owner and the Architect. Do not proceed with the installation unless the meeting was successfully concluded.

#### 1.06 OWNER'S MEETINGS

- A. Reference Exhibit "A" for the Schedule of Meetings and Attendees.
- B. The Contractor and Subcontractor will be required to participate in Owner's Meetings bi-weekly. The requirements of the Contractor's and Subcontractor's participants will include, but not be limited to, presentation and discussion of; project status, schedule, cost status, projections and coordination with Owner. The Contractor will provide documentation and support for these meetings as requested by the Owner.

#### 1.07 SCHEDULE MEETINGS

- A. Scheduling meeting will be held in accordance with requirements shown in Section 01320 or as dictated by the nature of the work, or as requested by the Owner.

**END OF SECTION**

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**SECTION 013000  
SUBMITTALS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. This Section specifies administrative and procedural requirements for submittal of Shop Drawings, Product Data and Samples to verify that products, materials and systems proposed for use comply with provisions of the Contract Documents.
- B. Shop Drawings include, but are not limited to, the following:
  - 1. Fabrication Drawings.
  - 2. Installation Drawings.
  - 3. Setting diagrams.
  - 4. Shopwork manufacturing instructions.
  - 5. Templates and patterns.
  - 6. Schedules.
  - 7. Design mix formulas: standard information prepared without specific reference to the Project is not considered to be Shop Drawings.
  - 8. Coordination Drawings are a special type of Shop Drawing that show the relationship and integration of different construction elements that require close and careful coordination during fabrication or during installation to fit in the restricted space provided or to function as intended.
- C. Product Data include, but are not limited to, the following:
  - 1. Manufacturer's product Specifications.
  - 2. Manufacturer's installation instructions.
  - 3. Standard color charts.
  - 4. Catalog cuts.
  - 5. Roughing-in diagrams and templates.
  - 6. Standard wiring diagrams.
  - 7. Printed performance curves.
  - 8. Operational range diagrams.
  - 9. Mill reports.
  - 10. Standard product operating and maintenance manuals.
- D. Samples include, but are not limited to, the following:
  - 1. Partial Sections of manufactured or fabricated components.
  - 2. Small cuts or containers of materials.
  - 3. Complete units of repetitively-used materials.
  - 4. Swatches showing color, texture and pattern.
  - 5. Color range sets.
  - 6. Components used for independent inspection and testing.
  - 7. Field Samples are full-size physical examples erected on site to illustrate finishes, coatings, or finish materials and to establish the standard by which the Work will be judged.
  - 8. Mock-ups are full size assemblies for review of construction, coordination, testing, or operation; they are not Samples.
- E. Administrative Submittals: Refer to other Division - 1 Sections and other Contract Documents for requirements for administrative submittals. Such submittals include, but are not limited to:
  - 1. Permits.
  - 2. Applications for Payment.
  - 3. Performance and Payment Bonds.
  - 4. Insurance certificates.

5. Listing of subcontractors.

F. Inspection and Test Reports: Submittal of inspection and test reports is included under Section "Testing Laboratory Services."

#### 1.02 SUBMITTAL SCHEDULE

- A. Submit a preliminary "Submittal Schedule" to the Architect for review and response. The submittal schedule must be integrated into the CPM Project Schedule. Submittals that are on the Critical Path must be identified clearly. The "Submittal Schedule" shall contain the following information:
1. Section number and name
  2. Submittal information required
  3. Date submittal will be received by the Architect
  4. Time allowed for review of submittal (in calendar days)
  5. Date returned submittal will be received by the Contractor
- B. Submit the final "Submittal Schedule" to the Architect for review and approval. Modifications to the approved schedule shall be submitted to the Architect for review and approval allowing adequate time for review and response.
- C. Submittals received by the Architect on or before the scheduled date will be processed to meet the scheduled date.
- D. Submittals received by the Architect after the scheduled date will be processed within the number of calendar days allotted for the review.
- E. The Architect will not be responsible for delays due to receiving submittals after the date indicated in the submittal schedule.
- F. See submittal schedule requirements in Sections 01310 and 01320.

#### 1.03 SHOP DRAWINGS

- A. Submit one (1) correctable translucent reproducible print and three (3) blue-line or black-line prints with each shop drawing submittal.
- B. The Contractor shall make prints of the corrected reproducible as necessary for distribution and record.
- C. If resubmission is required, correct the original drawings and prepare new reproducible and submit as above.
- A. Provide shop drawings as complete submittals (no partial sets) on original drawings or information prepared solely by the fabricator or supplier.
- B. Do not reproduce the Contract Drawings for shop drawing submittals.
- C. Sheet sizes: not to exceed the size of the contract drawings.
- D. Provide blank spaces on each reproducible print large enough to accept 4" x 4" review stamps of both the Architect and the Contractor.
- E. Provide the following information on each reproducible:
1. Project name and project number

2. Date
3. Names of:
  - a. Architect
  - b. Contractor
  - c. Subcontractor (if applicable)
  - d. Supplier
  - e. Manufacturer
4. Identification of product or material.
5. Relation to adjacent structure or materials.
6. Field dimensions, clearly stated as such.
7. Project manual section number.
8. Applicable referenced standards
9. Identification of deviations from Contract Documents.
10. Reference to construction drawings by drawing number and/or detail number.

F. Submit reproducible prints without folds either as flat sheets if size permits, or rolled in tubes.

#### 1.04 PRODUCT DATA

- A. Product data such as catalog cuts, brochures or manufacturer's printed sheets may be submitted in lieu of reproducible prints if adequately identified. Submit six (6) copies of product data to the Architect and one (1) copy to the Owner. The Architect will retain two (2) copies, one (1) stamped copy will be given to the Owner, and three (3) copies will be returned to the Contractor.
- B. Modify product data sheets to delete information which is not applicable to the Project. Provide additional information if necessary to supplement standard information.
- C. Product Data such as catalog cuts, brochures or manufacturer's preprinted sheets may be submitted if adequately identified. Where contents of submitted product data include data not pertinent to the submittal, clearly indicate which portions of the contents are being submitted for review. Where more than one product is included, clearly indicate which product is being submitted for review.
- D. Product data sheets that are submitted with extraneous information not deleted and/or modified will be returned without review to the Contractor for resubmittal.

#### 1.05 SAMPLES

- A. Provide samples to illustrate materials, equipment or workmanship, and to establish standards by which completed work may be judged.
- B. Provide office samples in sufficient size and of quantity to clearly illustrate full range of colors and textures available and the functional characteristics of the product or material.
- C. Construct mock-ups as required by the technical sections, at the project site in a location designated by the Architect. Construct mock-ups, including adjacent work required, to demonstrate the final appearance of the work.
- D. Provide field samples at the request of the Architect where construction materials and methods deviate from the requirements or the intent of the Contract Documents or conventional construction practice.

#### 1.06 CERTIFICATIONS

- A. Provide certifications required by various technical sections on the Contractor's letterhead stationary. Identify and date certifications with project name and the Contractor's signature in the same format used for the Owner/Contractor Agreement.
- B. Clearly identify the materials referenced and state that the material and the intended installation methods, where applicable, are in compliance with the Contract Documents. Attach manufacturer's affidavits where applicable.

#### 1.07 CONTRACTOR'S RESPONSIBILITIES

- A. Before making submittals to the Architect, review each submission, make changes or notations as necessary to conform to the Contract Documents, identify such review with review stamp and forward reviewed submittal with comments to the Architect for review. Return submittals not meeting contract requirements to the subcontractors and do not forward such submittals to the Architect.
- B. Verify field measurements and product catalog numbers or similar data.
- C. Notify the Architect, in writing at time of submission, of deviations in submittals from the requirements of the Contract Documents. All deviations must be identified on a cover page attached to any submittal in which they occur. Requirements for each substitution request shall be in accordance with Section 01630.
- D. After the Architect's review, distribute copies with one copy to be maintained at the Project Site for reference use and other copies distributed to suppliers/fabricators.
- E. Do not begin work which requires submittals until return of submittals with the Architect's stamp and initials indicating review.
- F. The Contractor's responsibility for errors and omissions in submittals is not relieved by the Architect's review of submittals.
- G. The Contractor's responsibility for deviations in submittals from requirements of the Contract Documents is not relieved by the Architect's review of submittals unless the Architect gives written acceptance of specific deviations.

#### 1.08 ARCHITECT'S RESPONSIBILITIES

- A. The Architect will review submittals, checking only for conformance with the design concept of the Project and compliance with information given in the Contract Documents.
- B. The Architect will return without review all submittals not bearing the Contractor's review stamp or showing that it has not been reviewed by the Contractor.
- C. The Architect will make changes or notations directly on the submittal, identify such review with his review stamp, obtain and record the Architect and the Owner's file copies and return the submittal to the Contractor.

#### 1.09 RESUBMISSION REQUIREMENTS

- A. Shop drawings: review initial drawings as required and resubmit as specified for initial submittal. Indicate on drawings changes which have been made other than those requested by the Architect.
- B. Product data and samples: resubmit new data and samples as required for initial submission.



1.10 PROJECT CLOSEOUT SUBMITTALS

- A. Project Closeout submittals shall be specified in Section 01700.

**END OF SECTION**

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**SECTION 013100  
SCHEDULES AND REPORTS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for schedules and reports required for proper performance of the Work.
- B. The Contractor shall closely coordinate scheduling and reporting with the scheduling and reporting of subcontractors.
- C. Schedules required include:
  - 1. Construction Schedule.
  - 2. Submittal Schedule.
  - 3. Unit Price Schedule.
  - 4. Schedule of Inspections and Tests.
- D. Reports required include:
  - 1. Daily Construction Reports.
  - 2. Material location reports.
  - 3. Field correction reports.
  - 4. Special reports.

1.02 CONSTRUCTION SCHEDULE

- A. Construction Schedule requirements shall be in accordance with Section 01320.
  - 1. Coordinate the Contractor's Construction Schedule with the schedule of values, list of subcontracts, Submittal Schedule, progress reports, payment requests and other required schedules and reports.
  - 2. Indicate completion of the Work in advance of the date established for Substantial Completion. Indicate Substantial Completion on the Schedule to allow ample time for the Architect's administrative procedures necessary for Certification of Substantial Completion.
- B. Distribution: Following the Architect's response to initial submittal of the Contractor's Construction Schedule, print and distribute copies to the Architect, Owner, separate contractors, subcontractors, suppliers, fabricators, and other parties required to comply with scheduled dates.
  - 1. Post copies of the Schedule in the Project meeting room and temporary field office.
  - 2. When revisions are made, distribute the updated Schedule to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.03 SUBMITTAL SCHEDULE

- A. Immediately after development and acceptance of the Contractor's Construction Schedule, prepare a complete Submittal Schedule. Submit the Schedule within 10 days of the date required for establishment of the Contractor's Construction Schedule.
  - 3. Coordinate Submittal Schedule with the list of subcontracts, Schedule of Values and the list of products specified in Section "Materials and Equipment" as well as the Contractor's Construction Schedule.
  - 4. Prepare the Schedule in chronological order; include submittals listed on the tabulation of submittals required during the first 90 days of construction. Provide the following information on

the Schedule:

- a. Scheduled date for the first submittal.
  - b. Related Section number.
  - c. Submittal category.
  - d. Name of subcontractor.
  - e. Description of the part of the Work covered.
  - f. Scheduled date for resubmittal.
  - g. Scheduled date the Architect's final release or approval.
- B. Distribution: Following the Architect's response to initial submittal, print and distribute the Schedule to the Architect, Owner, separate Contractors, subcontractors, suppliers, fabricators, and other parties required to comply with submittal dates indicated.
1. Post copies in the Project Meeting Room and temporary field office.
  2. When revisions are made, distribute the updated Schedule to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned part of the Work and are no longer involved in the performance of construction activities.
- C. Schedule Updating: Revise the Schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue the updated Schedule concurrently with report of each meeting.

#### 1.04 SCHEDULE OF INSPECTIONS AND TESTS

- A. Prepare a schedule of inspections, tests and similar services required by the Contract Documents. Submit the schedule within 30 days of the date established for commencement of the Work.
- B. Form: The Schedule shall be in tabular form and shall include but not be limited to the following data:
1. Specification Section number.
  2. Description of the test.
  3. Identification of applicable standards.
  4. Identification of test methods.
  5. Number of tests required.
  6. Time schedule or time span for tests.
  7. Entity responsible for performing tests.
  8. Requirements for taking Samples.
  9. Unique characteristics of each service.
- C. Distribution: Distribute the Schedule to the Owner, Architect, and each party involved in performance of portions of the Work, where inspections and tests are required.

#### 1.05 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report, recording the following information concerning events at the site; and submit duplicate copies to the Architect at weekly intervals:
1. List of subcontractors at the site.
  2. List of separate contractors at the site.
  3. Approximate count of personnel at the site.
  4. High and low temperatures, general weather conditions.
  5. Accidents (refer to accident reports).
  6. Meetings and significant decisions.
  7. Unusual events (refer to special reports).
  8. Stoppages, delays, shortages, losses.
  9. Meter readings and similar recordings.
  10. Emergency procedures.

11. Orders and requests of governing authorities.
  12. Change Orders received, implemented.
  13. Services connected, disconnected.
  14. Equipment or system tests and start-ups.
  15. Partial Completions, occupancies.
  16. Substantial Completions authorized.
- B. Material Location Reports: At weekly intervals prepare a comprehensive list of materials delivered to and stored at the site. The list shall be cumulative, showing materials previously reported plus items recently delivered. Include with the list a statement of progress on and delivery dates for all materials or items of equipment being fabricated or stored away from the building site. Submit copies of the list to the Architect at weekly intervals.
- C. Field Correction Report: When the need to take corrective action that requires a departure from the Contract Documents arises, prepare a detailed report including a statement describing the problem and recommended changes. Indicate reasons the Contract Documents cannot be followed. Submit a copy to the Architect immediately.

**END OF SECTION**

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## **013200 – PROJECT CRITICAL PATH METHOD SCHEDULE**

### **PART 1 GENERAL**

#### **1.1 SUMMARY AND DEFINITIONS**

- A. This section specifies requirements for the Project CPM Schedule, progress updates and submittal schedule. The purpose of the Project CPM Schedule and reporting is to:
1. Ensure the Contractor has undertaken detailed planning of the work
  2. Ensure the Contractor is accurately monitoring and controlling the time elements of the Project
  3. Assist the Owner in monitoring progress relative to the contract completion time
  4. Assess the impact of any changes to the Contract
  5. Support the basis for Schedule of Values data
  6. Ensure the Contractor is using the appropriate tool for mitigating time-related impacts
  7. Establish the baseline against which satisfactory completion of the project shall be judged
  8. Evaluate claims and requests for extension of contract time
- B. "Total float" is defined as the amount of time between the earliest start date and latest start date or the earliest finish date and the latest finish date of an activity. Total float represents the amount of time the activity can be delayed before it causes delay to the completion date, and/or before it becomes critical.
- C. "Critical Path" is defined as that sequence of activities which forms the longest path through the Project CPM Schedule. Activities on the critical path will have total float less than or equal to zero. Any delay to activities on the critical path will cause delay to the overall contract completion date.
- D. Float belongs to the Project. It is for the mutual benefit of the Owner and Contractor. It is not for the exclusive use of either the Owner or the Contractor and will be consumed on a first come, first served basis.
- E. Extensions of time for contract performance or changes to the Project Milestones will only be granted by Change Order. Any claims for extensions of time shall be substantiated using the Contemporaneous Period Analysis method described in paragraph 1.7.
- F. The Owner and the Architect will review all schedule submittals, including the schedule updates. Such review shall not constitute an approval or acceptance of the Contractor's construction means, methods, or sequencing, or its ability to complete the Work in a timely manner. Review by the Owner and the Architect does not waive any of the Owner's rights granted under other provisions of the Contract Documents.
- G. The scheduling conventions noted below shall be followed for all schedules on this Project.
1. Negative values in lead/lag relationships are not to be used.
  2. Only one start and one finish activity will be allowed for the entire schedule. All other activities must be linked between the start and the finish activity.
  3. Activities with open ends are not allowed. The only exceptions to this are the start activity, the finish activity, the first activity in a sequence of activities representing a change in the work, and recorded natural events such as weather.
  4. Activity Descriptions shall, at a minimum, describe the item, the action and the location of the work represented by that activity. In the example "Install Steel Studs 3<sup>rd</sup> Floor", "Install" is the action, "Steel Studs" is the item and "3<sup>rd</sup> Floor" is the location.
  5. The Contractor shall not sequester float by engaging in scheduling practices that artificially consume float.

6. The use of constraints will only be allowed to reflect contractually and/or environmentally imposed conditions. Constraints shall not be used where an activity or logical relationship is appropriate.
  7. Progress updating shall be based on actual starts, actual finishes and remaining durations. Percent complete progressing will not be accepted.
  8. Schedule calculations shall be based on retained logic, not progress override.
  9. All schedules and schedule related documentation shall be prepared using the software specified in this section.
- H. Timely submissions of the schedules described in this section are of significant and crucial importance to this Project. Lack of or late receipt of these diminishes their value to the Owner and Contractor. At the Owner's discretion, if any of these submissions are not submitted according , the Owner may withhold up to U.S. \$500.00 per occurrence from the Contractor's payment in recognition of the value and importance of each update to the Owner and the Project. The Owner will estimate the cost of lost days and completion and/or the cost of recovering lost time in arriving at this withheld amount, as these are amounts to which the Owner attaches the value of the CPM scheduling on this project.
- I. The Contractor shall extract from the updated Project CPM Schedule a Short Interval Schedule (four week look-ahead) based upon the Contractor's work plan. It shall be prepared and submitted weekly unless otherwise requested by the Owner and / or as dictated by the status of the Project. The window represented by the Short Interval Schedule shall be the previous week of progress and the upcoming three weeks of planned activities. The look-ahead schedule submitted to the Owner shall indicate the early start and finish dates and the total float of all activities in this period.
- J. The Contractor shall employ (either directly or through a consultant) a person who is skilled in and has a demonstrated knowledge of CPM scheduling on projects of this nature. This person shall also be experienced with and able to demonstrate a working knowledge of the Contemporaneous Period Analysis methodology as described in paragraph 1.7. The Contractor shall submit this person's resume immediately following the Notice of Award, the Notice to Proceed or execution of the contract (whichever is the earliest) for the Owner's approval.

## **1.2 RELATED DOCUMENTS**

1. Contract between the Owner and the Contractor
2. General and Supplemental Conditions
3. Drawings and Specifications
4. Submittals required by the Contract Documents

## **1.3 WORK INCLUDED**

- A. Provide a Project CPM Schedule in accordance with paragraph 1.4 of this section.
- B. Participate in schedule update meetings and provide schedule updates in accordance with paragraph 1.5.
- C. Participate in Contemporaneous Period Analysis in accordance with paragraph 1.7.
- D. Provide a submittal schedule in accordance with paragraph 1.8.

## **1.4 ORIGINAL PROJECT CPM SCHEDULE**

- A. Within fourteen calendar days of the Notice of Award, the Notice to Proceed or the execution of the contract (whichever is the earliest), the Contractor shall prepare and submit a detailed Project CPM Schedule. This schedule shall be the Contractor's working schedule and shall be used to plan, organize, and execute the work, record and report actual performance and progress through updates, and indicate the Contractor's plan to complete all remaining work. The Project CPM



Schedule and subsequent progress updates shall be the basis for consideration and analysis of requests for time extensions, to evaluate Applications for Payment and to evaluate changes to the work. The schedule shall be in the form of an activity-oriented precedence network diagram.

- B. The Contractor shall submit the Project CPM Schedule to the Owner for review and comment. The Owner will review the schedule for conformance with the Contract Documents and provide comment within seven (7) calendar days of receipt from the Contractor of all submittals required under this paragraph 1.4. The Contractor shall respond to the Owner's comments within seven (7) calendar days of its receipt of the Owner's comments.
- C. The Project CPM Schedule shall be constructed to show the order in which the Contractor proposes to carry out the work and to indicate the restrictions of access and availability of work area, and availability and use of manpower, materials and equipment.

The Contractor shall prepare the schedule in a level of detail commensurate with the size and complexity of the Project. At a minimum, work activities shall be broken down by trade and location. Where a trade performs more than one discrete task in completing their work, each discrete task shall be shown separately (i.e. install steel studs; install wallboard; tape and finish wallboard).

In preparing the schedule, the Contractor shall consider the following.

- 1. The breakdown of the project schedule by sub-projects.
  - 2. The type of work to be performed and labor trades involved.
  - 3. Procurement, manufacture, and delivery activities for all major materials and equipment.
  - 4. Procurement, delivery, and installation activities of Owner-furnished equipment and materials.
  - 5. Preparation and submission of shop drawings and material samples.
  - 6. Approval by the Owner and Architect of shop drawings and material samples.
  - 7. Assignment and coding of all activities by the performing entity such as subcontractors, vendors, governing authorities, the Architect, and the Owner.
  - 8. Access and availability to the work area.
  - 9. Identification of interfaces and dependencies with preceding, concurrent, and succeeding contractors.
  - 10. Testing and / or submission and approval of test results.
  - 11. Approvals required by regulatory agencies or other third parties.
  - 12. Contract-stipulated limitations and restrictions, construction milestones and substantial and total completion dates.
  - 13. Engineering and design activities.
  - 14. Commissioning, systems start-up, and testing.
  - 15. Punchlist activities and project closeout.
  - 16. Input from the Owner, Architect, Designers, Subcontractors and Vendors.
  - 17. The Project CPM Schedule shall be specific in showing what activities must be completed prior to Substantial Completion and what activities occur between the time of Substantial Completion and Total Completion.
- D. The project activities shall be coded in a manner that optimizes the readability of reports generated from the electronic schedule files. In doing so the contractor is to use at a minimum the code fields itemized in this Section D. Additional code fields may be utilized upon approval of the Owner.
    - 1. PHAS, for the project phases. Groupings within the PHAS code may include Design, Submit, Review, Fabricate & Deliver, Install, Test & Commission and Closeout.
    - 2. LOC, for the project locations. Groupings within the LOC code may include Sitework, Building Foundations, Building First Floor, Roof, and Exterior Closure.
    - 3. RESP, for the party responsible for the specific activity. Groupings within the RESP code may include Owner, Architect, Contractor, and specific subcontractors.
    - 4. SPEC, for the coding of submittals (see 1.8).

- E. The planned durations of activities defined in the Project CPM Schedule shall consider the specific manpower and equipment requirements of the Project. Normal inclement weather shall be considered in calculating activity durations. All durations shall be in units of working days.
- F. Scheduled activities shall contain the following data.
  - 1. Activity ID. Numeric only, or as approved by Owner.
  - 2. Activity Description.
  - 3. Activity Codes, format to be agreed to by Owner and Contractor.
  - 4. Activity Labor. Direct labor only shall be assigned to the appropriate resource code (i.e. laborer, electrician, operator, et cetera) for each activity.
- G. The critical path shall be clearly identified on all submissions.
- H. The Contractor shall prepare and submit a written narrative report with the original schedule submittal and with each schedule update describing the following.
  - 1. The planned work flow on the Project.
  - 2. Unusual manpower needs such as multiple shifts or overtime.
  - 3. Unusual equipment needs.
  - 4. The planned achievement of milestones and completion dates.
  - 5. The critical path and factors that might jeopardize it.
  - 6. An explanation of relationships based on preferential logic (logic of convenience) and all constraints.
  - 7. Any other factors or events having an impact on the timely completion of the Project.
  - 8. Contractor's explanation for not achieving planned early dates in the previous period (Not needed with the original schedule submittal).
  - 9. Responses to Owner comments and suggestions from previous schedule update revisions (Not needed with the original schedule submittal).
- I. With the exception of submit, fabricate and approve activities, no construction phase activity shall exceed fifteen days planned (original) duration. Pre-construction activities may exceed this duration upon approval from the Owner.
- J. The Contractor shall submit, with the Project CPM Schedule, a sign-off sheet from the available major subcontractors and vendors indicating they have participated in, reviewed, and concur with the Project CPM Schedule and manpower loading as it relates to their work.
- K. The Contractor shall prepare computer-generated reports as part of the Project CPM Schedule submission and for each progress update thereafter. Reports shall be in bar chart format with tabular data for each activity at the left side of the bar chart. Each activity in each specified bar chart shall include, at a minimum:
  - 1. Activity number.
  - 2. Activity description.
  - 3. Original and remaining durations in work days.
  - 4. Early start and finish dates.
  - 5. Actual start and finish dates.
  - 6. Total float in workdays.
- L. Specific bar chart reports required include:
  - 1. All activities sorted by activity number including predecessor and successor relationships (initial Project CPM Schedule only), or as agreed to by the Owner.
  - 2. All activities not 100% complete, grouped by phase and location and sorted first by early start and second by early finish.

3. All activities not 100% complete, grouped by total float and sorted by early start and then by early finish.

The contractor shall also submit:

1. A logic network diagram displaying all activities less than 100% complete in a time-scaled format and including the activity ID, description, total float and remaining duration. The network need not be confined to a single sheet but shall be printed on D size paper
- M. The Contractor shall prepare computer-generated reports and diagrams in the following quantities, as part of the original Project CPM Schedule submission and for each monthly progress update thereafter.
1. Three copies of all reports as specified in paragraph 1.4 (L).
  2. One copy of the electronic schedule file.
  3. Three copies of the narrative report specified in paragraph 1.4 (H).

## **1.5 PROGRESS UPDATES**

- A. The Contractor is required to submit updates of the Project CPM Schedule and to participate in schedule update meetings with the Owner. Submission of updates and participation in schedule update meetings will occur monthly or more frequently if requested by the Owner and / or as dictated by the status of the Project.
- B. The Contractor shall submit its final updated schedule for the monthly submittal, having incorporated the progress achieved and all logic and duration changes that represent its revised planning.
- C. The Contractor shall review and analyze all out-of-sequence progress within the schedule file prior to submitting the final update. Out-of-sequence progress that causes activities to have erroneous total float values shall be corrected.
- D. The Contractor must maintain a constrained (finish no later than) end date (the contract completion date) when generating the required reports and diagrams for the Owner as specified by this section. The fixed end date will be modified to reflect only those time extensions currently incorporated into the contract.
- E. The Contractor shall account for all excusable non-compensable delays, during which little or no work is progressed and which the Owner acknowledges in the period within which the events occur. The Contractor may choose to account for such delays within the Project CPM Schedule by treating these events as it would a typical holiday at the calendar function of the software. Whatever method is chosen by the Contractor and agreed to by the Owner, a description of the accounting shall be made in the narrative report.
- F. A monthly schedule update meeting shall be held at the construction site one week prior to the due date of the Contractor's monthly Application for Payment. The Contractor and Owner will review and discuss the following draft reports, to be provided by the Contractor at least two working days prior to the monthly schedule update meeting. Reporting requirements may be waived by Owner, on a month by month basis, based on relevance and project status:
1. Three copies of: (a) a total float bar chart clearly indicating the current critical path through project completion, and (b) a bar chart of activities sorted by early start dates commencing with the previous update data date and including all activities in progress since the previous update.
  2. Three copies of its draft narrative report. The report shall contain the items described in paragraph 1.4 (H) as well as: (a) a description of the work progressed; (b) a discussion of work scheduled for, but not performed in, the previous period, explaining why it was deferred; and (c)

a discussion of work scheduled for the upcoming period noting any issues or events that could impact this work. If the Contractor intends to make logic or original duration changes, the report will present such intentions.

Decisions made at these meetings and agreed to by all parties are binding. Progressing of work, logic and/or original duration changes agreed to at this meeting shall be incorporated into an "approved progress update" and submitted to the Owner as in paragraph 1.4 (J), (K), (L), and (M).

## **1.6 SCHEDULE FILE NAMING PROTOCOL**

- A. File names shall have four characters, consistent with the requirements of Primavera Project Planner, or Suretrak. The four characters, ordered 1, 2, 3, and 4 for this description are to be used as follows:
1. The first (leftmost) character is reserved for the Owner to identify the project. The Owner will likely assign an alpha character to this character of the file name.
  2. The second and third characters are reserved for the sequential numeric numbering of the monthly updating cycle. The approved project baseline schedule will be 00; the first month's update will use 01, and so forth.
  3. The fourth character is reserved for all updates that are performed between the monthly schedule submittals, and are to be named in the chronological order they were created. These are to be numbered 1 through 9, and if needed, the alpha characters A through Z will be used.
- B. The first baseline file for the Owner's project K will be named K000. The first monthly update will be named K010. The update following K010, but prior to the next monthly update submittal, is to be named K011. The second monthly update will be named K020.

## **1.7 THE CONTEMPORANEOUS PERIOD ANALYSIS ("CPA")**

- A. The Owner desires and intends to resolve all issues affecting the contract completion date in a timely, efficient, and effective manner. To achieve this goal, the Owner and Contractor shall participate in periodic contemporaneous analyses of all delays by application of the CPA method. The CPA shall coincide with the monthly schedule update meetings.
- B. The logic and planning elements of the Project CPM Schedule are the Contractor's responsibility. Assessment of impacts due to changes or other events, in accordance with the CPA method described herein, must be performed on the most recent approved update of the schedule, further progressed to the date the impact occurs.
- C. While the Owner might not agree in all instances as to the proper assessment of liability for delay, it is essential that both parties determine and accept the monthly update. Agreement is essential, as the update becomes the baseline schedule for the upcoming period and the schedule to be updated for the next monthly schedule meeting.
- D. Submission of valid monthly updates and the completion of the CPA are conditions precedent to the review and approval of any request for an extension of the contract completion date or project milestone. Failure to complete monthly updates and to participate in CPA will defer consideration of any time extensions by the Owner until the work is completed and the Owner analyzes all as-built progress. Further, the Owner will assess damages (liquidated or actual), if any, regardless of the status of any requests for time extensions pending, until any such requests are resolved.
- E. Change Orders requesting time extensions shall be accompanied by two versions of the most recently approved progress update, further progressed to the date the Contractor was directed to proceed with the work contemplated by the Change Order. The first schedule version shall reflect the status of the Project prior to the imposition of the Change Order work. A copy of this file is then created and the sequence of reasonably known activities representing the Change Order work are to be inserted into this copy and the schedule shall be recalculated, current as of the same date and

identical to the first schedule except for these Change Order activities. The net change in the project's end date between the second copy and the first copy will reflect and substantiate the request for extension of time related to the Change Order.

#### **1.8 SUBMITTAL SCHEDULE**

- A. The Contractor shall prepare and submit to the Architect a complete schedule of submittals extracted from the Project CPM Schedule and as required by the Specifications.
- B. The schedule shall (through activity coding) show the category of submittal, name of subcontractor, description of work covered, related specification section numbers, activity ID number and planned early / late dates for submit and review activities.
- C. The Architect will be required to review the submittal schedule and provide written comments regarding its ability to meet the timeframes established by the submittal schedule.
- D. Information from the submittal schedule shall be coordinated with the submittal log, which will show the information noted in paragraph 1.8 (B) as well as blank columns for actual date of submittal, re-submittal, and final release or approval by the Architect.
- E. Actual start/finish data related to submittals shall be kept current in the Project CPM Schedule.

## **PART 2 PRODUCTS**

#### **2.1 SCHEDULING SOFTWARE**

- A. The Contractor shall use an authorized copy of the latest version of Primavera Project Planner or P3 for Windows or SureTrak, also produced by Primavera.
- B. All scheduling, updating and reporting functions shall be performed using this software.

**END OF SECTION**

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## **SECTION 013520**

### **INFECTION CONTROL POLICIES**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Infection control policies.

##### **1.02 QUALITY ASSURANCE**

- A. Infection control is critical in all hospital areas. Dust in ceilings and construction debris contains fungus which, if inhaled by patients, can cause pneumonia and even death. Construction activities causing disturbances of existing dust or creating new dust shall be conducted in tight enclosures cutting off any flow of particles into patient areas.
- B. It is the policy of the Owner to contain airborne contaminants related to construction, such as dust, airborne fungus, vapors and odors, and to identify precautions necessary to do so. Waterborne contaminants are also of concern when pipes are shut off for long periods of time, and precautions will be taken to prevent the creation of reservoirs where pathogens can grow.

##### **1.03 EDUCATION**

- A. Dust and dirt carry microorganisms that can be spread by clothing and shoe contamination.
- B. Intrinsic risks are involved during renovation/construction in a hospital environment.
- C. Prevention and control:
  - 1. The Owner will educate contractors and construction workers; each person must understand the reasons for and the need for compliance with infection control policies for the control of airborne pathogens, as well as dust and dirt.

##### **1.04 PROJECT CONDITIONS**

- A. Infection control policies will be reviewed before beginning construction/renovation and decisions will be made for the implementation of prevention and control measures that will be monitored and documented throughout the duration of the project.
  - 1. These requirements will be included in the Contractor's Contracts.
  - 2. Reports will be presented to the Owner's Infection Control Committee.

##### **1.05 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Pre and post construction checklists.

#### **PART 2 PRODUCTS - NOT USED**

#### **PART 3 EXECUTION**

##### **3.01 FIELD QUALITY CONTROL**

- A. Pre and post construction checklists to be completed for this construction / renovation project.

##### **3.02 SCHEDULES**

- A. A sample "CONSTRUCTION/RENOVATION POLICY CHECKLIST" to be used is attached at the end of this section.

#### **END OF SECTION**

**Construction/Renovation Policy Checklist**

<b>Checklist</b>	<b>Yes</b>	<b>No</b>	<b>Date</b>	<b>N/A</b>
<b>Air Handling</b>				
A. Type of HVAC system involved identified.				
B. Identified what portions will be shut down				
C. Identified air sources				
D. Identified air filters that will be shut down and those that will have increased load				
E. Removed filters in shutdown areas				
F. Changed filters in increased flow areas				
G. Installed HEPA filters in areas that care for compromised patients				
H. Areas above ceiling tiles cleaned with HEPA filtered vacuum before opening				
I. All air ducts, ventilation ducts, doors, service chutes sealed and taped closed				
J. After sealing of area complete and negative pressure fan is on, but demolition has not started, the remaining system is tested for ability to maintain negative pressure and positive pressure in those areas that require it.				
K. Just prior to demolition, all air ducts are sealed.				
L. Negative air pressure HEPA filter with alarm installed in project area at all times.				
M. Those intakes that are within 25' of chute or exposed to unfiltered exhaust air are sealed and taped during the construction/renovation project.				
N. All windows are sealed closed for the duration of the demolition				
O. Notification is sent to all units involved of expected dates of altered interruption in normal air handling system				
<b>Barriers</b>				
A. Restricted area signs are posted				
B. Access path and elevator to work site designated for construction workers				
C. Appropriate ceiling to floor barriers erected and sealed				
D. Access door is gasketed and has tight seal				
E. Adhesive strips placed outside construction site door				
F. Appropriate attire available for those who require it upon entering or exiting project area				
<b>Project Area</b>				
A. Covered bins available for moving tools, equipment and debris to and from site.				
B. HEPA filtered vacuums available for routine cleaning of site				
C. Seal all (except chute) windows closed.				
<b>Traffic Control</b>				
A. Path to and from site away from patients, visitors; assigned to construction workers				
B. Elevator assigned to construction workers				
C. New routes to areas for employees of hospital identified and plan communicated to all departments.				





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**SECTION 014100  
TESTING LABORATORY SERVICES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Testing laboratory services

1.02 SELECTION AND PAYMENT

- A. The Owner will employ and pay for services of an independent testing laboratory to perform specified inspection and testing indicated in technical specification sections.
- B. Employment of testing laboratory shall in no way relieve Contractor of obligation to perform work in accordance with requirements of Contract Documents.

1.03 LIMITS ON TESTING LABORATORY AUTHORITY

- A. The testing laboratory may not release, revoke, alter, or enlarge on requirements of the Contract Documents.
- B. The testing laboratory may not approve or accept any portion of the Work or assume any duties of the Contractor. The testing laboratory has no authority to stop the Work.

1.04 CONTRACTOR RESPONSIBILITIES

- A. Deliver to the testing laboratory at designated location, adequate samples of materials proposed to be used which require testing, along with proposed mix designs.
- B. Cooperate with testing laboratory personnel, and provide access to the Work and to the manufacturer's facilities.
- C. Provide incidental labor and facilities to provide access to Work to be tested, to obtain and handle samples at the site or at source of products to be tested, to facilitate tests and inspections, storage and curing of test samples.
- D. Notify the Architect and the testing laboratory 24 hours prior to expected time for operations requiring inspection and testing services.
- E. Employ services of a separate qualified testing laboratory and pay for additional samples and tests required by the Contractor beyond the specified requirements.

1.05 RETEST RESPONSIBILITY

- A. Where the results of required inspections, tests, or similar services prove unsatisfactory and do not indicate compliance with the requirements of the Contract Documents, the retests shall be the responsibility of the Contractor regardless of whether the original test was the Contractor's responsibility.
- B. Retesting of work revised or replaced by the Contractor is the Contractor's responsibility where required tests were performed on original work. Costs and fees for retesting shall be paid by the Contractor.

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**END OF SECTION**

## SECTION 015000

### TEMPORARY FACILITIES AND CONTROLS

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Temporary utilities.
- B. Temporary telecommunications services.
- C. Temporary sanitary facilities.
- D. Temporary Controls: Barriers, enclosures, and fencing.
- E. Security requirements.
- F. Vehicular access and parking.
- G. Waste removal facilities and services.
- H. Project identification sign.
- I. Field offices.

##### 1.02 RELATED REQUIREMENTS

- A. Section 015100 - Temporary Utilities.
- B. Section 017000 - Contract Closeout.

##### 1.03 TEMPORARY UTILITIES - See Section 015100

- A. Owner will provide the following:
  - 1. Electrical power and metering, consisting of connection to existing facilities.
  - 2. Water supply, consisting of connection to existing facilities.
- B. Existing facilities may not be used.
- C. New permanent facilities may be used.

##### 1.04 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office at time of project mobilization.
- B. Telecommunications services shall include:
  - 1. Windows-based personal computer dedicated to project telecommunications, with necessary software and laser printer.
  - 2. Telephone Land Lines: One line, minimum; one handset per line.
  - 3. Internet Connections: Minimum of one; DSL modem or faster.
  - 4. Facsimile Service: Minimum of one dedicated fax machine/printer, with dedicated phone line.

##### 1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities located at a location designated by the Owner is permitted.
- C. New permanent facilities located at P2A, P2CD and P6 may be used during construction operations.
- D. Maintain daily in clean and sanitary condition.
- E. At end of construction, return facilities to same or better condition as originally found.

### **1.06 BARRIERS**

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.
- C. Provide protection for plants designated to remain. Replace damaged plants.
- D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

### **1.07 FENCING**

- A. Construction: Commercial grade chain link fence.
- B. Provide 6 foot (1.8 m) high fence around construction site; equip with vehicular and pedestrian gates with locks.

### **1.08 EXTERIOR ENCLOSURES**

- A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
- B. Provide temporary roofing as specified in Section 075300.

### **1.09 INTERIOR ENCLOSURES**

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
  - 1. STC rating of 35 in accordance with ASTM E 90.
  - 2. Maximum flame spread rating of 75 in accordance with ASTM E 84.
- C. Paint surfaces exposed to view from Owner-occupied areas.

### **1.10 SECURITY**

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

### **1.11 VEHICULAR ACCESS AND PARKING**

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Designated existing on-site roads may be used for construction traffic.
- F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- G. Existing parking areas designated by Owner may be used for construction parking.

### **1.12 WASTE REMOVAL**

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

### **1.13 PROJECT IDENTIFICATION**

- A. Provide project identification sign of design and construction indicated on Drawings.
- B. Erect on site at location established by Owner.
- C. No other signs are allowed without Owner permission except those required by law.

### **1.14 FIELD OFFICES**

- A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack and drawing display table.
- B. The Owner will provide space for Project meetings, with table and chairs to accommodate 12 persons.

### **1.15 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS**

- A. Remove temporary utilities, equipment, facilities, materials, prior to Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.
- D. Restore new permanent facilities used during construction to specified condition.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

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## **SECTION 015100**

### **TEMPORARY UTILITIES**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 015000 - Temporary Facilities and Controls:
  - 1. Temporary telecommunications services for administrative purposes.
  - 2. Temporary sanitary facilities required by law.

##### **1.03 TEMPORARY ELECTRICITY**

- A. Cost: By Owner.
- B. Connect to Owner's existing power service.
  - 1. Do not disrupt Owner's need for continuous service.
  - 2. Exercise measures to conserve energy.
- C. Provide temporary electric feeder from existing building electrical service at location as directed.
- D. Power Service Characteristics: 120 volt, 60 ampere, three phase, four wire.
- E. Complement existing power service capacity and characteristics as required.
- F. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- G. Provide main service disconnect and over-current protection at convenient location and meter.
- H. Permanent convenience receptacles may be utilized during construction.
- I. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

##### **1.04 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES**

- A. Provide and maintain incandescent lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft (21 watt/sq m).
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.

##### **1.05 TEMPORARY HEATING**

- A. Cost of Energy: By Owner.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Existing facilities shall not be used.
- E. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

### **1.06 TEMPORARY COOLING**

- A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- B. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

### **1.07 TEMPORARY VENTILATION**

- A. Ventilate enclosed areas to assist curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors or gases.
- B. Existing ventilation equipment may not be used.

### **1.08 TEMPORARY WATER SERVICE**

- A. Cost of Water Used: By Owner.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.
  - 1. Exercise measures to conserve water.
- D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

### **PART 2 PRODUCTS - NOT USED**

### **PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 016300  
POST-BID SUBSTITUTIONS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Post-bid substitutions

1.02 SUBSTITUTIONS

- A. Base Bid shall be in accordance with the Contract Documents.
- B. After the end of the bidding period, substitution requests will be considered by the Architect only in case of:
  - 1. Product unavailability
  - 2. Other conditions beyond the control of the Contractor.
- C. Submit a separate request for each substitution. Support each request with complete data substantiating compliance of proposed substitution with requirements stated in Contract Documents:
  - 1. Product identification, including manufacturer's name and address.
  - 2. Manufacturer's literature, identifying:
    - a. Product description.
    - b. Reference standards.
    - c. Performance and test data.
    - d. Warranty information for specified and alternate items.
  - 3. Samples, as applicable.
  - 4. Name and address of similar projects on which product has been used and date of each installation.
  - 5. Itemized comparison of the proposed substitution with product specified, listing significant variations.
  - 6. Data relating to changes in construction schedule.
  - 7. Effects of substitution on separate contracts.
  - 8. List of changes required in other work or products.
  - 9. Accurate cost data comparing proposed substitution with product specified, including amount of net change to the Contract Sum.
  - 10. Designation of required license fees or royalties.
  - 11. Designation of availability of maintenance services, sources of replacement materials.
- D. Substitutions will not be considered for acceptance when:
  - 1. A substitution is indicated or implied on shop drawings or product data submittals without a formal request from the Contractor.
  - 2. Acceptance will require substantial revision of Contract Documents.
  - 3. In the judgement of the Architect, the substitution request does not include adequate information necessary for a complete evaluation.
  - 4. Requested directly by a subcontractor or supplier.
- E. Do not order or install substitute products without written acceptance of the Architect.
- F. The Architect will determine acceptability of proposed substitutions.
- G. No verbal or written approvals other than by Change Order will be valid.

### 1.03 CONTRACTOR'S REPRESENTATION

- A. In making formal request for substitution the Contractor represents that:
  - 1. The proposed product has been investigated and it has been determined that it is equivalent to or superior in all respects to the product specified.
  - 2. The same warranties or bonds will be provided for the substitute product as for the product specified.
  - 3. Coordination and installation of the accepted substitution into the Work will be accomplished and changes as may be required for the Work to be complete will be accomplished.
  - 4. Claims for additional costs caused by substitution which may subsequently become apparent will be waived by the Contractor.
  - 5. Complete cost data is attached and includes related costs under the Contract, but does not include:
    - a. Costs under separate contracts.
    - b. The Architect's costs for redesign or revision of the Contract Documents.

### 1.04 POST-BID SUBSTITUTION REQUEST FORM

- A. The form is attached to this Section.
- B. Substitutions will be considered only when the attached form is completed and included with the submittal with back-up data.

TO: Beth Schidzig, Project Architect

We hereby submit for your consideration the following product instead of the specified item:

DRAWING NO. \_\_\_\_\_ DRAWING NAME \_\_\_\_\_

SPEC. SECT.	SPEC NAME	PARAGRAPH	SPECIFIED ITEM
_____	_____	_____	_____

Proposed Substitution: \_\_\_\_\_

Attach complete information on changes to Drawings and/or Specifications which proposed substitution will require for its proper installation.

Submit with request necessary samples and substantiating data to prove equal quality and performance to that which is specified. Clearly mark manufacturer's literature to indicate equality in performance.

The undersigned certifies that the function, appearance and quality are of equal performance and assumes liability for equal performance, equal design and compatibility with adjacent materials.

Submitted By:

\_\_\_\_\_  
Signature (Contractor) Title

\_\_\_\_\_  
Name

\_\_\_\_\_  
Firm

\_\_\_\_\_  
Address

\_\_\_\_\_  
Telephone Date

Signature shall be by person having authority to legally bind the Contractor to the above terms. Failure to provide legally binding signature will result in retraction of approval.

For use by the Architect

Recommended  Recommended as noted

Not Recommended

Insufficient data received

by \_\_\_\_\_ date \_\_\_\_\_

For use by the Owner

Approved  Approved as noted

Not Approved

Insufficient data received

by \_\_\_\_\_ date \_\_\_\_\_

Fill in blanks below:

- A. Does the substitution affect dimensions indicated on the Drawings?  
Yes \_\_\_\_ No \_\_\_\_ If yes, clearly indicate changes.

\_\_\_\_\_

- B. Will the undersigned pay for changes to the building design, including engineering and detailing costs caused by the requested substitution?

Yes \_\_\_\_ No \_\_\_\_ If no, fully explain: \_\_\_\_\_

\_\_\_\_\_

- C. What effect does the substitution have on other Contracts or other trades?

\_\_\_\_\_

- D. What effect does the substitution have on construction schedule?

\_\_\_\_\_

- E. Manufacturer's warranties of the proposed and specified items are:

Same \_\_\_\_ Different \_\_\_\_ Explain: \_\_\_\_\_

\_\_\_\_\_

- F. Reason for Request:

\_\_\_\_\_

- G. Itemized comparison of specified item(s) with the proposed substitution; list significant variations:

\_\_\_\_\_

\_\_\_\_\_

- H. This substitution will amount to a credit or extra cost to the Owner of:

\_\_\_\_\_

- I. Designation of maintenance services and sources:

\_\_\_\_\_

(Attach additional sheets if required.)

**END OF SECTION**

**SECTION 017000  
CONTRACT CLOSEOUT**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Closeout procedures.
- B. Adjusting.

1.02 PROJECT TERMINATION

- A. Contract requirements are met when construction activities have successfully produced, in this order, these three terminal activities:
  - 1. Substantial Completion
  - 2. Final Completion
  - 3. Final Payment

1.03 SUBSTANTIAL COMPLETION

- A. Submit to the Architect when the Work is substantially complete:
  - 1. A written notice that the Work, or designated portion thereof, is substantially complete.
  - 2. A list of items to be completed or corrected (Punch List).
  - 3. Request Substantial Completion observation at a mutually agreeable date.
  - 4. Certifications of systems and testing/balancing final reports.
  - 5. Submit evidence of compliance with requirements of governing authorities:
    - a. Certificate of Occupancy
    - b. Certificates of Inspection:
      - 1) Mechanical systems
      - 2) Electrical systems
- B. Within a reasonable time after receipt of such notice, the Architect, the Contractor, and at his option, the Owner, will make an observation to determine the status of completion.
- C. Should the Architect determine that the Work is not substantially complete the following will occur:
  - 1. The Architect will promptly notify the Contractor in writing, giving the reasons.
  - 2. The Contractor shall remedy the deficiencies in the Work, and send a second written notice of substantial completion to the Architect.
  - 3. The Architect will observe the Work again.
- D. When the Architect concurs that the work is substantially complete, the following will occur:
  - 1. The Architect will prepare a Certificate of Substantial Completion on AIA Form G704, accompanied by the Contractor's Punch List of items to be completed or corrected, as verified and amended by the Architect. Contract responsibilities are not altered by inclusion or omission of required work from the Punch List.
  - 2. The Architect will submit the Certificate to the Owner and the Contractor for their written acceptance of the responsibilities assigned to them in the Certificate.
- E. Complete or correct items identified on the Punch List and required by the Contract requirements within time limit established by the Certificate.

#### 1.04 FINAL COMPLETION

- A. To attain final completion, the Contractor shall complete activities pertaining to Substantial Completion, complete work on punch list items and submit written request to the Architect for Final Inspection.
- B. When the Work is complete, the Contractor shall submit written certification that:
  - 1. Contract Documents have been reviewed.
  - 2. Work has been inspected for compliance with Contract Documents.
  - 3. Work has been completed in accordance with Contract Documents.
  - 4. Equipment and systems have been tested in the presence of the Owner's representative and are operational.
  - 5. Work is completed and ready for final observation.
- C. The Architect, the Contractor and the Owner will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.
- D. Should the Architect consider that the Work is incomplete or defective:
  - 1. The Architect will promptly notify the Contractor in writing, listing the incomplete or defective work.
  - 2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to the Architect that the Work is Complete.
  - 3. The Architect will inspect the Work again.
- E. When the work is acceptable under the Contract Documents as determined by the Architect, the Architect will request the Contractor to make closeout submittals.

#### 1.05 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ARCHITECT

- A. Project Record Documents: To requirements of Section 01720.
- B. Operating and Maintenance Data, Instructions to Owner's Personnel: To requirements of Section 01730.
- C. Warranties and Bonds: To requirements of section 01740
- D. Keys and Keying Schedule: To requirements of Section 08710.
- E. Spare Parts and Maintenance Materials: To requirements of individual sections.
- F. Evidence of Payment and Release of Liens: To requirements of General and Supplementary Conditions.

#### 1.06 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to the Architect.
- B. Statement shall reflect adjustments to the Contract Sum:
  - 1. The original Contract Sum
  - 2. Additions and deductions resulting from:
    - a. Previous Change Orders
    - b. Deductions for uncorrected Work



- c. Deductions for reinspection payments
    - d. Other adjustments
  - 3. Total Contract Sum, as adjusted
  - 4. Previous payments
  - 5. Sum remaining due
  
- C. The Architect will prepare a final Change Order, reflecting adjustments the Contract Sum which were not previously made by Change Orders.

1.07 FINAL APPLICATION FOR PAYMENT

- A. The Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

**END OF SECTION**

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**SECTION 017100  
FINAL CLEANING**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Cleaning at completion of the Work.

1.02 DISPOSAL REQUIREMENTS

- A. Conduct cleaning and disposal operations to comply with codes, ordinances, regulations, and anti-pollution laws.
  - 1. Do not burn or bury rubbish and waste materials on project site.
  - 2. Do not dispose of volatile wastes such as mineral spirits, oil or paint thinner in storm or sanitary drains.

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

**PART 3 - EXECUTION**

3.01 FINAL CLEANING

- A. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from sight-exposed interior and exterior surfaces.
- B. Wash and polish glass and mirrors.
- C. Dust cabinetwork and remove markings.
- D. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- E. Prior to final completion, or Owner occupancy, conduct an inspection of sight-exposed interior surfaces, exterior surfaces and work areas, to verify that the entire Work is clean.
- F. Internally clean the entire system of piping and equipment. Open dirt pockets and strainers, completely blowing down as required and clean strainer screens of accumulated debris.
- G. Drain tanks, fixtures and pumps to be free of sludge and accumulated matter.
- H. Remove temporary labels and stickers from fixtures and equipment. Do not remove permanent name plates, equipment model numbers and ratings.
- I. Thoroughly clean heating and air conditioning equipment, tanks, pumps and traps. Install final filters or filter media.

**END OF SECTION**

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**SECTION 017200  
PROJECT RECORD DOCUMENTS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. The Contractor shall maintain at the job site one copy of:
  - 1. Record Contract Drawings
  - 2. Record Project Manual
  - 3. Coordination drawings
  - 4. Addenda
  - 5. Reviewed Shop Drawings
  - 6. Change Orders
  - 7. Other modifications to Contract
  - 8. Field test records

1.02 GENERAL

- A. Store documents in a fire resistant location in temporary field office, apart from documents used for construction.
- B. Maintain documents in clean, dry, legible condition.
- C. Do not use project record documents for construction purposes.
- D. Make documents available for inspection by Architect and Owner.
- E. Failure to maintain documents up-to-date will be cause for withholding payments.
- F. Obtain from the Architect (at no charge) one set of Contract Documents for project record documents including:
  - 1. Project Manual with all addenda.
  - 2. One complete set of black line prints of all Drawings. Mark record sets with erasable red pencil, and where feasible, use other colors to distinguish between variations in separate categories of work.

1.03 RECORDING

- A. Label each document "Project Record".
- B. Keep record documents current.
- C. Do not permanently conceal any work until required information has been recorded.
- D. Contract Drawings:
  - 1. Required information may, as an option, be entered on a "working set" and then at completion of project transfer the information to final submitted "Project Record" set.
  - 2. Legibly mark to record actual construction:
    - a. Depths of various elements of foundation in relation to survey data.
    - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
    - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

- d. Field changes of dimension and detail.
  - e. Changes made by Change Order or Field Order.
  - f. Details not on original Contract Drawings.
- E. Project Manual and Addenda:
1. Legibly mark up each section to record:
    - a. Manufacturer, trade name, catalog number and Supplier of each product and item of equipment actually installed.
    - b. Changes made by Change Order or Field Order.
    - c. Other items not originally specified.
- F. Conversion of Schematic Layouts:
1. Arrangement of conduits, circuits, piping, ducts and similar items are in most cases shown schematically on the Drawings.
  2. Legibly mark to record actual construction:
    - a. Dimensions accurate to within 1" of the centerline of items shown schematically.
    - b. Identify each item, for example, "cast iron drain" "galvanized water".
    - c. Identify location of each item, for example, "under slab", "in ceiling plenum", "exposed".
  3. The Architect may waive requirements of schematic layout conversion, when in his opinion, it serves no beneficial purpose. Do not, however, rely on waivers being issued except specifically issued by the Architect in writing.

#### 1.04 SUBMITTAL

- A. At completion of project, deliver Project Record Documents to the Architect prior to request for final payment.
- B. Accompany submittal with transmittal letter, in duplicate, containing:
1. Date
  2. Project title project number
  3. The Contractor's name and address
  4. Title and number of each record document
  5. Certification that each document as submitted is complete and accurate.
  6. Signature of the Contractor, or his authorized representative.

**END OF SECTION**

**SECTION 017300  
OPERATION AND MAINTENANCE DATA**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Format and content of manuals.
- B. Instruction of the Owner's personnel.
- C. Schedule of submittals.

1.02 QUALITY ASSURANCE

- A. Prepare instructions and data by personnel experienced in maintenance and operation of described products.

1.03 FORMAT

- A. Prepare data in the form of an instructional manual.
- B. Binders: Commercial quality, 8-1/2" x 11" three-ring binders with hardback, cleanable, plastic covers; 1-1/2" maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- C. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; list title of Project and separate building; identify subject matter of contents.
- D. Arrange content by systems under section numbers and sequence of Table of Contents of this Project Manual.
- E. Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- F. Text: manufacturer's printed data, or typewritten data on 20 pound paper.
- G. Drawings: provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

1.04 CONTENTS, EACH VOLUME

- A. Table of contents: provide title of Project; names, addresses, and telephone numbers of the Architect, consultants, and Contractor with name of responsible parties; schedule of products and systems, indexed to content of the volume.
- B. For each product or system: list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- C. Product data: mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- D. Drawings: supplement product data to illustrate relations of component parts of equipment and

systems, to indicate control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

- E. Type text: as required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.
- F. Warranties and bonds: Bind in copy of each.

#### 1.05 MANUAL FOR MATERIALS AND FINISHES

- A. Building products, applied materials, and finishes: include product data, with catalog number, size, composition, and color and texture designations. Provide information for re-ordering custom manufactured products.
- B. Instructions for care and maintenance: include the manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather exposed products: include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional requirements: as specified in individual product specification Sections.

#### 1.06 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Each item of equipment and each system: include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- B. Panelboard circuit directories: provide electrical service characteristics, controls and communications.
- C. Include color coded wiring diagrams as installed.
- D. Operating procedures: include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.
- E. Maintenance requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- F. Provide servicing and lubrication schedule, and list of lubricants required.
- G. Include manufacturer's printed operation and maintenance instructions.
- H. Include sequence of operation by controls manufacturer.
- I. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- J. Provide control diagrams by controls manufacturer as installed.



- K. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- L. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- M. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- N. Include test and balancing reports.
- O. Additional requirements: as specified in individual product specification Sections.
- P. Provide a listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.
- Q. Maintenance agreements and similar continuing agreements.

#### 1.07 INSTRUCTION OF OWNER PERSONNEL

- A. Before final inspection, instruct the Owner's designated personnel in operation, adjustment, and maintenance of products, equipment, and systems, at agreed upon times.
- B. For equipment requiring seasonal operation, perform instructions for other seasons within six months.
- C. Use operation and maintenance manuals as basis for instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- D. Prepare and insert additional data in Operation and Maintenance Manual when need for such data becomes apparent during instruction.

#### 1.08 SUBMITTALS

- A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. The Architect will review draft and return one copy with comments.
- B. For equipment, or component parts of equipment put into service during construction and operated by the Owner, submit documents within ten days after acceptance.
- C. Submit one copy of completed volumes in final form 15 days prior to final inspection. Copy will be returned after final inspection, with Architect comments. Revise content of documents prior to final submittal.
- D. Submit two copies of revised volumes of data in final form within ten days after final inspection.

**END OF SECTION**

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**SECTION 017400  
WARRANTIES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Preparation and submittal of warranties.

1.02 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

1.03 WARRANTY REQUIREMENTS

- A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other Work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.
- B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective Work regardless of whether the Owner has benefitted from use of the Work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
  - 1. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.
- E. The Owner reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

1.04 SUBMITTALS

- A. Submit written warranties to the Architect prior to the date certified for Substantial Completion. If the Architect's Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the Work, or a designated portion of the Work, submit written warranties upon request of the Architect.
  - 1. When a designated portion of the Work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Architect within fifteen days of completion of that designated portion of the Work.

- B. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner through the Architect for approval prior to final execution.
- C. Forms for special warranties are included at the end of this Section. Prepare a written document utilizing the appropriate form, ready for execution by the Contractor, or the Contractor and subcontractor, supplier or manufacturer. Submit a draft to the Owner through the Architect for approval prior to final execution.
  - 1. Refer to individual Sections of Divisions-2 through -16 for specific content requirements, and particular requirements for submittal of special warranties.

#### 1.05 FORM OF SUBMITTALS

- A. Form of Submittal: At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- B. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2" by 11" paper.
  - 1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.
  - 2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS, the Project title or name, and the name of the Contractor.
  - 3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.
- C. Label cover of each binder with typed or printed title WARRANTIES, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible principal.
- D. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification Section in which specified, and the name of the product or work item.

#### 1.06 PREPARATION OF SUBMITTALS

- A. Obtain warranties, executed in duplicate by responsible manufacturers, within ten days after completion of the applicable item or work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until the Date of Substantial Completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Retain warranties until time specified for submittal.

#### 1.07 TIME OF SUBMITTALS

- A. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.

- B. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
- C. For items of Work when acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing the date of acceptance as the beginning of the warranty period.

**END OF SECTION**

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**SECTION 017500  
STARTING OF SYSTEMS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Starting systems.
- B. Demonstration and instructions.
- C. Testing, adjusting, and balancing.

1.02 STARTING SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify the Architect seven days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or other conditions which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of responsible Contractors' personnel in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

**END OF SECTION**

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## **SECTION 024100**

### **DEMOLITION**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of building elements for alterations purposes.
- C. Abandonment and removal of existing utilities and utility structures.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 011000 - Summary: Limitations on Contractor's use of site and premises.
- B. Section 011000 - Summary: Sequencing and staging requirements.
- C. Section 011000 - Summary: Description of items to be removed by Owner.
- D. Section 011000 - Summary: Description of items to be salvaged or removed for re-use by Contractor.
- E. Section 015000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- F. Section 016000 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- G. Section 017000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

##### **1.03 REFERENCE STANDARDS**

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2004.

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

#### **PART 2 PRODUCTS**

**Not Used**

#### **PART 3 EXECUTION**

##### **3.01 SCOPE**

- A. Demolish existing partitions and structure as detailed in the Construction Documents. Renovate temporary spaces in P2A and P2CD for relocation of P6 Patients during construction of Pavilion 6. Refurbish temporary spaces after P6 patients are back in their unit.

### 3.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Comply with applicable requirements of NFPA 241.
  - 3. Use of explosives is not permitted.
  - 4. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
  - 5. Provide, erect, and maintain temporary barriers and security devices.
  - 6. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 7. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 8. Do not close or obstruct roadways or sidewalks without permit.
  - 9. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
- B. Do not begin removal until receipt of notification to proceed from Owner.
- C. Do not begin removal until built elements to be salvaged or relocated have been removed.
- D. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.
  - 3. Stop work immediately if adjacent structures appear to be in danger.
- E. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- F. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- G. Perform demolition in a manner that maximizes salvage and recycling of materials.
  - 1. Comply with requirements of Section 017419 - Waste Management.
  - 2. Dismantle existing construction and separate materials.
  - 3. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

### 3.03 EXISTING UTILITIES

- A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
- B. Protect existing utilities to remain from damage.
- C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.
- G. Prepare building demolition areas by disconnecting and capping utilities outside the demolition

zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

### **3.04 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as shown.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 015000 in locations indicated on drawings and other locations as determined during construction.
- C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
- D. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
  - 2. Remove items indicated on drawings.
- E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.
  - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
  - 2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
  - 3. Verify that abandoned services serve only abandoned facilities before removal.
  - 4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- F. Protect existing work to remain.
  - 1. Prevent movement of structure; provide shoring and bracing if necessary.
  - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  - 3. Repair adjacent construction and finishes damaged during removal work.
  - 4. Patch as specified for patching new work.

### **3.05 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; do not burn or bury.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

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**SECTION 035400  
LEVELING UNDERLAYMENT CONCRETE**

**PART I – GENERAL**

1.01 SUMMARY

- A. Furnish and install self-Leveling underlayment concrete for use over interior substrates.

1.02 SECTION INCLUDES

- A. ARDEX K-15 Self-Leveling Underlayment Concrete
- B. ARDEX P-51 Primer

1.03 QUALITY ASSURANCE

- A. Installation of concrete underlayment shall be by an applicator using mixing equipment and tools approved by the manufacturer.
- B. Underlayment shall be able to be installed from 1/8" to 1 1/2" in one pour and up to 5" with the addition of aggregate. It may also be feathered to match existing elevations.
- C. Underlayment to be applied to a minimum thickness of 1/8" over highest point in the subfloor, with an average typical thickness of 1/4".
- D. Underlayment compressive strength shall be 4100 psi after 28 days per ASTM C109/mod (air cure only).
- E. Underlayment shall be walkable after 2 hours and allow floor covering to be installed after 16 hours at 70°F.
- F. Manufacturer's certification that the product is Portland cement-based having an inorganic binder content which is a minimum 100% Portland cement when tested per ASTM C150: Standard Specification for Portland Cement.

1.04 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in their unopened packages and protect from extreme temperatures and moisture. Protect liquids from freezing.

1.05 SITE CONDITIONS

- A. Concrete Underlayment is a cementitious material. Observe the basic rules of concrete work. Do not install below 50°F surface temperature. Install quickly if floor is warm and follow hot weather precautions available from the manufacturer Technical Service Department. Never mix with cement or additives other than manufacturer's-approved products.

## **PART 2 – PRODUCTS**

### **2.01 MATERIALS**

- A. The cement-based self-leveling underlayment: ARDEX K-15 Self-Leveling Underlayment Concrete.
- B. Primer for standard absorbent concrete shall be ARDEX P-51 Primer.
- C. Aggregate shall be well graded, washed gravel (1/8" to 1/4" or larger) for use when underlayment is installed over 1 1/2" thick.
- D. Water shall be clean, potable, and sufficiently cool (not warmer than 70°F).

### **2.02 MIX DESIGNS**

A. Standard mixing ratio: ARDEX K-15 is mixed in 2-bag batches at one time. Mix each bag of ARDEX K-15 (55 lb.) with 7 quarts of water. Product shall be mixed in an ARDEX T-10 Mixing Drum using an ARDEX T-1 Mixing Paddle and a 1/2" heavy-duty drill (min. 650 rpm). Mix thoroughly for approximately 2-3 minutes to obtain a lump-free mixture. Follow written instructions per the ARDEX K-15 bag label.

B. Resilient mix for applications over cutback and non-water soluble adhesive residues, wood, and metal: Use 6 qt. of water and 2 qt. of ARDEX E-25 Resilient Emulsion for each bag of ARDEX K-15.

C. Aggregate mix: For areas to be installed over 1 1/2" thick, aggregate may be added to reduce material costs. Mix ARDEX K-15 with water first, then add from 1/3 up to 1 part by volume of aggregate (1/8" to 1/4" or larger). Do not use sand.

D. For pump installations, ARDEX K-15 shall be mixed using the ARDEX Levelcraft Automatic Mixing Pump. Start the pump at 210 gallons of water per hour, and then adjust to the minimum water reading that still allows self-leveling properties. **DO NOT OVERWATER!** Check the consistency of the product on the floor to ensure a uniform distribution of the sand aggregate at both the top surface and bottom of the pour. If settling is occurring, reduce the water amount and recheck. Conditions during the installation, such as variations in water, powder, substrate, and ambient temperature, require that the water setting be monitored and adjusted carefully to avoid overwatering.

## **PART 3 – EXECUTION**

### **3.01 PREPARATION**

A. All subfloors must be sound, solid, cleaned, and primed:

1. All concrete subfloors must be of adequate strength, clean, and free of all oil, grease, dirt, curing compounds and any substance that might act as a bondbreaker before priming. Mechanically clean if necessary using shot blasting or other. Acid etching and the use of sweeping compounds and solvents are not acceptable.

2. Wooden subfloors must be clean and free of all foreign matter. Sand to bare wood then vacuum to remove all dust. Re-nail any loose boards exhibiting movement.

3. Metal subfloors must be clean and free of all rust and foreign matter. Where

required, a corrosive resistant coating should be applied and allowed to dry before priming.

4. Cutback and other non-water soluble adhesive residues must be wet scraped to a thin, well-bonded layer.
5. Non-porous subfloors such as ceramic and quarry tile as well as terrazzo should be clean and free of all waxes and sealers. If necessary, have the surface professionally cleaned.
6. All cracks in the subfloor shall be repaired to minimize telegraphing through the underlayment.
7. Substrates shall be inspected and corrected for moisture or any other conditions that could affect the performance of the underlayment or the finished floor covering.

#### B. JOINT PREPARATION

1. Moving Joints – honor all expansion and isolation joints up through the underlayment.
2. Saw Cuts and Control Joints – fill all non-moving joints with ARDEX SD-F Feather Finish or ARDEX SD-P InstantPatch as required.

#### C. PRIMING

1. Primer for standard absorbent concrete subfloors: Mix ARDEX P-51 1:1 with water and apply evenly with a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, thin film (min. 3 hours, max. 24 hours). Underlayment shall not be applied until the primer is dry. Primer coverage is approximately 400 to 600 sq. ft. per gallon.
2. Primer for extremely absorbent concrete subfloors: Make an initial application of ARDEX P-51 mixed with 3 parts water using a soft push broom. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry thoroughly before proceeding with the standard application of primer as described above for standard absorbent concrete.
3. Primer for non-porous subfloors, wooden or metal subfloors, or cutback and other nonwater soluble adhesive residues over concrete: Prime with ARDEX P-82 Ultra Prime. Mix Part A (red) with Part B (white) and apply with a short-nap or sponge paint roller, leaving a thin coat of primer no heavier than a thin coat of paint. Do not leave any bare spots. Remove all puddles and excess primer. Allow to dry to a clear, slightly tack film (minimum 3 hours, maximum 24 hours). Underlayment shall not be installed until primer is dry. Primer coverage is approximately 200 to 400 square feet per gallon.
4. Minimum drying time for ARDEX P-82 Ultra-Prime over cutback adhesive is 18 hours.

### 3.02 APPLICATION OF UNDERLAYMENT

#### A. INSTALLATION

1. Wooden subfloors require the use of the mesh-reinforced ARDEX K-15 + E-25 Underlayment System. After priming, install 3.4 galvanized diamond metal lath by stapling to the wooden subfloor approximately every 6 inches on center.

2. Steel subfloors require that the substrate first be primed with an anti-corrosive paint. After thorough drying of the paint, prime this surface with ARDEX P-82 Ultra Prime.

3. Pour or pump the liquid ARDEX K-15 and spread in place with the ARDEX T-4 Spreader. Use the ARDEX T-5 Smoother for featheredge and touch-up. Wear baseball shoes with non-metallic cleats to avoid leaving marks in the liquid ARDEX K-15. Underlayment can be walked on in 2-3 hours at 70° F.

### 3.03 PREPARATION FOR FLOORING INSTALLATION

A. Underlayment can accept finish floor covering materials after 16 hours at 70°F and 50% relative humidity.

B. Due to the wide range of adhesives that are used to install floor coverings, some adhesives may dry more quickly over Ardex underlayments than over other substrates. If this condition occurs, priming the surface of the underlayment with ARDEX P-51 Primer diluted 1:3 with water will even out the drying of the adhesive. Allow the primer to dry 1-3 hours before proceeding with the adhesive installation.

### 3.04 FIELD QUALITY CONTROL

A. Where specified, field sampling of the Ardex underlayment is to be done by taking an entire unopened bag of the product being installed to an independent testing facility to perform compressive strength testing in accordance with ASTM C 109/modified: air-cure only. There are no in situ test procedures for the evaluation of compressive strength.

### 3.05 PROTECTION

A. Prior to the installation of the finish flooring, the surface of the underlayment should be protected from abuse by other trades by the use of plywood, Masonite or other suitable protection course.

**END OF SECTION**



SECTION 05 12 00 – STRUCTURAL STEEL

**PART 1 GENERAL**

1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK:

- A. Extent of structural steel work is shown on drawings, including schedules, notes and details to show size and location of members, typical connections, and type of steel required.
- B. Structural steel is that work defined in AISC "Code of Standard Practice" and as otherwise shown on drawings.

1.03 RELATED WORK

- 1. Section 05 30 00 – Metal Deck
- 2. Section 05 50 00 - Metal Fabrications

1.04 QUALITY ASSURANCE:

- A. Codes and Standards: Comply with latest provisions of the following, except as otherwise indicated:
  - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges", Latest Edition. Exclude the word "structural" in reference to the "Design Drawings" in section 3.1 of the Code.
  - 2. AISC "Specification for Structural Steel Buildings", including "Commentary" and Supplements issued thereto.
  - 3. AISC "*Specifications for Structural Joints using ASTM A 325 or A 490 Bolts*" approved by the Research Council on Structural Connections of the Engineering Foundation.
  - 4. AISC 341, "Seismic Provisions for Steel Buildings".
  - 5. AWS D1.1 - "Structural Welding Code" - Steel.
  - 6. AWS D1.3 - "Structural Welding Code" - Sheet Steel.

7. ASTM A6 "General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use."
  8. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Qualifications for Welding Work: Qualify welding processes and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."
1. Provide certification that welders to be employed in work have satisfactorily passed AWS D1.1 qualification tests and maintained a current certification. Current certification and/or continuity log shall be submitted and be available in the field.
  2. If re-certification of welders is required, retesting will be the Contractor's responsibility.
- C. Fabricator Qualifications: Fabricator must be a member of the American Institute of Steel Construction (AISC), be certified for SBD – Conventional Steel Building Structures, STD – Standard for Steel Building Structures. Fabricator shall be certified at time of bidding and for duration of project.

#### 1.05 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. INCOMPLETE SUBMITTALS WILL NOT BE REVIEWED.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Product Data: Submit producer's or manufacturer's specifications and installation instructions for the following products. Include laboratory test reports and other data to show compliance with specifications (including specified standards).
  1. Structural steel certified mill reports for each grade of steel covering chemical and physical properties and yield strengths.

2. High-strength bolts (each type), including nuts and washers.
  3. AWS D1.1 Welder certifications.
  4. Expansion/Adhesive Anchors
- H. Fabricator's Quality Control Procedures: Fabricator shall submit their written procedural and quality control manuals, and evidence of periodic auditing of fabrication practices by an approved inspection Agency.
- I. Fabricator's Certificate of Compliance: At completion of fabrication, fabricator shall submit a certificate of compliance stating that the work was performed in accordance with the construction documents.
- J. Shop Drawings:
1. Shop Drawing Review: Electronic files of structural drawings will not be provided to the contractor for preparation of shop drawings. Reproduction of any portion of the Construction Documents for use as Shop drawings and/or Erection Drawings is prohibited. Shop drawings and/or Erection drawings created from reproduced Construction Documents will be returned without review.
    - a. Review of the shop drawings will be made for the size and arrangement of the members and strength of the connections. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. **Submit three prints. Prints will be reviewed by the Engineer, and then the Architect. One marked print will be returned to Contractor for printing and distribution. Multiple copies will not be marked by the Engineer.**
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings indicating all members, braced frames, moment frames and connections. Incomplete submittals will not be reviewed.
  2. Alternate Connection Design: Connections for all beam, column, braced frame, and moment connections not tabulated in the AISC "Manual of Steel Construction" (ASD or LRFD) have been designed and detailed in the drawings. Alternate connection design shall be allowed only with prior approval of the Structural Engineer. If such approval is granted, all redesigned connections shall be designed by the fabricator's engineer, registered in the State of Maine. Calculations for redesigned connections shall be signed and sealed.
  3. Test Reports: Submit copies of reports of tests conducted on shop and field bolted and welded connections. Include data on type(s) of test conducted and test results.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place, in ample time to not delay work.
- C. Store materials to permit easy access for inspection and identification. Keep steel members off ground, using pallets, platforms, or other supports. Protect steel members and packaged materials from corrosion and deterioration.
- D. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Steel materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

## **PART 2 PRODUCTS**

### **2.01 MATERIALS:**

- A. Structural Steel Shapes, Plates and Bars (U.N.O): ASTM A 36 minimum, higher strength steel is acceptable.
- B. Structural Steel Hot Rolled Wide Flange Shapes: ASTM A 992 Grade 50 (ASTM A572 Grade 50 with special requirements per AISC Technical Bulletin #3, dated March 1997)
- C. Steel Tube: ASTM A 500, Grade B,  $F_y = 46$  ksi.
- D. Unfinished Threaded Fasteners: ASTM A 307, Grade A, regular low-carbon steel bolts and nuts. Provide hexagonal heads and nuts for all connections.
- E. High-Strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, as follows:
  - 1. Quenched and tempered medium-carbon steel bolts, nuts and washers, complying with ASTM A325 or ASTM A490. Refer to drawings for diameter.
  - 2. Direct tension indicator washers or bolts may be used at Contractor's option.
- F. Electrodes for Welding:
  - 1. Minimum 70 ksi electrodes. Filler material shall meet the grouping requirements per AWS D1.1 Table 3.1 for matching strength of connected materials.
  - 2. All filler metal used welding shall meet the following Charpy V-Notch (CVN) requirements.
    - a. 20 ft-lb at 0 degrees Fahrenheit unless noted otherwise.
    - b. 20 ft-lb at -20 degrees Fahrenheit and 40 ft-lb at 70 degrees Fahrenheit at all complete joint penetration (CJP) groove welds.
- G. Non Shrink Cement-Based Grout: See Section 03300

- H. Drilled Anchors: Unless noted otherwise, Hilti HIT HY150 Max Adhesive; use Hilti HAS rods for threaded rod material unless noted otherwise.

## 2.02 FABRICATION:

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings.
  - 1. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
  - 2. Where finishing is required, complete assembly, including welding of units, before start of finishing operations. Provide finish surfaces of members exposed in final structure free of markings, burrs and other defects.
- B. Connections: Weld or bolt shop connections, as indicated.
  - 1. Provide field bolted connections, except where welded connections or other connections are indicated.
  - 2. Provide high-strength threaded fasteners for principal bolted connections, except where unfinished bolts are indicated.
- C. High-Strength Bolted Connection: Install high-strength threaded fasteners in accordance with AISC "Specification for Structural Joints using ASTM A 325 or A 490 Bolts". Unless otherwise indicated, all bolted connections are to be tightened to the snug tight condition as defined by AISC.
- D. Welded Construction: Comply with AWS Codes for procedures, appearance and quality of welds, and methods used in correcting welding work.
- E. Holes for Other Work: Provide holes required for securing other work to structural steel framing, and for passage of other work through steel framing members, as shown on final shop drawings.
- F. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame cut holes or enlarge holes by burning. Drill holes in bearing plates.
- G. Weld Access Holes at Moment Connections: Detailing and Fabrication of welded access holes for all welded moment connections shall meet the requirements of FEMA 350, "Recommended Seismic Design Criteria for New Steel Moment-Frame Buildings". This document is available at [www.fema.gov](http://www.fema.gov).
- H. Fabricator, Erector and General Contractor shall coordinate safety requirements for the project, in accordance with OSHA Part 1926. Provide all necessary pieces and fabrications as required to safely erect and access the structure for the duration of project construction.
- I. Camber, if any, is indicated on the drawings. Camber indicated is the required camber at time of erection. Contractor shall survey camber prior to placing metal deck.

## 2.03 STRUCTURAL STEEL COATINGS

- A. Coordinate coating requirements with the Architect, and with Division 9 of the specifications.
- B. Shop priming nor painting of structural steel is not required for this project unless noted otherwise.

## PART 3 EXECUTION

### 3.01 ERECTION:

- A. General: Comply with AISC Specifications for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
- B. Erection Procedures: Comply with "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- C. Surveys: Employ a Registered Land Surveyor to verify elevations of bearing surfaces, and locations of column anchors and similar devices, before erection work proceeds, and report discrepancies to Architect and Structural Engineer. Do not proceed with erection until corrections have been made, or until compensating adjustments to structural steel work have been approved by Structural Engineer of Record. Additional surveys required to verify out-of-alignment work and/or corrective work shall be performed at the contractor's expense.
- D. Temporary Shoring and Bracing: This is the sole responsibility of the Contractor. Provide temporary shoring and bracing members with connections of sufficient strength to support imposed loads. Remove temporary members and connections when all permanent members are in place, and all final connections are made, including the floor and roof diaphragms. Provide temporary guy lines to achieve proper alignment of structures as erection proceeds. Comply with OSHA Standard referenced previous. Retain the services of a Specialty Structural Engineer (Not the Engineer of Record) to design specialty shoring and bracing.
- E. Column Anchors: Furnish column anchors (Nelson Studs or post-installed anchor rods) and other connectors required for securing structural steel to existing structure
  - 1. Nelson Studs shall be installed by stud welding process and shall not be "stick" or "wire" welded to existing steel.
  - 2. Tighten base plate nuts after supported members have been positioned and plumbed. Do not remove wedges or shims, but if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
  - 3. Welding to column Nelson Studs or anchor rods for corrective measures is strictly prohibited without prior written approval from the Engineer.
- F. When installing expansion bolts or adhesive anchors, the contractor shall take measures to avoid drilling or cutting any existing reinforcement or damaging adjacent concrete. Holes shall be blown clean with compressed air and/or cleaned per manufacturer's recommendations prior to the installation of anchors.

G. Field Assembly:

1. Set structural frames accurately to lines and elevations indicated.
2. Align, adjust, level and plumb members of complete frame in to the tolerances indicated in the AISC Code of Standard Practice and in accordance with OSHA regulations.
3. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly.
4. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
5. Splice members only where indicated and accepted on shop drawings.
6. Do not enlarge unfair holes in members by burning or by use of drift pins, except in secondary bracing members. Ream holes that must be enlarged to admit bolts.

H. Erection bolts: Remove erection bolts. On exposed welded construction fill holes with plug welds and grind smooth at exposed surface.

I. Gas Cutting: Do not use gas cutting torches in field for correcting fabrication errors in primary structural framing. Cutting will be permitted only on secondary members which are not under stress, as accepted by the Engineer of Record. Finish gas-cut sections equal to a sheared appearance when permitted.

J. Field Cut Beam Web Penetrations:

1. Field cut beam web penetrations are not permitted without written approval from the Structural Engineer.
  2. Gas cutting torches are not permissible for cutting beam web penetrations without written approval from the Structural Engineer.
  3. Beams with field cut beam web penetrations may require reinforcement, subject to the evaluation by the Structural Engineer.
  4. The evaluation of field cut web penetrations by the Structural Engineers for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be compensated by the General Contractor or Design-Build Subcontractor.
  5. The cost of executing field cut web penetrations and the associated beam reinforcement for Design-Build Subcontractors, including but not by limitation, Mechanical, Electrical, Plumbing and Sprinkler Subcontractors shall be paid for by the General Contractor or Design-Build Subcontractor.
  6. Field cut beam web penetrations may not be permitted in certain locations, subject to the evaluation by the Structural Engineer.
- K. Welders shall have current evidence of passing and maintaining the AWS D1.1 Qualifications test available in the field.
- L. Welding electrodes, welding process, minimum preheat and interpass temperatures shall be in accordance with AISC and AWS specifications. Any structural steel damaged in welding shall be replaced.
- M. Field Welded Moment Connections:
1. Backing materials for top and bottom flanges for field welded moment connections shall be removed, backgouge the weld root, and apply a reinforcing fillet weld.
  2. Where top flange steel backing materials are utilized, the backing may be left in place. In this case, the backing material shall be welded with a reinforcing fillet weld.

### 3.02 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
1. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- B. Testing: Owner shall engage an Independent Testing Agency to inspect all high-strength bolted and welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.



1. Testing agency shall conduct tests and state in each report which specific connections were examined or tested, whether the connections comply with requirements, and specifically state any deviations therefrom.
2. Contractor shall provide access for testing agency to places where structural steel work is being fabricated, produced or erected so that required inspection and testing can be accomplished. Testing agency may inspect structural steel at plant before shipment. The Engineer, however, reserves the right, at any time before final acceptance, to reject material not complying with specified requirements.

C. Inspection Requirements (to be performed by the Independent Testing Agency):

1. Bolted Connections: Inspect all bolted connections in accordance with procedures outlined in the AISC "Specification for Structural Joints using ASTM A325 or A490 Bolts.
2. Snug Tight Bolted Connections:
  - a. The inspector shall monitor the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
  - b. If the inspector does not monitor the installation of bolts, he shall visually inspect the connection to determine that all plies of connected material have been drawn together and conduct tests on a sampling connection bolts to determine if they have been tightened to the snug tight condition. The test sample shall consist of 10% of the bolts in the connection, but not less than two bolts, selected at random. If more than 10% of the tested bolts fail the initial inspection, the engineer reserves the right to increase the number of bolts tested.
3. Slip Critical Bolted Connections:
  - a. The inspector shall monitor the calibration of torquing equipment and the installation of bolts to determine that all plies of connected material have been drawn together and that the selected procedure is used to tighten all bolts.
  - b. If the inspector does not monitor the calibration or installation procedures, he shall test all bolts in the affected connection using a manual torque wrench to assure that the required pretension has been reached.
4. Field Welded Connections: inspect and test during fabrication of structural steel assemblies, and during erection of structural steel all welded connections in accordance with procedures outline in AWS D1.1. Record types and location of defects found in work. Record work required and performed to correct deficiencies.
  - a. Certify welders and conduct inspections and tests as required. Submit welder certifications to Engineer of Record. Perform visual inspection of all welds. Primary and secondary welds, including fillet

welds, full penetration welds, and deck puddle welds, applied in the field and/or shop, shall be visually inspected.

- b. Welds deemed questionable by visual inspection shall receive non-destructive testing. In addition, all partial and full penetration welds, and any other welds indicated on the drawings are to receive non-destructive testing. Non-destructive testing methods include the following:
    - 1. Radiographic Inspection (RT): ASTM E 94 and ASTM E 142; minimum quality level "2-2T".
    - 2. Ultrasonic Inspection (UT): ASTM E 164.
    - 3. Magnetic Particle (MT) inspection procedures may be utilized at the inspectors discretion in addition to RT or UT inspection. MT procedures shall not replace RT or UT procedures without permission from the Structural Engineer.
  - c. All welds deemed unacceptable shall be repaired and retested at the Contractor's expense.
- D. Testing and inspection reports shall be submitted to the Owner, Architect and Engineer within 48 hours of completion of each test or inspection.
- E. Nonconforming Work: Contractor shall be responsible for correcting deficiencies in structural steel work which inspections laboratory test reports have indicated to be not in compliance with requirements. Additional tests and/or surveys shall be performed, at the Contractor's expense, as may be necessary to show compliance of corrected work. Any costs associated with the Engineer's review and disposition of faulty works shall be borne by the Contractor.

**END OF SECTION**

SECTION 05 30 00 – METAL DECKING

**PART 1 GENERAL**

1.01 RELATED DOCUMENTS

- A. The drawings and general conditions of the contract including General and Supplementary Conditions and other Division 1 Specification sections apply to work of this section.
- B. Examine all other sections of the Specifications for requirements which affect work of this Section whether or not such work is specifically mentioned in this Section.
- C. Coordinate work with that of all trades affecting or affected by work of this Section. Cooperate with such trades to assure the steady progress of all work under the Contract.

1.02 DESCRIPTION OF WORK

- A. Extent of metal floor and roof deck is shown on the drawings and includes type "N" roof deck, cell closures, end plates metal lath column closures, composite finish strips, welding washers and sump plates or pans.

1.03 RELATED WORK

- 1. Section 05 12 00 - Structural Steel
- 2. Section 05 50 0 - Metal Fabrications

1.04 QUALITY STANDARDS

- A. Codes and Standards: Comply with provisions of the following codes and standards, except where more stringent requirements are indicated or specified:
  - 1. AISI "Specification for the Design of Cold Formed Steel Structural Members".
  - 2. AWS D1.1 "Structural Welding Code" - Steel
  - 3. AWS D1.3 "Structural Welding Code" - Sheet Steel
  - 4. Steel Deck Institute (SDI) " Design Manual for Floor Decks and Roof Decks".
  - 5. "Code of Federal Regulations, Part 1926" per the Occupational Safety and Health Administration (OSHA), Department of Labor (Latest Revision).
- B. Qualification of field welding: Qualify welding process and welding operators in accordance with AWS D1.1 "Standard Qualification Procedure."

1.05 SUBMITTALS

- A. Unless otherwise specified, submittals required in this section shall be submitted for review. Submittals shall be prepared and submitted in accordance with this section and Division 1.
- B. General Contractor shall submit a Submittal Schedule to the engineer within 30 days after they have received the Owner's Notice to Proceed.
- C. All submittals shall be reviewed and returned to the Architect within 10 working days.
- D. Incomplete submittals will not be reviewed.
- E. Submittals not reviewed by the General Contractor prior to submission to the Engineer will not be reviewed. Include on the submittal statement or stamp of approval by Contractor, representing that the Contractor has seen and examined the submittal and that all requirements listed in Division 1 have been complied with.
- F. Engineer will review submittals a maximum of two review cycles as part of their normal services. If submittals are incomplete or otherwise unacceptable and re-submitted, General Contractor shall compensate Engineer for additional review cycles.
- G. Product Data: Submit manufacturer's specifications and installation instructions for each type of decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.
- H. Shop Drawings:
  - 1. Shop Drawing Review: Electronic files of structural drawings **will not** be provided to the contractor for preparation of shop drawings.
    - a. Submit detailed drawings showing layout and types of deck panels, galvanizing, shop paint, anchorage details, and conditions requiring closure panels, supplementary framing, sump pans, cant strips, cut openings, special jointing, and all other accessories. Conformance of the Shop Drawings to the Contract Drawings remains the responsibility of the General Contractor. Engineer's review in no way relieves the General Contractor of this responsibility. Submit one print and one reproducible. Print will be reviewed and a reproducible will be returned to Contractor for printing and distribution. Multiple copies will not be marked by Engineer.
    - b. Shop drawings will not be reviewed as partial submittals. A complete submittal shall be provided and shall include; erection and piece drawings. Incomplete submittals will not be reviewed.

1.06 DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials to site at such intervals to insure uninterrupted progress of work.
- B. Store materials to permit easy access for inspection and identification. Keep deck sheets off ground, using pallets, platforms, or other supports. Protect deck sheets and packaged materials from corrosion and deterioration.

- C. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Materials shall be stored in a manner to avoid ponding of precipitation on members. Repair or replace damaged materials or structures as directed.

## **PART 2 PRODUCTS**

### **2.01 GENERAL:**

- A. Acceptable Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:
  - 1. United Steel Deck
  - 2. Wheeling Corrugating Co.
  - 3. Epic Metals Corporation
  - 4. Vulcraft
- B. Materials:
  - 1. Steel for Metal Deck Units:
    - a. Roof Deck Units: ASTM A611, Grade C, D, or E, or ASTM 653-94, Structural Quality, grade 33 or higher.
  - 2. Miscellaneous Steel Shapes: ASTM A36 minimum.
  - 3. Sheet metal Accessories: ASTM A526, commercial quality, galvanized.
- C. Galvanizing: Conform to ASTM 924-94 with minimum coating class of G60 (Z180) as defined in ASTM A653-94.
- D. Paint: Manufacturer's baked on, rust inhibitive paint, for application to metal surfaces which have been chemically cleaned and phosphate chemical treated.
- E. Flexible closure Strips: Manufacturer standard vulcanized, closed-cell, synthetic rubber.

### **2.02 FABRICATION:**

- A. General: Form deck units in lengths to span 3 or more supports, unless otherwise noted on the drawings, with flush, telescoped or nested 2" laps at ends and interlocking or nested side laps, unless otherwise indicated. For roof deck units, provide deck configurations complying with SDI "Roof Deck Specifications," of metal thickness, depth and width as shown.

- B. Metal Cover Plates: Fabricate metal cover plates for end-abutting floor deck units of not less than same thickness as decking. Form to match contour of deck units and approximately 6" wide.
- C. Metal Closure Strips: Fabricate metal closure strips, cell closures, "Z" closures, column closures, pour stops, girder fillers and openings between decking and other construction, of not less than 0.045" min. (18 gage) sheet steel or as indicated on the drawings. Form to provide tight fitting closures at open ends of cells or flutes and sides of decking.
- D. Pour Stops: Minimum material thickness shall be 18 gage or as indicate on drawings.. Fabricate vertical leg to accommodate specified slab thickness. Fabricate horizontal leg to minimize field cuts. Provide welded attachment sufficient to resist forces during concrete placement.
- E. Roof Sump Pans: Fabricate from a single piece of 0.071" min. (14 gage) galvanized sheet steel with level bottoms and sloping sides to direct water flow to the drains, unless otherwise shown. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3" wide. Recess pans not less than 1 1/2" below roof deck surface, unless otherwise shown or required by deck configuration. Holes for drains will be cut in the field.
- F. Provide all pour stops and accessories necessary to contain concrete for poured concrete surfaces.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION:**

- A. Install deck units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.
- B. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before permanently fastened. Deck shall be in full contact with members parallel to ribs and attached as indicated. Do not stretch or contact side lap interlocks.
- C. Place deck units in straight alignment for entire length of run of cells and with close alignment between cells at ends of abutting units.
- D. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.
- E. Coordinate and cooperate with the structural steel erector in locating decking bundles to prevent overloading of structural members.
- F. Do not use decking units for storage or working platforms until permanently installed.

#### **3.02 FASTENING:**

- A. Roof Deck: Each deck is to be fastened with a minimum of 5/8" diameter puddle welds spaced in a 24/4 pattern (3N deck) or 36/7 pattern (1.5B deck) with a minimum of 2 welds per unit at each support if incomplete sheet is utilized. Where support is parallel to support, at edge of building, at brace lines, at edge of opening or deck discontinuity provide puddle welds at 6" o.c. Secure deck to each supporting member in ribs where sidelaps occur. Deck units shall bear over the ends of supports by a minimum of 1.5". Sidelaps: #10 Tek screws, 6 per span for B deck, 10 per span for N deck.
- B. Welding: Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used in correcting welding work.
- C. Uplift loading: Decking units used at the roof level shall be designed for a net uplift of 15 psf.
- D. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking.
- E. Reinforcement at openings: Provide additional metal reinforcement and closures pieces as required for strength, continuity of decking and support of other work shown.
  - 1. Deck penetrations affecting no more than (1) deck rib need not be reinforced.
  - 2. For deck penetration affecting more than (1) deck rib, but less than 10", reinforce the opening with a 0.057" thick plate spanning between unaffected ribs, unless otherwise shown on the Design Drawings or supporting a piece of mechanical equipment (see item 3).
  - 3. Reinforce deck penetrations larger than 10" with the structural frame described in the Design Drawings.
- F. Joint Covers: Provide metal joint covers at abutting ends and changes in direction of floor deck units.
- G. Roof Sump Pans: Place over openings provided in roof decking and weld to top decking surface. Space welds not more than 12" on center with at least 1 weld in each corner. Cut opening in roof sump bottom to accommodate drain size indicated.
- H. Closure Strips: Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction. Weld into position to provide a complete decking installation.
- I. Touch-Up Painting:
  - 1. Painted Deck: After decking installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of decking units and supporting steel members.
    - a. Touch up painted surfaces with same type paint used on adjacent surfaces.

- b. In areas where shop-painted surfaces are to be exposed, apply touch-up paint to blend into adjacent surfaces.

3.03 QUALITY CONTROL:

- A. General: Contractor is responsible for maintaining quality control in the field and for providing a structure that is in strict compliance with the Contract Documents.
- B. Required inspection and testing services are intended to assist the Contractor in complying with the Contract Documents. These specified services, however, do not relieve the Contractor of his responsibility for compliance, nor are they intended to limit the Contractor's quality control efforts in the field.
- C. Testing: Owner shall engage an Independent Testing Agency to inspect all puddle welded connections, to perform tests and prepare reports of their findings. All connections must pass these inspections prior to the installation of subsequent work which they support.
- D. Deck Testing Requirements (to be performed by the Independent Testing Agency):
  1. Deck and accessory welding and/or attachments subject to inspection and testing. Work found to be defective will be removed and replaced at the Contractor's expense.
  2. Provide certification that welders to be employed in work have satisfactorily passed AWS qualification tests. If re-certification of welders is required, re-testing will be the Contractor's responsibility.

**END OF SECTION**



## SECTION 054000

### COLD-FORMED METAL FRAMING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Formed steel stud exterior wall framing.

##### 1.02 RELATED REQUIREMENTS

- A. Section 061000 - Rough Carpentry: Wood blocking and miscellaneous framing.
- B. Section 072500 - Weather Barriers: Weather barrier over sheathing.
- C. Section 079005 - Joint Sealers.
- D. Section 092116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.
- E. Section 092116 - Gypsum Board Assemblies: Gypsum-based sheathing.

##### 1.03 REFERENCE STANDARDS

- A. AISI SG02-1 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2001 with 2004 supplement. (replaced SG-971)
- B. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.
- D. ASTM C 955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2007.
- E. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2008.
- F. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

##### 1.04 SYSTEM DESCRIPTION

- A. Design, engineer, and provide a complete metal framing exterior wall assembly designed to resist all gravity and lateral loads as prescribed by the applicable building code for this project location.
  - 1. Deflection and structural calculations shall not include any structural benefit from the façade systems, metal framing alone shall carry the loads.
  - 2. Where a member supports more than one finish, the most restrictive deflection criteria shall govern.
  - 3. Size all components and connections to withstand all requirements as indicated in the applicable building codes, and as noted below:
    - a. Wind Velocity: Minimum 90 miles per hour per International Building Code 2006 edition.
    - b. Wind Exposure: Exposure B.

4. Design wall system to provide for movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to seasonal or cyclic day/night temperature ranges.
  5. Design system to accommodate construction tolerances, deflection of building structural members, and clearances of intended openings.
  6. Deflections limits: Stud spacing shall be 16" inches maximum on center unless indicated otherwise.
    - a. Deflection limit for exterior metal panel systems:  $L/XXX$  maximum where L is the length of the steel member.
    - b. Deflection limit for GFRC panel systems:  $L/XXX$  maximum where L is the length of the steel member.
    - c. Deflection limit for exterior brick or stone:  $L/600$  maximum where L is the length of the steel member.
- B. Design, engineer, and provide interior partitions designed and braced to resist all earthquake forces as prescribed in the applicable building code for this project location. Bracing shall be independent of any ceiling splay bracing.
1. Bracing shall be independent of any ceiling splay bracing.

#### **1.05 DESIGN REQUIREMENTS**

- A. Engineering and Design: Provide the Services of a Professional Engineer, registered in the State of Maine to design, engineer, and certify that the work of this section meets or exceeds the requirements specified in this section. The Engineer shall assume professional responsibility for the design of all cold formed metal framing components and their connections. Design decisions which affect visual characteristics shall be subject to the approval and modifications of the Architect.
- B. Structural Performance Loads: Design cold formed metal framing and connections to support total loads including dead load, live loads, earthquake loads, thermal loads, wind loads, and other loads as specified in the applicable Building Code.
- C. Allowable Connection Points: Connect cold formed metal framing to building structure only at locations approved by the building Engineer of Record and as indicated on the Contract Drawings and approved shop drawings. Any additional bracing of the structural steel or cold form framing (as determined by the Engineer of Record) required by the cold form metal Contractor's request to attach at alternate locations shall be furnished and installed by the cold form metal Contractor at no additional cost to the Owner.
- D. Provide moveable joints to accommodate the full range of manufacturing tolerances, field tolerances, thermal movement, wind and seismic movement, and floor and beam deflections. Joints shall accommodate the worst possible combination of effects so as to prevent internal stress, failure, deterioration or failure of weather seals.

#### **1.06 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations.
- C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.
- D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, type and location of fasteners, and connections, and accessories or items required of related work.
1. Indicate stud layout.
  2. Describe method for securing studs to tracks and for bolted framing connections.

3. Engineering calculations or data shall be submitted verifying the framing assembly's ability to meet or exceed the specified design requirements and the requirements of governing codes and authorities. In the event of a conflict between these requirements, the more stringent requirements shall govern, as determined by the Architect. All calculations shall be sealed and signed by a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located. These calculations shall include, but are not limited to the following items:
    - a. Steel Framing, including built-up framing supporting windows against lateral and gravity loads.
    - b. All connections (member to member, and member to structure) shall be thoroughly examined and designed.
    - c. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs.
    - d. Wall framing that does not have continuous sheathing applied to one side shall be checked for compression in the unsheathed flanges and compression flange bracing shall be added as required.
  4. Provide details and calculations for factory-made framing connectors, stamped by a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.
- E. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

#### **1.07 QUALITY ASSURANCE**

- A. Engineering Responsibility: Preparation of Shop Drawings, design calculations, and other structural data by a qualified professional engineer.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of cold-formed metal framing that are similar to those indicated for this Project in material, design, and extent.
- C. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, and with minimum five years of documented experience.
- D. Installer Qualifications: Company specializing in performing the work of this section approved by manufacturer.

#### **1.08 DELIVERY, STORAGE, AND PROTECTION**

- A. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Store cold-formed metal framing protected with a waterproof covering, and ventilated to avoid condensation.

#### **1.09 PROJECT CONDITIONS**

- A. Verify that field measurements are as indicated on shop drawings.
- B. Coordinate work of this section with the placement of components within the stud framing system.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
  1. Dietrich Metal Framing: [www.dietrichindustries.com](http://www.dietrichindustries.com).
  2. MarinoWare: [www.marinoware.com](http://www.marinoware.com).

3. The Steel Network, Inc: [www.SteelNetwork.com](http://www.SteelNetwork.com).
4. Substitutions: See Section 016000 - Product Requirements.

## 2.02 FRAMING SYSTEM

- A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.
- B. Metal Framing Connectors and Accessories:
  1. Same manufacturer as framing.
  2. Substitutions: See Section 016000 - Product Requirements.
- C. Basis of Design: Marino\WARE Components. The manufacturer's "Suggested Specification" listed in Marino\WARE "Cold Formed Steel Framing Systems" (latest edition) shall apply to all work.

## 2.03 FRAMING MATERIALS

- A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade as required by structural performance.
- B. Steel Sheet for Vertical Deflection Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade as required by structural performance.
- C. Studs and Track: ASTM C 955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track in matching nominal width and compatible height.
  1. Gage and depth: As required to meet specified performance levels.
    - a. Stone Veneer: Where walls provide lateral support for stone veneer, provide a minimum thickness of 0.043 inch or 18 gage members for all studs, track and blocking.
  2. Stud Depth: As indicated on the drawings.
  3. Galvanized in accordance with ASTM A 653/A 653M G90/Z275 coating.
- D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
  1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal and lateral loads and transfer them to the primary structure, gage as required to meet specified performance levels.
  2. Inner Track: Of web depth and gage as required to meet specified performance levels.
- E. Framing Connectors: Factory-made formed steel sheet, ASTM A 653/A 653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.
  1. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI North American Specification for the Design of Cold Formed Steel Structural Members; minimum 16 gage, 0.06 inch (1.5 mm) thickness.
  2. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, screws and anti-friction bushings, while maintaining structural performance of framing. Provide movement connections at the following locations:
    - a. Where continuous studs bypass elevated floor slab, connect stud to slab in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).

- b. Where top of stud wall terminates below structural floor or roof, connect studs to structure in manner allowing vertical and horizontal movement of slab without affecting studs; allow for minimum movement of 1/2 inch (13 mm).
  - c. Provide top track preassembled with connection devices spaced to fit stud spacing indicated.
3. Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.

## 2.04 ACCESSORIES

- A. Provide all accessories recommended by manufacturer and as required by AISI specifications.
- B. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.
- C. Bracing, Furring, Bridging: Formed sheet steel, thickness determined for conditions encountered; finish to match framing components.
- D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

## 2.05 FASTENERS

- A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.
- B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel headless, hooked bolts, and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.
- C. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A 153/A 153M.
- D. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping steel drill screws.
  1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.
  2. Basis of Design: MarinoWARE; Product FrameRITE fasteners.
- E. Anchorage Devices: Power actuated.
  1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, a load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by a qualified independent testing agency.
- F. Welding: In conformance with AWS D1.1.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that building framing components are ready to receive work.
- B. Verify field measurements and adjust installation as required.

### 3.02 INSTALLATION OF STUDS

- A. Install components in accordance with manufacturers' instructions and ASTM C 1007 requirements.

- B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners at maximum 24 inches (600 mm) on center. Coordinate installation of sealant with floor and ceiling tracks.
- C. Set members parallel and level, with lateral bracing and bridging.
- D. Place studs at 16 inches (400 mm) on center; not more than 2 inches (50 mm) from abutting walls and at each side of openings. Connect studs to tracks using fastener method.
- E. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs up to 3'-0" wide openings. For openings larger than 3'-0", Structural Engineer who is preparing the shop drawings should design for the specific opening requirements.
- F. Install load bearing studs full length in one piece. Splicing of studs is not permitted.
- G. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.
- H. Install intermediate studs above and below openings to align with wall stud spacing.
- I. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.
- J. Provide web stiffeners at reaction points.
- K. Attach cross studs to studs for attachment of fixtures anchored to walls.
- L. Install framing between studs for attachment of mechanical and electrical items, and to prevent stud rotation.
- M. Touch-up field welds and damaged galvanized surfaces with primer.

### **3.03 TOLERANCES**

- A. Maximum Variation from True Position: 1/8 inch (3 mm).
- B. Maximum Variation of any Member from Plane: 1/8 inch (3 mm).

**END OF SECTION**

## **SECTION 055000**

### **METAL FABRICATIONS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Shop fabricated steel items.
  - 1. Metal ships ladder and guardrails for access at new roof.

##### **1.02 RELATED REQUIREMENTS**

- D. Section 099000 - Painting: Paint finish.

##### **1.03 REFERENCE STANDARDS**

- A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 2002.
- B. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- C. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2007.
- D. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- E. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- F. ASTM A 283/A 283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2003 (Reapproved 2007).
- G. ASTM A 325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2009.
- H. ASTM A 325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric); 2009.
- I. ASTM A 500/A 500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2007.
- J. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2007.
- K. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2008.
- L. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).
- M. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).
- N. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
  - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

- C. Welders' Certificates: Submit certification for welders employed on the project, verifying AWS qualification within the previous 12 months.

## 1.05 QUALITY ASSURANCE

- A. Design member sizes and connections under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

## PART 2 PRODUCTS

### 2.01 MATERIALS - STEEL

- A. Steel Sections: ASTM A 36/A 36M.
- B. Steel Tubing: ASTM A 500, Grade B cold-formed structural tubing.
- C. Plates: ASTM A 283.
- D. Pipe: ASTM A 53/A 53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM A 325 (ASTM A 325M), Type 1, galvanized to ASTM A 153/A 153M where connecting galvanized components.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### 2.02 FABRICATION

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- E. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### 2.03 FABRICATED ITEMS

- A. Ladders: Stairs and Ladders: Details are provided as required to convey design requirements. The fabricator is responsible for the design and detailing of stair components, connections and details not provided on the drawings and those connections and details where redesign is desirable. Submitted shop drawings shall include calculations and erection details as required for structural evaluation and proper erection. Design shall be performed by a registered Professional Engineer, registered in the State of Maine. Submit signed and sealed design for review. Design shall be completed in accordance with the following loadings and conditions:
  - 1. Code: International Building Code, 2003 Edition. Reference for additional requirements not contained here within
  - 2. Stair Design Requirements (including "ships" ladders)



- a. Stair Design Uniform Load: 100 lbf/sq. ft.
  - b. Stair Design Concentrated Load: 300 lbf applied on an area of 4 sq. in
  - c. Uniform and concentrated loads need not be assumed to act concurrently.
  - d. Stair Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
  - e. Limit deflection of treads, platforms, and framing members to L/360, but not greater than 1/4 inch for treads and platforms.
3. Railing Design Requirements
- a. Railing Design Linear Load: 50 lbf/ft in any direction
  - b. Railing Design Concentrated Load: 200 lbf at any point, in any direction
  - c. Intermediate Rails, Balusters and Panel Fillers: Horizontally applied load of 50 lbf on an area not to exceed 1 sq. ft.
  - d. Referenced loads need not be assumed to act concurrently.
4. Fixed Ladders:
- a. 300 lbf. at any point
  - b. An additional 300 lbf per 10 feet of length, combined to produce the maximum load effect
  - c. When the rails of fixed ladders extend above the floor or landing, each side rails shall be designed to resist a concentrated live load of 100 lbf in any direction at any height up to the top of the side rail extension.
  - d. Side Rails: 3/8 x 2 inches (9 x 50 mm) members spaced at 20 inches (500 mm).
  - e. Rungs: one inch (25 mm) diameter solid round bar spaced 12 inches (300 mm) on center.
  - f. Space rungs 7 inches (175 mm) from wall surface.
5. Steel; in compliance with ANSI A14.3; with mounting brackets and attachments; prime paint finish.
- B. Guard Rails: As detailed; prime paint finish.
- C. Lintels: As detailed; prime paint finish.

## **2.04 FINISHES - STEEL**

- A. Prime paint all steel items.
  1. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A 123/A 123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A 123/A 123M requirements.

## **2.05 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).
- C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).
- D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).
- E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

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

### **3.02 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

### **3.03 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components indicated.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.
- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### **3.04 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

**END OF SECTION**

## **SECTION 061000**

### **ROUGH CARPENTRY**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Rough opening framing for doors, windows, and roof openings.
- B. Sheathing.
- C. Roof-mounted curbs.
- D. Roofing nailers.
- E. Roofing edge strip nailers.
- F. Preservative treated wood materials.
- G. Fire retardant treated wood materials.
- H. Communications and electrical room mounting boards. Grid mounting boards for storage bins.
- I. Concealed wood blocking, nailers, and supports.
- J. Miscellaneous wood nailers, furring, and grounds.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 055000 - Metal Fabrications: Miscellaneous steel connectors and support angles for wood framing.

##### **1.03 REFERENCE STANDARDS**

- A. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- B. ASTM D 2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2007.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- D. AWPA C2 - Lumber, Timber, Bridge Ties and Mine Ties -- Preservative Treatment by Pressure Processes; American Wood Protection Association; 2003.
- E. AWPA C9 - Plywood -- Preservative Treatment by Pressure Processes; American Wood Protection Association; 2003.
- F. AWPA C20 - Structural Lumber -- Fire Retardant Treatment by Pressure Processes; American Wood-Protection Association; 2003.
- G. AWPA C27 - Plywood -- Fire-Retardant Treatment by Pressure Processes; American Wood-Protection Association; 2002.
- H. AWPA U1 - Use Category System: User Specification for Treated Wood; American Wood-Protection Association; 2007.
- I. PS 1 - Structural Plywood; 2007.
- J. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce); 2005.

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

- B. Product Data: Provide technical data on wood preservative materials and application instructions.
- C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.
- B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

## **PART 2 PRODUCTS**

### **2.01 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.
  - 2. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.
- B. Lumber fabricated from old growth timber is not permitted.

### **2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Sizes: Nominal sizes as indicated on drawings, S4S.
- B. Moisture Content: S-dry or MC19.
- C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No. 2 or Standard Grade.
  - 2. Boards: Standard or No. 3.

### **2.03 CONSTRUCTION PANELS**

- A. Communications and Electrical Room Mounting Boards, and Mounting Boards for Owner Furnished Grids for Bin Storage: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E 84.
- B. Other Applications:
  - 1. Plywood Concealed From View But Located Within Exterior Enclosure: PS 1, C-C Plugged or better, Exterior grade.
  - 2. Plywood Exposed to View But Not Exposed to Weather: PS 1, A-D, or better.
  - 3. Other Locations: PS 1, C-D Plugged or better.

### **2.04 ACCESSORIES**

- A. Fasteners and Anchors:
  - 1. Metal and Finish: Hot-dipped galvanized steel per ASTM A 153/A 153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
  - 2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.
  - 3. Anchors: Toggle bolt type for anchorage to hollow masonry.

### **2.05 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System  
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for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Manufacturers:
  - a. Arch Wood Protection, Inc: [www.wolmanizedwood.com](http://www.wolmanizedwood.com).
  - b. Hoover Treated Wood Products, Inc: [www.frtw.com](http://www.frtw.com).
  - c. Osmose, Inc: [www.osmose.com](http://www.osmose.com).
  - d. Substitutions: See Section 016000 - Product Requirements.
2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D 2898.
  - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
  - b. Do not use treated wood in direct contact with the ground.
3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread rating of 25 when tested in accordance with ASTM E 84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
  - a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
  - b. Treat rough carpentry items as indicated .
  - c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:

1. Manufacturers:
  - a. Arch Wood Protection, Inc: [www.wolmanizedwood.com](http://www.wolmanizedwood.com).
  - b. Chemical Specialties, Inc: [www.treatedwood.com](http://www.treatedwood.com).
  - c. Osmose, Inc: [www.osmose.com](http://www.osmose.com).
  - d. Substitutions: See Section 016000 - Product Requirements.
2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
  - a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
  - b. Treat lumber in contact with roofing, flashing, or waterproofing.
  - c. Treat lumber in contact with masonry or concrete.
  - d. Treat lumber less than 18 inches (450 mm) above grade.
3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft (4.0 kg/cu m) retention.
  - a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
  - b. Treat plywood in contact with roofing, flashing, or waterproofing.
  - c. Treat plywood in contact with masonry or concrete.
  - d. Treat plywood less than 18 inches (450 mm) above grade.
4. Preservative Pressure Treatment of Lumber in Contact with Soil: AWPA U1, Use Category UC4A, Commodity Specification A using waterborne preservative to 0.4 lb/cu ft (6.4 kg/cu m) retention.
  - a. Preservative for Field Application to Cut Surfaces: As recommended by manufacturer

of factory treatment chemicals for brush-application in the field.

- b. Restrictions: Do not use lumber or plywood treated with chromated copper arsenate (CCA) in exposed exterior applications subject to leaching.

### **PART 3 EXECUTION**

#### **3.01 INSTALLATION - GENERAL**

- A. Select material sizes to minimize waste.
- B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.
- C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

#### **3.02 BLOCKING, NAILERS, AND SUPPORTS**

- A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.
- B. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- D. Specifically, provide the following non-structural framing and blocking:
  1. Cabinets and shelf supports.
  2. Wall brackets.
  3. Handrails.
  4. Grab bars.
  5. Toilet and bath accessories.
  6. Wall-mounted door stops.
  7. Wood ceiling (under base bid of Alternate 3) and trim.
  8. Joints of rigid wall coverings that occur between studs.
  9. Flip Down Charting Stations
  10. Valve boxes for break-away shower wand in each Shower Area.
  11. Owner's relocated tackboards.

#### **3.03 ROOF-RELATED CARPENTRY**

- A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.
- B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

#### **3.04 INSTALLATION OF CONSTRUCTION PANELS**

- A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
  1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
  2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
  3. Install adjacent boards without gaps.
  4. Size: 48 by 96 inches (2440 by 4880 mm), installed horizontally at ceiling height.

#### **3.05 SITE APPLIED WOOD TREATMENT**

- A. Apply preservative treatment compatible with factory applied treatment at site-sawn cuts,

complying with manufacturer's instructions.

- B. Allow preservative to dry prior to erecting members.

### **3.06 TOLERANCES**

- A. Framing Members: 1/4 inch (6 mm) from true position, maximum.
- B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet (2 mm/m) maximum, and 1/4 inch in 30 feet (7 mm in 10 m) maximum.

### **3.07 CLEANING**

- A. Waste Disposal: Comply with the requirements of Section 017419.
  - 1. Comply with applicable regulations.
  - 2. Do not burn scrap on project site.
  - 3. Do not burn scraps that have been pressure treated.
  - 4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or "waste-to-energy" facilities.
- B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.
- C. Prevent sawdust and wood shavings from entering the storm drainage system.

**END OF SECTION**

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**SECTION 064100  
CUSTOM CASEWORK AND MILLWORK**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Furnish and install custom casework and millwork.
- B. Coordinate solid surface lavatory tops at Patient bathrooms.
- C. Furnish and install under counter blocking (full depth under counter) for all Owner furnished keyboard trays.
- D. Coordinate and verify locations of solid wood or metal blocking for all items, including Owner furnished items.
- E. Re-finish existing Oak hand rails in P6A Corridors.
- F. Interior Maple Borrowed Lites at Reception Counter
- G. Maple Bench

1.02 RELATED SECTIONS

- A. Section 061000: Rough Carpentry
- B. Section 066500: Solid Polymer Fabrications
- C. Section 099000: Painting
- D. Section 088000: Glazing

1.03 REFERENCES

- A. Architectural Woodwork Quality Standards, Guide Specifications and Quality Certification Program; Architectural Woodwork Institute; 1999.
- B. NEMA LD 3-1985 High Pressure Decorative Laminates; National Electrical Manufacturer's Association; 1985.

1.04 SUBMITTALS

- A. Submittals shall be in accordance with Section 013000.
- B. Shop Drawings: Dimensioned Plans, elevations and sections, and large scale details, showing location of each item, identifying components used, size and locations of blocking and indicating method of attachment, including blocking for Owner furnished items.
- C. Cabinets: Full size cabinet sample cabinet, showing actual construction and materials to be used.
- E. Factory Finishes:
  - 1. Samples - 8 by 10 inch samples, finished for reach finish and color.
- F. Plastic Laminate and Solid Polymer Surfacing materials:
  - 1. Product Data.
  - 2. Samples: Manufacturer's samples for verification of each color selected.
  - 3. Maintenance Data.
- G. Cabinet Hardware:
  - 1. Product Data.
  - 2. One sample of each type, showing finish.

1.05 QUALITY ASSURANCE

- A. Standard for Materials and Workmanship: Comply with applicable requirements of "Architectural Wood Work Quality Standards," published by Architectural Woodwork Institute (AWI) and conforming to specific materials specified.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver products until ambient conditions required can be and are maintained.
- B. Do not deliver woodwork until wet work, painting, grinding, and similar operations in storage and installation areas which could damage, soil, or deteriorate woodwork have been completed.
- C. Deliver inserts and anchors required to be built into concrete or masonry well in advance of construction of these substrates.
- D. Protect woodwork during transit, delivery, storage, and handling to prevent damage, soiling, and deterioration.
- E. Store products only in areas where ambient conditions required can be and are maintained.
- F. Allow 2- 4 weeks minimum for custom roll formed counter edges. No color substitutions will be permitted.

1.07 PROJECT CONDITIONS

- A. Maintain temperature and humidity in storage and installation areas as required to maintain moisture content of installed woodwork within a 1 percent tolerance of the optimum moisture content determined by the fabricator; maintain required conditions from date of delivery through the remainder of the construction period.
- B. Obtain field measurements and verify dimensions before fabricating woodwork.

**PART 2 - PRODUCTS**

2.01 MATERIALS AND GRADES

- A. Maple: AWI Quality Standards 100, Grade 2, plain sawn, White Maple Oak.
- B. Hardwood: Custom Grade Poplar, Birch or Maple.
- C. Maple Plywood: AWI Quality Standards 200, Grade 2, plain sliced White Maple veneer with 7-ply or more, all hardwood core, no voids permitted.
- E. Hardwood Plywood: Custom grade hardwood.
- E. Medium Density Fiberboard (MDF): ANSI A208.2; type as specified in AWI/AWMAC Architectural Woodwork Quality Standards Illustrated; composed of wood fibers pressure bonded with moisture resistant adhesive to suit application; sanded faces; thickness as required.
  - 1. Use for painted components and concealed components.
  - 2. Use as backing for plastic laminate unless otherwise indicated.

## 2.02 LAMINATE MATERIALS

- A. Plastic Laminate: Pionite, Formica, or Nevamar, matching Architects approved samples, .050 inch thick, high pressure plastic laminate Use .030 inch thick low pressure plastic laminate for semi-exposed areas.
- B. Balancing Sheet: .02 inch thick back-up sheet.

## 2.03 HARDWARE

- A. Hinges: Blum No. 71.6530 Hinge with No. 175L810 Mtg. Plate. 170 degree, independent three dimensional adjustment, heavy duty concealed hinge for overlay doors, satin chrome finish.
- B. Cabinet Door Push Latch: For casework doors at hand wash stations.
- C. Drawer Slides:
  - 1. Grass 6036, 6034 MEPLA 2031, Grant, side mounted, 100 pound minimum load capacity, self-closing feature, baked-on white epoxy finish.
- D. Coat Rod: 1 5/16 inch diameter hardwood pole.
- E. Door and Drawer Pulls (for P6 Casework): Hafele No. 104.66.600 cup pull.
- F. Door and Drawer Pulls (for P2A Casework): Ives, Stanley, EPCO, Colonial 1-5/16" projection by 4" screw hole spacing. Solid aluminum with a clear anodized satin.
- G. Countertop Support Brackets: Size according to countertop dimensions and support spacing to provide load capacity recommended by manufacturer.
  - 1. Product: Hebgo Bracket manufactured by Hafele.
- H. Cabinet Locks (for all casework in Patient Accessible Areas): Keyed cylinder, two keys per lock, master keyed, steel with chrome finish. Coordinate keying with Owner.

## 2.04 ACCESSORIES

- A. Counter Bracket Supports: Flat steel plate triangle brackets ¼ inch thick, painted to match wall.
- B. Plastic Grommets: Outwater Plastics, Woodridge, N.J., (800) 631-8375, or approved equal, 4 inch diameter hole. Color shall be black. Furnish and install grommets in counters above all data outlets.
- C. Fabric Wrapped Tacksurfaces in Millwork for Charting and Reception Areas: Claridge Tan Nucork Natural cork bulletin board, No. 150 FR, with a class "B" fire rating. Fabric shall be C.F. Stinson (800)841.6279, Tally Class "A" Fire Rating.

## 2.05 FABRICATION

- A. Fabricate case work and countertops and millwork items in strict accordance with AWI Quality Standard 400 custom grade. Cabinets shall be fabricated in accordance with flush overlay construction without face frame cabinet construction.

1. Body members - sides, bottom, back and shelves:
  - a. Laminate Clad: hardwood plywood with high pressure plastic laminate exposed faces, low-pressure plastic laminate semi-exposed faces.
  - b. Wood: Veneer core Maple plywood.
2. Drawer Sides, Backs, Bottoms, and Subfronts:
  - a. Laminate Clad: Hardwood plywood with low pressure plastic laminate all sides and edges.
  - b. Wood: Maple veneer MDF core plywood.
3. Drawer Fronts:
  - a. Laminate Clad: particleboard high-pressure plastic laminate on exposed surfaces, low-pressure semi-exposed surfaces.
  - b. Wood: Solid Maple
4. Doors:
  - a. Wood: MDF core Maple veneer plywood.
  - c. Laminate Clad: Particleboard with high pressure plastic laminate exposed surfaces, low-pressure plastic laminate semi-exposed.
5. Cabinet Edging:
  - a. Wood: Band all edges of Maple Plywood with ¼ inch solid Maple.
  - b. Laminate Clad: 3 mm Solid PVC Edging, color shall match plastic laminate.
6. Counter Edging:
  - a. Counters with sinks: Solid Surface Material.
  - b. Counters without sinks shall have solid Maple half round edging or 3 mm PVC edge, as detailed.
7. Base Toe Kick:
  - a. Exterior Grade Hardwood plywood covered with resilient base, as specified in Section 09650, Resilient Flooring.

## 2.06 INTERIOR WOOD BORROW LITES.

- A. Wood Borrow Lite Frames: Paint Grade Poplar, fabricated in strict accordance with A.W.I. Quality Standards Section 900, Custom Grade.

## 2.07 MILLWORK ITEMS AND TRIM.

- B. Fabricate standing and running trim and rails in strict accordance with AWI Quality Standard 300 grade II.
- C. Factory finish casework and millwork items in strict accordance with AWI Quality Standards 1500.
- D. Finish casework and millwork items to have a clear finish in accordance with Finish System #TR-4 Conversion Varnish, grade, II.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that site conditions are free of defects or errors which would cause defective installation of casework and millwork items.
- B. Verify adequacy of blocking and support framing.

3.02 INSTALLATION

- A. Install casework, trim, and millwork items in strict accordance with AWI Quality Standard 1700, Grade II.
- B. Set and secure casework in place; rigid, plumb and level.
- C. Carefully scribe casework abutting other components.

3.03 CLEANING AND ADJUSTING

- A. Adjust moving or operating parts to function smoothly and correctly.
- B. Clean casework counters, shelves, hardware, fittings and fixtures.

**END OF SECTION**

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## **SECTION 066500**

### **SOLID POLYMER FABRICATIONS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Solid Surface Counters with integral sinks, backsplashes and side splashes.
- B. Solid Surface cabinet in Toilet/ Shower Room 683A.
- C. Solid Surface Window Sills.

##### **1.02 RELATED SECTIONS**

- A. Section 061000 - Rough Carpentry: Wood blocking.
- B. Section 064100 - Custom Casework and Millwork.

##### **1.03 SUBMITTALS**

- A. See Section 01300 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements.
- C. Shop Drawings: Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.
- D. Maintenance Data: Submit manufacturer's care and maintenance data, including repair and cleaning instructions.
- E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

##### **1.04 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section and approved by manufacturer.

##### **1.05 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver materials to site when construction is ready for installation. Store materials indoors, in a controlled environment as recommended by the manufacturer.
- B. Handle materials to prevent damage to finished surfaces. Provide protective coverings to prevent damage or staining following installation.

##### **1.06 WARRANTY**

- A. See Section 01780 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten year manufacturer warranty against defects in materials. Warranty to cover material and labor to repair or replace defective materials.

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. DuPont/Corian: [www.corian.com](http://www.corian.com).

##### **2.02 MATERIALS**

- A. Homogeneous filled acrylic; not coated, laminated or of composite construction; meeting ANSI Z124.3 and .6, type Six; and Federal Spec. WW-P-541E/GEN.
  - 1. Superficial damage to a depth of 0.010" (0.25 mm) shall be repairable by sanding and polishing.
  - 2. Color: Solid Surface material (SS), Color as selected.

### **2.03 COMPONENTS**

- A. Countertops: Integral with sinks.
  - 1. Horizontal surfaces: ½" thick.
  - 2. Vertical surfaces: ¼" thick.
- B. Sinks: TFI – East (1-866-834-6055), fabricated solid surface Corian sinks.
  - 1. Model (for solid surface sinks, except Corridor handwash stations. Corridor handwash stations are custom size): Lavanto Ventura, ADA compliant, 15 ¼" x 12 7/8" inside diameter, 4 5/8" deep.
  - 2. Model (for all Patient room toilets): Lavanto Bastia C75600
  - 3. Provide sinks with overflows.
  - 4. Color: Sinks color shall be selected by Architect.
- C. Backsplashes and sidesplashes: Corian to match counters, integral.

### **2.04 ACCESSORIES**

- A. Joint Adhesive: Manufacturer's standard two-part adhesive kit to create inconspicuous, non-porous joints, with a chemical bond.
- B. Panel adhesive: Manufacturer's standard neoprene-based panel adhesive meeting ANSI A 136.1 - 1992, UL listed.
- C. Sealant: As specified in Section 07900, appropriate to application, and compatible with adjacent materials.
  - 1. Color: Match color of product selected.

### **2.05 FABRICATION**

- A. Form joints between components using manufacturer's standard joint adhesive. Joints to be inconspicuous in appearance and without voids. Attach 2 inch wide reinforcing strip of same material under each joint.
- B. Provide holes and cutouts for faucets, and accessories as indicated.
- C. Provide integral sinks.
- D. Rout and finish component edges to a smooth, uniform finish.

### **2.06 SHOP FINISHING**

- A. Uniform matte finish, with a gloss rating of 5 - 20.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that work is ready to receive work of this section.

### **3.02 PREPARATION**

- A. Clean and seal substructure as recommended by manufacturer.



**3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, in accordance with approved shop drawings and product installation details.

**3.04 ERECTION TOLERANCES**

- A. Maximum Variation From True Position: 1/8" over the length of each component.
- B. Maximum joint with between window stool and adjoining construction: 3/8".

**3.05 CLEANING**

- A. Clean adhesives, sealants and other stains from installed components.
- B. Protect installed components from subsequent construction operations.

**END OF SECTION**

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## SECTION 072100

### THERMAL INSULATION

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Board insulation at exterior walls.

##### 1.02 REFERENCE STANDARDS

- A. ASTM C 578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2007.
- B. ASTM D 2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2006.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

##### 1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

#### PART 2 PRODUCTS

##### 2.01 FOAM BOARD INSULATION MATERIALS

- A. Extruded Polystyrene Board Insulation: ASTM C 578, Type X; Extruded polystyrene board with either natural skin or cut cell surfaces; with the following characteristics:
  - 1. Flame Spread Index: 75 or less, when tested in accordance with ASTM E 84.
  - 2. Smoke Developed Index: 450 or less, when tested in accordance with ASTM E 84.
  - 3. Board Size: 48 x 96 inch (1220 x 2440 mm).
  - 4. Board Thickness: 2 inches (50 mm).
  - 5. Board Edges: Square.
  - 6. Thermal Conductivity (k factor) at 25 degrees F (-3.9 degrees C): 0.18 (0.31).
  - 7. Compressive Resistance: 15 psi (104 kPa).
  - 8. Board Density: 1.3 lb/cu ft (21 kg/cu m).
  - 9. Water Absorption, maximum: 0.3 percent, volume.
  - 10. Manufacturers:
    - a. Dow Chemical Co: [www.dow.com](http://www.dow.com).
    - b. Owens Corning Corp: [www.owenscorning.com](http://www.owenscorning.com).
    - c. Pactiv Building Products: [www.pactiv.com/green-guard/](http://www.pactiv.com/green-guard/).
  - 11. Substitutions: See Section 016000 - Product Requirements.

##### 2.02 ACCESSORIES

- A. Tape: Bright aluminum self-adhering type, mesh reinforced, 2 inch (50 mm) wide.

#### PART 3 EXECUTION

##### 3.01 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation and adhesive.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

##### 3.02 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION**

## **SECTION 072119**

### **FOAMED-IN-PLACE INSULATION**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Foamed-in-place insulation in exterior masonry walls.
- B. Foamed-in-place insulation at junctions of dissimilar wall and roof materials to achieve a thermal and air seal, with protective overcoat.

##### **1.02 RELATED REQUIREMENTS**

##### **1.03 REFERENCE STANDARDS**

- A. ASTM D 1621 - Standard Test Method for Compressive Properties of Rigid Cellular Plastics; 2004a.
- B. ASTM D 1622 - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2008.
- C. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- D. ASTM E 96/E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention
- D. Certificates: Certify that products of this section meet or exceed specified requirements.

##### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than five years of documented experience.
- B. Applicator Qualifications: Company specializing in performing work of the type specified, and approved by manufacturer.

##### **1.06 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for flame and smoke limitations.

##### **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Deliver materials in manufacturers original sealed containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.
- B. 2. Store materials in a safe manner and maintain temperatures within the limits specified by the material manufacturer.
- C. Remove empty containers from site on a daily basis.

##### **1.08 FIELD CONDITIONS**

#### **PART 2 PRODUCTS**

##### **2.01 MANUFACTURERS**

- A. Foamed-In-Place Insulation:
  - 1. BASF Polyurethane Foam Enterprises LLC; Product Walltite: [www.foamenterprises.com](http://www.foamenterprises.com).
  - 2. North Carolina Foam Industries; Product 11-015: [www.ncfi.com](http://www.ncfi.com).
  - 3. Substitutions: See Section 016000 - Product Requirements.

## **2.02 MATERIALS**

- A. Insulation: ASTM C 1029, Type I, polyurethane.
  - 1. Thermal Conductivity: Aged k-factor 0.149 (R=6.7in) @ 1" (Btu in/ft<sup>2</sup> hr °F), measured in accordance with ASTM C 518.
  - 2. Water Vapor Transmission: 1.82 perms, measured in accordance with ASTM E 96/E 96M.
  - 3. Compressive Strength: 22 psi, when tested in accordance with ASTM D 1621.
  - 4. Density: Nominal 2.0 lb/cu ft, when tested in accordance with ASTM D 1622.
  - 5. Surface Burning Characteristics: Flame spread/Smoke developed index of 25 / 450, when tested in accordance with ASTM E 84.

## **2.03 ACCESSORIES**

- A. Primer: As required by insulation manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

### **3.02 PREPARATION**

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

### **3.03 APPLICATION**

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Apply to a minimum cured thickness of 3 inches (150 mm).
- D. Patch damaged areas.

### **3.04 FIELD QUALITY CONTROL**

- A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 014100.

### **3.05 PROTECTION**

- A. Do not permit subsequent construction work to disturb applied insulation.

**END OF SECTION**

**SECTION 072130  
BUILDING INSULATION**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Batt insulation for interior partitions

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Unfaced fiberglass fiber batt.
  - 1. Thermal Resistance R = 3.0 per inch of thickness (ASTM C518)
  - 2. Facing: Unfaced
  - 3. Acceptable manufacturers:
    - a. Owens-Corning
    - b. Schuller International
    - c. Knauf Fiber Glass

- B. Unfaced Mineral Fiber Blanket/Batt Insulation: Thermal insulation produced by combining mineral fibers of type described below with thermosetting resins to comply with ASTM C 653 and C 518 for Type I (blankets without membrane facing) ASTM 136; insulation shall comply with Federal Specification HH-1-521-F.

- C. Foam Insulation (foam sealant): On site foam-in-place insulation shall be Froth-Pak 1.75-25FS, Class 1 foam manufactured by Insta-Foam Products, Inc., or approved equal.

- D. Insulation Support Tabs: Insul-Fast continuous metal support tabs.

2.02 OTHER MATERIALS

- A. Fasteners and retainers for a complete and proper installation of building insulation shall be as recommended by the insulation manufacturer.

**PART 3 - EXECUTION**

3.01 EXAMINATION

- A. Examine substrates and conditions to determine if other conditions affecting performance of insulation are satisfactory. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean substrates of substances harmful to insulations.

3.03 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's instructions applicable to products and application indicated. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with installation of insulation.

- B. Extend insulation full thickness as indicated to envelop entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections that interfere with placement. Position ventilation through so that vent area is not obstructed.
- C. Insulation material shall be cut and fit as necessary to fully insulate small areas between closely spaced framing members and to accommodate piping, conduit, outlet boxes, and other construction penetrating the insulation material. Split insulation and install on both sides of wiring. Secure insulation with "Insul-Fast" continuous metal support tabs, 5 feet on center starting at the top of each stud.
- D. Re-install disturbed insulation batts tightly around all penetrations.

#### 3.04 CONDITIONS AT THE BUILDING

- A. Insulation shall not be installed until building construction has progressed to the point that inclement weather will not damage or wear the insulation material.
- B. Electrical wiring, plumbing, and other concealed work shall be completed and approved prior to the start of building insulation work.

#### 3.06 PROTECTION

- A. General: Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation will be subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

#### END OF SECTION



## **SECTION 072500**

### **WEATHER BARRIERS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Vapor Retarders: Materials to make roof assemblies water vapor-resistant.
- B. Air/Vapor Barriers: Materials to stop passage of air through, and to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor-resistant.
  - 1. Fluid applied membrane.
  - 2. Self-adhesive sheet membrane.

##### **1.02 RELATED SECTIONS**

- A. Section 076200 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with weather barriers.
- B. Section 079005 - Joint Sealers: Sealant materials and installation techniques.
- C. Section 092116 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

##### **1.03 REFERENCES**

- A. ASTM C 836 - Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course; 2006.
- B. ASTM D 412 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers--Tension; 2006a.
- C. ASTM D 570 - Standard Test Method for Water Absorption of Plastics; 1998 (reapproved 2005).
- D. ASTM D 1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting; 2007.
- E. ASTM D 1644 - Standard Test Methods for Nonvolatile Content of Varnishes; 2001 (reapproved 2006).
- F. ASTM D 1876 - Standard Test Method for Peel Resistance of Adhesives (T-Peel Test); 2008.
- G. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2001.
- H. ASTM D 3767 - Standard Practice for Rubber - Measurement of Dimensions; 2003 (reapproved 2008).
- I. ASTM D 4541 - Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers; 2002.
- J. ASTM E 96 / E 96M - Standard Test Methods for Water Vapor Transmission of Materials; 2005.
- K. ASTM E 154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover; 2008.
- L. ASTM E 283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.
- M. ASTM E 1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 1997 (Reapproved 2004).
- N. ASTM E 283 Standard Test Method for Determining the Rate of Air Leakage Through Exterior

Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on material characteristics and standard details for the air/vapor barrier membrane systems showing a continuous plane of air tightness throughout the building envelope.
- C. Shop Drawings: Provide drawings of special joint conditions.
- D. Manufacturer's Installation Instructions: Indicate preparation.
- E. Manufacturer's Certificate: Certify that materials meet or exceed specified requirements.

#### **1.05 QUALITY ASSURANCE**

- A. Vapor Permeability (Perm): Measure in accordance with ASTM E 96 Procedure E.
- B. Regulatory Requirements: Comply with applicable codes, regulations, ordinances, and laws regarding use and application of products that contain volatile organic compounds (VOC).
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum ten years of documented experience.
- D. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

#### **1.06 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, away from direct sunlight, clear of ground and moisture.
- C. Store roll materials on end in original packaging.

#### **1.07 PROJECT CONDITIONS**

- A. Coordinate the work with installation of associated counterflashings installed by other sections as the work of this section proceeds.

#### **1.08 ENVIRONMENTAL REQUIREMENTS**

- A. Do not apply membrane to a damp, frosty or contaminated surface.
- B. Maintain working conditions at site as recommended by manufacturer and required by regulatory requirements.

### **PART 2 PRODUCTS**

#### **2.01 VAPOR RETARDER MEMBRANE**

- A. Sheet Seal: Multi-layer, fabric-, cord-, grid-, or aluminum-reinforced polyethylene or equivalent, complying with ASTM E 1745, Class A; stated by manufacturer as suitable for application indicated. Single ply polyethylene is prohibited.
  - 1. Permeance: 0.3 perm (17 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E 96.
  - 2. Thickness:
    - a. Metal Roof Decks Under Rigid Insulation: 6 mil.
- B. Tape: Bright aluminum self adhering type, mesh reinforced, 2 inches (50 mm) wide, compatible with sheet material.

## 2.02 AIR/VAPOR BARRIER MEMBRANES

- A. Manufacturers:
  - 1. American Hydrotech, Inc: [www.hydrotechusa.com](http://www.hydrotechusa.com).
  - 2. Carlisle Coatings & Waterproofing, Inc: [www.carlisle-ccw.com](http://www.carlisle-ccw.com).
  - 3. Grace Construction Products: [www.na.graceconstruction.com](http://www.na.graceconstruction.com).
  - 4. Substitutions: See Section 01600 - Product Requirements.
  
- B. Fluid Applied Air/Vapor Barrier Membrane: Two part, self-curing, synthetic rubber based material free of solvents, isocyanates and bitumen.
  - 1. Cured Film Thickness: 0.060 inch, measured in accordance with ASTM D 3767 Method A.
  - 2. Solids Content: 100%, measured in accordance with ASTM D 1644.
  - 3. Air Permeance: 0.00012 CFM/ft<sup>2</sup> at 75Pa differential pressure, measured in accordance with ASTM E 283.
  - 4. Water Vapor Permeance: Maximum 0.08 perms, measured in accordance with ASTM E 96 Method BW.
  - 5. Low Temperature Flexibility: Pass at -26°F, measured in accordance with ASTM C 836.
  - 6. Ultimate Elongation: 500% minimum, measured in accordance with ASTM D 412.
  - 7. Pull Adhesion to Glass Faced Wall Board: 5lb/in., measured in accordance with ASTM D 4541.
  - 8. Pliability (180° Bend over 1 inch Mandrel at -23°F): Passes, measured in accordance with ASTM D 1970.
  - 9. Basis of Design: Perm-A-Barrier manufactured by Grace Construction Products.
  
- C. Self-Adhesive Air/Vapor Barrier Sheet Membrane: 40 mil rubberized asphalt, self-adhering type, integrally bonded to a cross laminated polyethylene film.
  - 1. Film Thickness: 4 mil.
  - 2. Water Vapor Transmission: Maximum 0.05 perms, measured in accordance with ASTM E 96 Method B.
  - 3. Air Permeance: 0.00012 CFM/ft<sup>2</sup> at 75Pa differential pressure, measured in accordance with ASTM E 283.
  - 4. Puncture Resistance: 40 lbs minimum, measured in accordance with ASTM E 154.
  - 5. Tensile Strength (film): 400 psi, measured in accordance with ASTM D 412.
  - 6. Lap Adhesion: Minimum 5lb/in. of width at 25°F, measured in accordance with ASTM D 1876.
  - 7. Low temperature flexibility: Unaffected to -45°F, measured in accordance with ASTM D 1970.
  - 8. Ultimate Elongation: 200% minimum, measured in accordance with ASTM D 412.
  - 9. Basis of Design: Perm-A-Barrier Wall Membrane manufactured by Grace Construction Products.
  
- D. Primer: Water-based primer, as recommended by manufacturer, appropriate to application, and compatible with adjacent materials.
  - 1. Flash Point: No flash to boiling point.
  - 2. VOC Content: Not to exceed 10 g/l.
  - 3. Application Temperature: 25°F minimum.
  - 4. Basis of Design: Perm-A-Barrier WB Primer manufactured by Grace Construction Products.
  
- E. Accessories: As recommended by manufacturer, appropriate to application, and compatible with adjacent materials.

1. Flashing for Openings: 40 mil rubberized asphalt, self-adhering type, integrally bonded to a cross laminated polyethylene film.
  - a. Film Thickness: 8 mil.
  - b. Water Vapor Transmission: Maximum 0.05 perms, measured in accordance with ASTM E 96 Method B.
  - c. Water Absorption: 0.1% maximum by weight, measured in accordance with ASTM D 570.
  - d. Puncture Resistance: 80 lbs minimum, measured in accordance with ASTM E 154.
  - e. Tensile Strength (film): 800 psi, measured in accordance with ASTM D 412.
  - f. Lap Adhesion: Minimum 5lb/in. of width at 25°F, measured in accordance with ASTM D 1876.
  - g. Tear Resistance: 13lbs., measured in accordance with ASTM D 1004.
  - h. Low temperature flexibility: Unaffected to -45°F, measured in accordance with ASTM D 1970.
  - i. Ultimate Elongation: 200% minimum, measured in accordance with ASTM D 412.
  - j. Basis of Design: Perm-A-Barrier Wall Flashing manufactured by Grace Construction Products.
2. Mastic: Manufacturer's standard mastic.

### **2.03 SEALANTS**

- A. Butyl Sealant: as specified in Section 079005.
- B. Silicone Sealant: as specified in Section 079005.
- C. Sealant Backers: As specified in Section 079005.
- D. Primers, Cleaners, and Other Sealant Materials: As recommended by sealant manufacturer, appropriate to application, and compatible with adjacent materials.

### **2.04 ACCESSORIES**

- A. Self-Adhesive Sheet Flashing: ASTM D 1970.
- B. Thinners and Cleaners: As recommended by material manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces and conditions are ready to accept the work of this section.
- B. Verify that attachment of sheathing meets air/vapor barrier sheet membrane manufacturer's requirements.

### **3.02 PREPARATION**

- A. Remove projections, protruding fasteners, and loose or foreign matter which might interfere with proper installation.
- B. Sand or fill irregularities as required to achieve flush surfaces.
  1. All cracks over 1/16 inch (1.6 mm) in width should be filled with material compatible to the substrate.
- C. Clean and prime substrate surfaces to receive adhesives in accordance with manufacturer's instructions.
- D. Trim or detail all door, window, and penetrations per manufacturer's standard details.
- E. Install brick ledge flashing prior to application of vapor/air barrier sheet membrane.
- F. Protect adjacent surfaces not designated to receive fluid applied air/vapor barrier membrane.

### **3.03 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Vapor Retarders: Install continuous air-tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
- C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.
- D. Self-Adhesive Sheets:
  - 1. Prepare substrate in manner recommended by sheet manufacturer; fill and tape joints in substrate and between dissimilar materials.
  - 2. Lap sheets shingle-fashion to shed water and seal laps air-tight.
  - 3. Use same material, or other material approved by sheet manufacturer for the purpose, to seal to adjacent construction and as flashing.
  - 4. At wide joints, provide extra flexible membrane allowing joint movement.
- E. Coatings:
  - 1. Prepare substrate in manner recommended by coating manufacturer; fill and tape joints in substrate and between dissimilar materials.
  - 2. Where exterior stone veneer is to be installed, install veneer anchors before installing weather barrier over masonry; seal around anchors airtight.
  - 3. Sprayed Coating: Install to thickness recommended by manufacturer.
  - 4. Use self-adhesive sheet flashing to seal to adjacent construction and to bridge joints.
- F. Openings and Penetrations in Exterior Weather Barriers:
  - 1. Install self-adhesive flashing over sills, covering entire sill frame member, extending at least 5 inches (125 mm) onto weather barrier and at least 6 inches (150 mm) up jambs; mechanically fasten stretched edges.
  - 2. At openings to be filled with non-flanged frames, seal weather barrier to all sides of opening framing, using self-adhesive flashing at least 9 inches (230 mm) wide, covering entire depth of framing.
  - 3. At head of openings, install self-adhesive flashing under weather barrier extending at least 2 inches (50 mm) beyond face of jambs; seal weather barrier to flashing.
  - 4. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
  - 5. Service and Other Penetrations: Form self-adhesive flashing around penetrating item and seal to weather barrier surface.

### **3.04 CLEANING AND PROTECTION**

- A. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
- B. Protect completed installations from subsequent construction activities as recommended by manufacturer.
- C. Cover vapor/air barrier membranes as soon as possible after installation. Do not leave materials exposed to weather longer than recommended by manufacturer.

**END OF SECTION**

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## **SECTION 074264**

### **METAL COMPOSITE MATERIAL WALL PANELS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.
- B. Matching flashing and trim.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 054000 - Cold Framed Metal Framing: Panel support framing.
- B. Section 076200 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.
- C. Section 079005 - Joint Sealers.

##### **1.03 REFERENCE STANDARDS**

- A. ASTM A 36/A 36M - Standard Specification for Carbon Structural Steel; 2005.
- B. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- C. ASTM A 153/A 153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2005.
- D. ASTM A 276 - Standard Specification for Stainless Steel Bars and Shapes; 2008a.
- E. ASTM A 480/A 480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2008b.
- F. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.
- G. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.
- H. ASTM A 792/A 792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2006a.
- I. ASTM D 523 - Standard Test Method for Specular Gloss; 2008.
- J. ASTM D 1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2004).
- K. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 1996 (Reapproved 2001).
- L. ASTM D 2244 - Standard Practice for Calculation of Color Differences from Instrumentally Measured Color Coordinates; 2007.
- M. ASTM D 4145 - Standard Test Method for Coating Flexibility of Prepainted Sheet; 1983 (Reapproved 2002).
- N. ASTM D 4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films; 2007.
- O. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.

- P. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across the Specimen; 2004.
- Q. ASTM E 330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2002.
- R. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors By Uniform Static Air Pressure Difference; 2000.
- S. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2006.

#### **1.04 DESIGN REQUIREMENTS**

- A. Components: Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable building codes.
- B. Maximum Allowable Deflection of Panel: 1/180 of span.
- C. Provide certified test results by a recognized testing laboratory or agency in accordance with specified test methods as follows:
  - 1. Air Infiltration: Provide wall system with an air infiltration rate of not more than 0.06 cfm/sf of fixed wall area when tested in accordance with ASTM E-331 at a static air pressure differential of 1.57 psf.
  - 2. Water Penetration: Provide panel system with no uncontrolled water penetration as defined in test method ASTM E-331 at an inward static pressure differential of not less than 6.24 psf and not more than 12.0 psf.
- D. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement within system; movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
- E. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
- F. Products: Provide continuity of thermal barrier at building enclosure elements.

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Wall System Manufacturer Qualifications.
- C. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:
  - 1. Finish manufacturer's data sheet showing physical and performance characteristics.
  - 2. Storage and handling requirements and recommendations.
  - 3. Fabrication instructions and recommendations.
  - 4. Specimen warranty for finish, as specified herein.
- D. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
  - 1. Physical characteristics of components shown on shop drawings.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation instructions and recommendations.
  - 4. Specimen warranty for wall system, as specified herein.
- E. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, number of anchors,



supports, reinforcement, trim, flashings, and accessories.

1. Indicate panel numbering system.
  2. Differentiate between shop and field fabrication.
  3. Indicate substrates and adjacent work with which the wall system must be coordinated.
  4. Include large-scale details of anchorages and connecting elements.
  5. Include large-scale details or schematic, exploded or isometric diagrams to fully explain flashing, drainage system, and rainscreen interface at a scale of not less than 1-1/2 inches per 12 inches (1:10).
  6. Include design engineer's stamp or seal on shop drawings for attachments and anchors.
- F. Submit calculations stamped by design engineer for all items furnished under this section.
- G. Verification Samples: For each finish product specified, minimum size 12 inches (305 mm) square, representing actual product in color and texture.
- H. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.
- I. Test Report: Submit report of full-size mock-up test for NFPA 285 fire performance.
- J. Installer's Qualifications.
- K. Certificate: Certify that the work results of this section meet or exceed specified requirements.
- L. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.
- M. Maintenance Data: Care of finishes and warranty requirements.
- N. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of Work and licensed in the State in which the Project is located.
- B. Perform work in accordance with panel system manufacturer's instructions.
- C. Wall System Manufacturer Qualifications: Company specializing in manufacturing products specified in this section.
1. With not less than ten years of documented experience.
  2. Approved by MCM sheet manufacturer.
- D. Installer Qualifications: Company specializing in performing work of the type specified in this section.
1. With minimum ten of documented experience.
  2. Approved by wall system manufacturer.
- E. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

#### **1.07 MOCK-UP**

- A. Mock-Up: Provide a mock-up for evaluation of fabrication workmanship.
1. Locate where directed.
  2. Provide panels finished as specified.

#### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in manufacturer's original, unopened, undamaged packaging with identification labels intact.

1. Protect finishes by applying heavy duty removable plastic film during production.
  2. Package for protection against transportation damage.
  3. Provide markings to identify components consistently with drawings.
  4. Exercise care in unloading, storing and installing panels to prevent bending, warping, twisting and surface damage.
- B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
1. Store in well ventilated space out of direct sunlight.
  2. Protect from moisture and condensation with tarpaulins or other suitable weather tight covering installed to provide ventilation.
  3. Store at a slope to ensure positive drainage of any accumulated water.
  4. Do not store in any enclosed space where ambient temperature can exceed 120 degrees F (49 degrees C).
  5. Avoid contact with any other materials that might cause staining, denting, or other surface damage.

### **1.09 PROJECT CONDITIONS**

- A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid delays.

### **1.10 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Wall System Warranty: Provide joint written warranty by manufacturer and installer, agreeing to correct defects in manufacturing or installation within a ten year period after Date of Substantial Completion.
- C. MCM Sheet Manufacturer's Finish Warranty: Provide manufacturer's written warranty stating that the finish will perform as follows for minimum of 20 years:
1. Chalking: No more than that represented by a No.8 rating based on ASTM D 4214.
  2. Color Retention: No fading or color change in excess of 5 Hunter color difference units, calculated in accordance with ASTM D 2244.
  3. Gloss Retention: Minimum of 30 percent gloss retention, when tested in accordance with ASTM D 523.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Metal Composite Material Sheet Manufacturers:
1. Alcan Composites USA, Inc; Alucobond Plus: [www.alucobondusa.com](http://www.alucobondusa.com).
  2. Alcoa, Inc; Reynobond FR: [www.alcoa.com](http://www.alcoa.com).
  3. ALPOLIC Materials; ALPOLIC/fr: [www.alpolic-usa.com](http://www.alpolic-usa.com).
  4. Substitutions: See Section 016000 - Product Requirements.

### **2.02 WALL PANEL SYSTEM**

- A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage or failure.
1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.
  2. Provide panel jointing and weatherseal using reveal joints and gaskets but no sealant.
  3. Anchor panels to supporting framing without exposed fasteners.
- B. Performance Requirements:

1. All tests are to be on full-size mock-ups; tests performed previously for other projects are acceptable provided tested assemblies are truly equivalent to those to be used on this project, unless otherwise indicated.
  2. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F (minus 29 degrees C) to 180 degrees F (82 degrees C) without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.
  3. Wind Performance: Provide system tested in accordance with ASTM E 330 without permanent deformation or failures of structural members under the following conditions:
    - a. Withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall as calculated in accordance with applicable building codes.
    - b. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.
    - c. Maximum anchor deflection in any direction of 1/16 inch (1.6 mm) at connection points of framing members to anchors.
  4. Air Infiltration: 0.06 cfm/sq ft (0.003 L/s/sq m) of wall area, maximum, when tested at 1.57 psf (0.075 kPa) in accordance with ASTM E 283.
  5. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E 331 at a differential of 10 percent of inward acting design load, 6.24 psf (0.299 kPa) minimum, after 15 minutes.
    - a. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.
    - b. Design to drain leakage and condensation to the exterior face of the wall.
  6. Fire Performance: Tested in accordance with, and complying with the acceptance criteria of, NFPA 285; testing performed for previous project is acceptable provided tested system was truly equivalent.
- C. Panels: One inch (2.5 mm) deep pans formed of metal composite material sheet by routing back edges of sheet, removing corners, and folding edges.
1. Reinforce corners with riveted aluminum angles.
  2. Provide concealed attachment to supporting structure by adhering attachment members to back of panel; attachment members may also function as stiffeners.
  3. Maintain maximum panel bow of 0.8 percent of panel dimension in width and length; provide stiffeners of sufficient size and strength to maintain panel flatness without showing local stresses or read-through on panel face.
  4. Reinforce panels of sizes required by manufacturer, with metal angle braces 24 inches on center in short direction.
  5. Secure members to back face of panels using structural silicone sealant approved by MCM sheet manufacturer.
  6. Fabricate panels under controlled shop conditions.
  7. Where final dimensions cannot be established by field measurement before commencement of manufacturing, make allowance for field adjustments without requiring field fabrication of panels.
  8. Fabricate as indicated on drawings and as recommended by MCM sheet manufacturer.
    - a. Make panel lines, breaks, curves and angles sharp and true.
    - b. Keep plane surfaces free from warp or buckle.
    - c. Keep panel surfaces free of scratches or marks caused during fabrication.
  9. Provide joint details providing a watertight and structurally sound wall panel system that allows no uncontrolled water penetration on inside face of panel system.
  10. For "dry" jointing, secure extrusions to returned pan edges with stainless steel rivets; provide means of concealed drainage with baffles and weeps for water that might accumulate in members of system.

## 2.03 MATERIALS

- A. Metal Composite Material (MCM) Sheet: Two sheets of aluminum sandwiching a solid core of extruded thermoplastic material formed in a continuous process with no glues or adhesives between dissimilar materials; core material free of voids and spaces; no foamed insulation material content.
1. Overall Sheet Thickness: 4 mm.
  2. Face Sheet Thickness: 0.020 inches (0.51 mm), minimum.
  3. Alloy: Manufacturer's standard, selected for best appearance and finish durability.
  4. Bond and Peel Strength: No adhesive failure of the bond between the core and the skin nor cohesive failure of the core itself below 22.4 inch-pound/inch (100 N-mm/mm) with no degradation in bond performance, when tested in accordance with ASTM D 1781, simulating resistance to panel delamination, after 8 hours of submersion in boiling water and after 21 days of immersion in water at 70 degrees F (21 degrees C).
  5. Surface Burning Characteristics: Flame spread index of 25, maximum; smoke developed index of 450, maximum; when tested in accordance with ASTM E 84.
  6. Flammability: Self-ignition temperature of 650 degrees F (343 degrees C) or greater, when tested in accordance with ASTM D 1929.
  7. Factory Finish: One coat fluoropolymer resin coating, approved by the coating manufacturer for the length of warranty specified for the project, and applied by coil manufacturing facility that specializes in coil applied finishes.
    - a. Basis of Design: Kynar 500 fluoropolymer resin coating.
    - b. Coating Flexibility: Pass ASTM D 4145 minimum 1T-bend, at time of manufacturing.
    - c. Long-Term Performance: Not less than that specified under WARRANTY in PART 1.
  8. Color/Texture: As selected from manufacturer's standard selection.
- B. Metal Framing Members: Include all sub-girts, zee-clips, base and sill angles and channels, hat-shaped and rigid channels, and furring channels required for complete installation.
1. Provide material strength, dimensions, configuration as required to meet the applied loads applied and in compliance with applicable building code.
  2. Sheet Steel Components: ASTM A 653/A 653M galvanized to G90/Z275 or zinc-iron alloy-coated to A60/ZF180; or ASTM A 792/A 792M aluminum-zinc coated to AZ60/AZM180.
  3. Stainless Steel Sheet Components: ASTM A 480/A 480M.
- C. Flashing: Sheet aluminum; 0.040 inch (1.0 mm) thick, minimum; finish and color to match MCM sheet.
- D. Anchors, Clips and Accessories: Use one of the following:
1. Stainless steel complying with ASTM A 480/A480M, ASTM A 276 or ASTM A 666.
  2. Steel complying with ASTM A 36/A 36M and hot-dipped galvanized to ASTM A153/A153M.
  3. Steel complying with ASTM A 36/A 36M and hot-dipped galvanized to ASTM A123/A123M Coating Grade 10.
- E. Fasteners:
1. Exposed fasteners: Stainless steel; permitted only where absolutely unavoidable and subject to prior approval of the Architect.
  2. Screws: Self-drilling or self-tapping Type 410 stainless steel or zinc-alloy steel hex washer head, with EPDM or PVC washer under heads of fasteners bearing on weather side of metal wall panels.
  3. Bolts: Stainless steel.
  4. Fasteners for Flashing and Trim: Blind fasteners of high-strength aluminum or stainless steel.
- F. Bituminous Coating: Cold-applied asphalt mastic, noncorrosive compound free of asbestos, sulfur, and other deleterious impurities; 15 mil (0.4 mm) dry film thickness per coat.
- G. Joint Sealer: As specified in Section 079005, subject to MCM sheet manufacturer's approval.
- H. Provide panel system manufacturer's and installer's standard corrosion resistant accessories, including fasteners, clips, anchorage devices and attachments.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify dimensions, tolerances, and interfaces with other work.
- B. Verify substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturers written instructions.

### **3.02 PREPARATION**

- A. Protect adjacent work areas and finish surfaces from damage during installation.

### **3.03 INSTALLATION**

- A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.
- B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.
- C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.
- D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.
- E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.
- F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.
- G. Install flashings as indicated on shop drawings At flashing butt joints, provide a lap strap under flashing and seal lapped surfaces with a full bed of non-hardening sealant.
- H. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:
  - 1. Variation From Plane or Location: 1/2 inch in 30 feet (10 mm in 10 m) of length and up to 3/4 inch in 300 feet (20 mm in 100 m), maximum.
  - 2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
  - 3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet (3 mm in 9 m) run, maximum.
  - 4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch (0.75 mm), maximum.
- I. Replace damaged products.
  - 1. Exception: Field repairs of minor damage to finishes are permitted only when approved in writing by Architect, panel manufacturer, and fabricator.
  - 2. Field Repairs to Finishes: Using materials and methods sufficient that repairs are not discernible when viewed at distance of 10 feet (3000 mm) under all typical light conditions experienced at the project.

### **3.04 FIELD QUALITY CONTROL**

- A. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.
- B. Site Visits: Schedule two site visits during execution of installation.

**3.05 CLEANING**

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Remove temporary coverings and protection of adjacent work areas.
- D. Clean installed products in accordance with manufacturer's instructions.

**3.06 PROTECTION**

- A. Protect installed panel system from damage by subsequent construction activities until Date of Substantial Completion.
- B. Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations; replace damaged components that cannot be repaired to original condition.

**END OF SECTION**

**SECTION 075300  
ADHERED EPDM ROOFING SYSTEM**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Adhered EPDM roofing system and accessories.

1.02 RELATED SECTIONS

- A. Section 079513: Expansion Joint Assemblies: for roof expansion joints

1.03 SUBMITTALS

- A. Submit shop drawings with materials list and descriptive product information, flashing details and insulation layout, roof walkway pad layout.
- B. Manufacturer's installation instructions: Indicate special precautions required for seaming the membrane.
- C. Submit Shop Drawings with the following information:
  - 1. Materials list and descriptive information
  - 2. Flashing details
- D. Submit sample of manufacturer's warranty with product data submittal.

1.04 QUALIFICATIONS

- A. Single-ply roofing system shall be applied only by factory trained and approved roofing installer familiar with the product and in strict compliance with manufacturer's recommendations.

1.05 QUALITY CONTROL

- A. Manufacturer's field reports: Submit written report from the roof system manufacturer's representative after inspection of roof deck to verify deck is satisfactory for installation of system. Submit additional report indicating roof has been installed in accordance with manufacturer's requirements.
- B. Record of work: Submit written records indicating temperature and moisture conditions and the type and location of work being done during each day of roofing operations.

1.06 PRE-INSTALLATION MEETING

- A. Convene one week before starting work of this section.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Do not apply roofing membrane during inclement weather.
- B. Do not apply roofing membrane to damp or frozen deck surface.
- C. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed during same day.

## 1.08 WARRANTY

- A. Provide the Owner with a written ten year limited warranty as follows:
1. The manufacturer of the roofing membrane shall warrant to the Owner for a period of ten years that the manufacturer's EPDM roofing system as installed on the building shall be free from defects in materials supplied by the manufacturer and free from defects in workmanship by the roofing installer.
  2. During the term of this warranty the manufacturer shall have access to the roof for inspection during normal business hours.
  3. The Owner shall obtain the manufacturer's written approval before making alterations of the roof or installing structures, fixtures or utilities on or through the roof.
  4. The Owner will provide the manufacturer with written notification of defects or leaks in the roof and claims under the warranty within 30 days of the discovery of the defect or leak.
  5. The installer of materials of this section shall provide the Owner with a ten year limited written warranty covering the complete repair, (including repair of all leaks) and/or replacement of roofing work including materials and labor. The warranty shall be written on the installer's letterhead stationery and signed by an employee of the firm with authority to provide the warranty.
  6. Cost of warranty repair/replacement shall not exceed the original cost of the installed roof.

## PART 2 - PRODUCTS

### 2.01 MATERIALS

- A. Fully Adhered EPDM Membrane: Ethylene propylene diene monomers formed into uniform, flexible sheets, complying with ASTM D 4637, Type FR Class "A" fire rating.
1. Class U: Unreinforced.
  2. Thickness: 60 mils, nominal.
  3. Exposed Face Color: Manufacturer's standard.
- B. Fully Adhered EPDM Membrane: Manufacturer's standard installation.

### 2.02 AUXILIARY MATERIALS

- A. Sheet Seaming System: Manufacturer's standard materials for sealing lapped joints, including edge sealer to cover exposed spliced edges as recommended by membrane manufacturer.
- B. Adhesive, Sealant, Thinner and Cleaner, Edge Strips, and Flashing Accessories: Types recommended by membrane manufacturer.
- C. Flashing Material: Manufacturer's standard system compatible with single-ply membrane.
- D. Elastomeric Membrane Flashing: Self-curing EPDM, Carlisle Elastoform, or approved equal.
- E. Fasteners: Fluoropolymer coated, corrosion resistant screw fasteners with stress plates, approved for use by membrane manufacturer.
- F. Roof and Tapered Insulation: NRG ENERGY -2 board, or approved equal, rigid, cellular, thermal insulation with polyisocyanurate closed-cell foam core and manufacturer's standard facing laminated to both sides; complying with FS HH-I-1972/2, Class 1. Provide tapered insulation with 1/4 inch taper.



Starting edge thickness for tapered shall be 1/2 inch. Provide positive pitch to roof drains.

- G. Crickets: Crickets made of same material as tapered insulation with 1/2 inch per foot taper.
- H. Molded Pipe Flashing: Manufacturer's standard one-piece, seamless, molded EPDM furnished by membrane manufacturer and designed for pipe flashings at roof penetrations, accommodating 1" o.d. pipe to 6-1/2" o.d. pipe. Pipe flashings shall include stainless steel clamping rings for compression.
- I. Roof Drains: Schuller Flexi-Drain, coordinate outlet size.
- J. Roof Walkway Pads: Carlisle 30" by 30" wide by 3/8 inch thick rubber roof guard pads. Provide quantity of roof pads from roof access point to all mechanical equipment.

## 2.04 AUXILIARY INSULATION MATERIALS

- A. Adhesive for Bonding Insulation: Type recommended by insulation manufacturer and complying with fire-resistance requirements.
- B. Mastic Sealer: Type recommended by insulation manufacturer for bonding edge joints and filling voids.
- C. Provide system tested and approved for I-90 wind-uplift rating.

## PART 3 - EXECUTION

### 3.1 PREPARING SUBSTRATE

- A. Comply with manufacturers' instructions to prepare substrate to receive single-ply membrane system.
- B. Verify that penetrations, expansion joints, and blocking are in place and secured and that roof drains are properly clamped into position.
- C. Clean substrate of dust, debris, and other substances detrimental to single-ply system installation. Remove sharp projections.

### 3.2 INSTALLING FIBERBOARD

- A. Mechanically fasten fiberboard to substrate, extending insulation over entire surface to receive EPDM roofing, cutting and fitting tightly around obstructions. Form crickets, saddles, and tapered areas with additional material as indicated and as required for proper drainage of membrane.
- B. Lay boards with edges in moderate contact without forcing. Cut insulation to fit neatly to perimeter blocking and around penetrations through roof.
- C. Provide tapered units to suit drainage pattern indicated.

### 3.3 INSTALLING MEMBRANE

- A. Start installation only in presence of manufacturer's technical representative.
- B. Fully adhered membrane: install membrane by unrolling over prepared substrate, lapping adjoining sheets as recommended by manufacturer. Apply adhesive to surfaces to be bonded and roll into place when adhesive has properly cured. Treat seams with special

adhesive and apply sealant to exposed sheet edges, tapering application as recommended by manufacturer. Install mechanical fasteners, flashings and counterflashings, and accessories at locations and as recommended by manufacturer.

- C. Overlap edges and ends and seal by solvent welding, minimum 3". Seal permanently waterproof. Apply uniform bead of sealant to joint edge.
- D. Shingle joints on sloped substrate in direction of drainage. Apply joint tape and seal.
- E. Seal membrane around roof penetrations.
- F. Walkway protection: adhere walkway pads to roofing membrane using manufacturer recommended tape or adhesive. Space as recommended by manufacturer. Do not place over seams in the roofing membrane.

#### 3.4 CLEANING

- A. In areas where finished surfaces are soiled by Work of this section, consult manufacturer of surfaces for cleaning advice and conform to their instructions.
- B. Repair or replace defaced or disfigured finishes caused by Work of this section.

#### 3.5 PROTECTING ROOFING

- A. After completing roofing (including associated work), institute appropriate procedures for surveillance and protection of roofing during remainder of construction period.
- B. Repair or replace (as required) deteriorated or defective work found at the time of final inspection to a condition free of damage and deterioration at the time of Substantial Completion and according to the requirements of the specified warranty.

**END OF SECTION**

## **SECTION 076200**

### **SHEET METAL FLASHING AND TRIM**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings and counterflashings.
- B. Fabricated sheet metal items for metal wall panels and metal composite material wall panels.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood nailers.
- B. Section 074264 - Metal Composite Material Wall Panels: Wall panel flashings.
- D. Section 075300 - Adhered EPDM Roof System.
- E. Section 079005 - Joint Sealers.

##### **1.03 REFERENCE STANDARDS**

- A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels; 2002.
- B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.
- C. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.
- D. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2003.
- E. ASTM D 2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing; 2004.
- F. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007.
- G. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association; 2003.

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
- C. Samples: Submit two samples 4 x 4 inch in size illustrating metal finish color.

##### **1.05 QUALITY ASSURANCE**

- A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements and standard details, except as otherwise indicated.
- B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

##### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in manufacturer's original packaging, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, away from direct sunlight, clear of ground and

- C. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- D. Prevent contact with materials that could cause discoloration or staining.

## **PART 2 PRODUCTS**

### **2.01 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.
- B. Pre-Finished Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal, shop pre-coated with modified silicone coating.
  - 1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system; color as scheduled.
  - 2. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as scheduled.
- C. Stainless Steel: ASTM A 666 Type 304, soft temper, 0.015 inch (0.4 mm) thick; smooth No. 4 finish.

### **2.02 ACCESSORIES**

- A. Fasteners: Stainless steel, with soft neoprene washers.
- B. Underlayment: ASTM D 2178, glass fiber roofing felt.
- C. Primer: Zinc chromate type.
- D. Protective Backing Paint: Zinc molybdate alkyd.
- E. Sealant: Type as specified in Section 079005.
- F. Plastic Cement: ASTM D 4586, Type I.

### **2.03 FABRICATION**

- A. Form sections true to shape, accurate in size, square, and free from distortion or defects.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch (450 mm) long legs; seam for rigidity, seal with sealant.
- F. Fabricate vertical faces with bottom edge formed outward 1/4 inch (6 mm) and hemmed to form drip.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.

### **3.02 PREPARATION**

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil (0.4 mm).

### **3.03 INSTALLATION**

- A. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- B. Apply plastic cement compound between metal flashings and felt flashings.
- C. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- D. Seal metal joints watertight.

### **3.04 FIELD QUALITY CONTROL**

- A. See Division 1 - Quality Requirements, for field inspection requirements.
- B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

### **3.05 CLEANING**

- A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.
- B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.
- C. Clean installed products in accordance with manufacturer's instructions.

### **3.06 PROTECTION**

- A. Protect installed flashing from damage by subsequent construction activities until Date of Substantial Completion.
- B. Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations; replace damaged components that cannot be repaired to original condition.

**END OF SECTION**

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## **SECTION 078100**

### **APPLIED FIREPROOFING**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Fireproofing of interior structural steel.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 053100 - Steel Decking.
- B. Section 051200 – Structural Steel
- C. Section 078400 - Firestopping.

##### **1.03 REFERENCE STANDARDS**

- A. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2008.
- B. ASTM E 605 - Standard Test Methods for Thickness and Density of Sprayed Fire-Resistive Material (SFRM) Applied to Structural Members; 1993 (Reapproved 2006).
- C. ASTM E 736 - Standard Test Method For Cohesion/Adhesion of Sprayed Fire-Resistive Materials Applied to Structural Members; 2000 (Reapproved 2006).
- D. ASTM E 760 - Standard Test Method for Effect of Impact on Bonding of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2005).
- E. ASTM E 761 - Standard Test Method for Compressive Strength of Sprayed Fire-Resistive Material Applied to Structural Members; 1992 (Reapproved 2005).

##### **1.04 PERFORMANCE REQUIREMENTS**

- A. Sprayed-On Fireproofing Systems: Provide fire-rated assembly ratings to UL Design Numbers as indicated on the drawings.

##### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittals procedures.
- B. Product Data: Provide data indicating product characteristics.
- C. Test Reports: Reports from reputable independent testing agencies for proposed products, indicating compliance with specified criteria, conducted under conditions similar to those on project, for:
  - 1. Bond Strength.
  - 2. Bond Impact.
  - 3. Compressive Strength.
  - 4. Fire tests using substrate materials similar those on project.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Manufacturer's Certificate: Certify that sprayed-on fireproofing products meet or exceed requirements of contract documents.
- F. Manufacturer's Field Reports: Indicate environmental conditions under which fireproofing materials were installed.

##### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

- B. Applicator Qualifications: Company specializing in performing the work of this section, and approved by manufacturer.

### **1.07 REGULATORY REQUIREMENTS**

- A. Conform to applicable code for fire resistance ratings.
- B. Provide certificate of compliance for fireproofing materials to authority having jurisdiction, indicating approval for use on this project.

### **1.08 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, away from direct sunlight, clear of ground and moisture.

### **1.09 PROJECT CONDITIONS**

- A. Sequence work in conjunction with placement of ceiling hanger tabs, mechanical component hangers, and electrical components.

### **1.10 FIELD CONDITIONS**

- A. Do not apply spray fireproofing when temperature of substrate material and surrounding air is outside range recommended by fireproofing manufacturer.
- B. Provide ventilation in areas to receive fireproofing during application and 24 hours afterward, to dry applied material.
- C. Provide temporary enclosure to prevent spray from contaminating air.
- D. Do not allow roof traffic during installation of roof fireproofing and drying period.

### **1.11 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
  - 1. Include coverage for fireproofing to remain free from cracking, checking, dusting, flaking, spalling, separation, and blistering.
  - 2. Reinstall or repair failures that occur within warranty period.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Sprayed-On Fireproofing:
  - 1. Grace Construction Products: [www.na.graceconstruction.com](http://www.na.graceconstruction.com).
  - 2. Isolatek International Inc: [www.isolatek.com](http://www.isolatek.com).
  - 3. Southwest Fireproofing Products Company: [www.sfrm.com](http://www.sfrm.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.

### **2.02 FIREPROOFING ASSEMBLIES**

- A. Provide assemblies as indicated on the drawings.

### **2.03 MATERIALS**

- A. Low Density Sprayed Fire-Resistive Material: Factory mixed, cementitious material blended for uniform texture with vermiculite or lightweight synthetic aggregate, and conforming to the following requirements:
  - 1. Bond Strength: ASTM E 736, 200 psf (9.6 kPa) when set and dry.
  - 2. Bond Impact: ASTM E 760, no cracking, flaking or delamination.



3. Dry Density: ASTM E 605, minimum average density of 14 lb/cu ft (225 kg/cu m), with minimum individual density of any test sample of 13 lb/cu ft (210 kg/cu m).
  4. Compressive Strength: ASTM E 761, minimum 7.0 psi (50 kPa).
  5. Surface Burning Characteristics: Maximum flame spread of 0 and maximum smoke developed of 0, when tested in accordance with ASTM E 84.
- B. Medium Density Sprayed Fire-Resistive Material: Factory mixed, portland cement blended for uniform texture with mineral aggregates or mineral fibers and additives, without chlorides, approved for exterior use and conforming to the following requirements:
1. Bond Strength: ASTM E 736, 2000 psf (95.7 kPa) when set and dry.
  2. Bond Impact: ASTM E 760, no cracking, flaking or delamination.
  3. Dry Density: ASTM E 605, minimum density of 21 lb/cu ft (340 kg/cu m).
  4. Compressive Strength: ASTM E 761, minimum 65 psi (450 kPa).
  5. Surface Burning Characteristics: Maximum flame spread of 0 and maximum smoke developed of 0, when tested in accordance with ASTM E 84.

## 2.04 ACCESSORIES

- A. Primer Adhesive: Of type recommended by fireproofing manufacturer.
- B. Overcoat: As recommended by manufacturer of fireproofing material.
- C. Metal Lath: Expanded metal lath; 3.4 lb/sq ft (16 kg/sq m), galvanized finish.
- D. Water: Clean, potable.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that surfaces are ready to receive fireproofing.
- B. Verify that clips, hangers, supports, sleeves, and other items required to penetrate fireproofing are in place.
- C. Verify that ducts, piping, equipment, or other items that would interfere with application of fireproofing have not been installed.
- D. Verify that voids and cracks in substrate have been filled. Verify that projections have been removed where fireproofing will be exposed to view as a finish material.

### 3.02 PREPARATION

- A. Perform tests as recommended by fireproofing manufacturer in situations where adhesion of fireproofing to substrate is in question.
- B. Remove incompatible materials that could affect bond by scraping, brushing, scrubbing, or sandblasting.
- C. Prepare substrates to receive fireproofing in strict accordance with instructions of fireproofing manufacturer.
- D. Apply fireproofing manufacturer's recommended bonding agent on primed steel.
- E. Protect surfaces not scheduled for fireproofing and equipment from damage by overspray, fall-out, and dusting.
- F. Close off and seal duct work in areas where fireproofing is being applied.

### **3.03 APPLICATION**

- A. Install metal lath over structural members as indicated or as required by UL Assembly Design Numbers.
- B. Apply primer adhesive in accordance with manufacturer's instructions.
- C. Apply fireproofing in sufficient thickness to achieve required ratings, with as many passes as necessary to cover with monolithic blanket of uniform density and texture.
  - 1. Low Density Sprayed Fire-Resistive Material: Apply in locations where fireproofing will be concealed by other construction.
  - 2. Medium Density Sprayed Fire-Resistive Material: Apply in locations where fireproofing will remain exposed at the end of construction.
- D. In exposed locations, trowel surface smooth and form square edges, using tools and procedures recommended by fireproofing manufacturer.
- E. Apply overcoat to a thickness of \_\_\_\_ inches.

### **3.04 FIELD QUALITY CONTROL**

- A. Inspect the installed fireproofing after application and curing for integrity, prior to its concealment. Ensure that actual thicknesses, densities, and bond strengths meet requirements for specified ratings.
- B. Re-inspect the installed fireproofing for integrity of fire protection, after installation of subsequent Work.

### **3.05 CLEANING**

- A. Remove excess material, overspray, droppings, and debris.
- B. Remove fireproofing from materials and surfaces not required to be fireproofed.
- C. At exposed fireproofing, clean surfaces that have become soiled or stained, using manufacturer's recommended procedures.

### **3.06 PROTECTION**

- A. Protect installed fireproofing from damage by subsequent construction activities until Date of Substantial Completion.
- B. Repair fireproofing damaged by subsequent construction activities in accordance with manufacturer's recommendations.

**END OF SECTION**

## **SECTION 078400**

### **FIRESTOPPING**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of all joints and penetrations in fire-resistance rated and smoke-resistant assemblies, whether indicated on drawings or not.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 017000 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 078100 - Applied Fireproofing.
- C. Section 092116 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.
- D. Division 15: Firestopping of mechanical work.
- E. Division 16: Firestopping of electrical work.

##### **1.03 REFERENCE STANDARDS**

- A. ASTM E 814 - Standard Test Method for Fire Tests of Through-Penetration Fire Stops; 2006.
- B. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- C. FM 4991 - Approval of Firestop Contractors; Factory Mutual Research Corporation; 2001.
- D. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.
- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; [www.aqmd.gov](http://www.aqmd.gov).
- F. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Certificate from authority having jurisdiction indicating approval of materials used.
- G. Qualification statements for installing mechanics.

##### **1.05 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in the current-year classification or certification books of UL, FM, or ITS (Warnock Hersey) will be considered as constituting an acceptable test report.
  - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
  - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.

- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section and:
  - 1. Approved by Factory Mutual Research under FM Standard 4991, Approval of Firestop Contractors, or meeting any two of the following requirements:.
  - 2. With minimum five years documented experience installing work of this type.

#### **1.06 MOCK-UP**

- A. Install one firestopping assembly representative of each fire rating design required on project.
  - 1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
- B. Obtain approval of authority having jurisdiction before proceeding.
- C. If accepted, mock-up will represent minimum standard for the Work.
- D. If accepted, mock-up may remain as part of the Work. Remove and replace mock-ups not accepted.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, away from direct sunlight, clear of ground and moisture.

#### **1.08 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation. Maintain minimum temperature before, during, and for 3 days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

### **PART 2 PRODUCTS**

#### **2.01 FIRESTOPPING SYSTEMS**

- A. Firestopping: Any material meeting requirements.
  - 1. Fire Ratings: Use any system listed by UL or tested in accordance with ASTM E 814 that has F Rating equal to fire rating of penetrated assembly and T Rating Equal to F Rating and that meets all other specified requirements.
- B. Firestopping Between Edge of Floor Slab and Curtain Wall (without Penetrations): Glass fiber or mineral fiber safing insulation.

#### **2.02 MATERIALS**

- A. Firestopping Sealants: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. Elastomeric Silicone Firestopping: Single component silicone elastomeric compound and compatible silicone sealant; conforming to the following:
  - 1. Movement Capability: ASTM C 719  $\pm$  50%.
  - 2. Stress: 1/2" x 1/2" Bead 35 lbs/in. at 50% Extension.
  - 3. Hardness Shore: 25 per ASTM D 2240.
  - 4. Tensile Strength: 270 per ASTM D 412.
  - 5. Sag: Non-slump.
  - 6. Flame Spread/Smoke Development: 5/45 per ASTM E 84.
  - 7. Durability and Longevity: Permanent.
  - 8. Color: Light gray.

9. Manufacturers:
  - a. A/D Fire Protection Systems Inc: [www.adfire.com](http://www.adfire.com).
  - b. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
  - c. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  - d. Specified Technologies, Inc: [www.stifirestop.com](http://www.stifirestop.com).
  - e. Substitutions: See Section 016000 - Product Requirements.
- C. Foam Firestopping: Single component silicone foam compound; conforming to the following:
  1. Density: 14-18 lb/cu ft.
  2. Cellular Structure: Approximately 50% Closed Cell.
  3. Oxygen Index: 28 Minimum.
  4. Durability and Longevity: Permanent.
  5. Color: Black.
  6. Manufacturers:
    - a. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
    - b. Specified Technologies, Inc: [www.stifirestop.com](http://www.stifirestop.com).
    - c. Substitutions: See Section 016000 - Product Requirements.
- D. Fiber Packing Material/Fire Safing Insulation: Manufactured from basaltic mineral wool, with fibers bonded and preformed into a selfsupporting semi-rigid board.
  1. Flame Spread/Smoke Development: 5/0 per ASTM E 84.
  2. Non-combustibility: Listed as non-combustible by UL when tested in accordance with ASTM E-136.
  3. Moisture Absorption: Less than 0.1% by volume when tested in accordance with ASTM C 1104.
  4. Non-corrosive: Will not cause or contribute to corrosion; ASTM C 692, ASTM C 795 and ASTM C 871.
  5. Thermal Resistance: R 4.35/in. per ASTM C 518.
  6. Manufacturers:
    - a. A/D Fire Protection Systems Inc. [www.adfire.com](http://www.adfire.com).
    - b. CertainTeed Corp. [www.certainteed.com](http://www.certainteed.com).
    - c. Fibrex Insulations Inc. [www.fibrex.on.ca](http://www.fibrex.on.ca).
    - d. Substitutions: See Section 01600 - Product Requirements.
- E. Firestop Devices - Wrap Type: Mechanical device with incombustible filler and sheet stainless steel jacket, intended to be installed after penetrating item has been installed; conforming to the following:
  1. Durability and Longevity: Permanent; suitable for pedestrian traffic.
  2. Manufacturers:
    - a. Grace Construction Products: [www.na.graceconstruction.com](http://www.na.graceconstruction.com).
    - b. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
    - c. Specified Technologies, Inc: [www.stifirestop.com](http://www.stifirestop.com).
    - d. Substitutions: See Section 016000 - Product Requirements.
- F. Firestop Devices - Cast-In Type: Sleeve and sealing material, intended to be cast in concrete floor forms or in concrete on metal deck, not requiring any additional materials to achieve penetration seal.
  1. Durability and Longevity: Permanent.
  2. Manufacturers:
    - a. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
    - b. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
    - c. Substitutions: See Section 016000 - Product Requirements.
- G. Intumescent Putty: Compound that expands on exposure to surface heat gain; conforming to the following:
  1. Potential Expansion: Minimum 500 percent.
  2. Density: 1.45 lb/cu ft.
  3. Solids: 100%.

4. Durability and Longevity: Permanent.
5. Color: Red.
6. Manufacturers:
  - a. Grace Construction Products: [www.na.graceconstruction.com](http://www.na.graceconstruction.com).
  - b. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
  - c. Specified Technologies, Inc: [www.stifirestop.com](http://www.stifirestop.com).
  - d. Substitutions: See Section 016000 - Product Requirements.

- H. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Type required for tested assembly design.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

#### **3.02 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to arrest liquid material leakage.
- D. Protect adjacent surfaces from damage by material installation.

#### **3.03 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by authority having jurisdiction.
- C. Install labelling required by code.

#### **3.04 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

#### **3.05 PROTECTION**

- A. Protect installed firestopping from damage by subsequent construction activities until Date of Substantial Completion.
- B. Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations; replace damaged components that cannot be repaired to original condition.

**END OF SECTION**

## **SECTION 079005**

### **JOINT SEALERS**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Sealants and joint backing.
- B. Precompressed foam sealers.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 078400 - Firestopping: Firestopping sealants.
- B. Section 086300 - Metal-Framed Skylights: Structural and weatherseal sealants and accessories.
- C. Section 088000 - Glazing: Glazing sealants and accessories.
- D. Section 092116 - Gypsum Board Assemblies: Acoustic sealant.
- E. Section 093000 - Tiling: Sealant used as tile grout.

##### **1.03 REFERENCE STANDARDS**

- A. ASTM C 834 - Standard Specification for Latex Sealants; 2005.
- B. ASTM C 919 - Standard Practice for Use of Sealants in Acoustical Applications; 2008.
- C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2005.
- D. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.
- E. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; [www.aqmd.gov](http://www.aqmd.gov).

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data indicating sealant chemical characteristics.
- C. Samples: Submit two samples, 12 inch in size illustrating sealant colors for selection.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

##### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- B. Applicator Qualifications: Company specializing in performing the work of this section approved by manufacturer.

##### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact.
- B. Store products in weather protected environment, away from direct sunlight, clear of ground and moisture.

##### **1.07 FIELD CONDITIONS**

- A. Maintain temperature and humidity recommended by the sealant manufacturer during and after installation.

## 1.08 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal, exhibit loss of adhesion or cohesion, or do not cure.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Silicone Sealants:
  - 1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 2. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com](http://www.momentive.com).
  - 3. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 4. BASF Construction Chemicals-Building Systems: [www.chemrex.com](http://www.chemrex.com).
  - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Polyurethane Sealants:
  - 1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 2. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 3. BASF Construction Chemicals-Building Systems: [www.chemrex.com](http://www.chemrex.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- C. Acrylic Sealants:
  - 1. Tremco Global Sealants: [www.tremcosealants.com](http://www.tremcosealants.com).
  - 2. Substitutions: See Section 016000 - Product Requirements.
- D. Butyl Sealants:
  - 1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 2. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 3. Substitutions: See Section 016000 - Product Requirements.
- E. Acrylic Emulsion Latex Sealants:
  - 1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  - 2. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  - 3. BASF Construction Chemicals-Building Systems: [www.chemrex.com](http://www.chemrex.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- F. Preformed Compressible Foam Sealers:
  - 1. EMSEAL Joint Systems, Ltd: [www.emseal.com](http://www.emseal.com).
  - 2. Sandell Manufacturing Company, Inc: [www.sandellmfg.com](http://www.sandellmfg.com).
  - 3. Dayton Superior Corporation: [www.daytonsuperior.com](http://www.daytonsuperior.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.

### 2.02 SEALANTS

- A. Sealants and Primers - General: Provide only products having lower volatile organic compound (VOC) content than required by South Coast Air Quality Management District Rule No.1168.
- B. General Purpose Exterior Sealant: Polyurethane; ASTM C 920, Grade NS, Class 25, Uses M, G, and A; single component.
  - 1. Color: Standard colors matching finished surfaces.
  - 2. Applications: Use for:
    - a. Control, expansion, and soft joints in masonry.
- C. General Purpose Exterior Sealant: Acrylic, solvent release curing; ASTM C 920, Grade NS,



Class 12-1/2, Uses M, G, and A; single or multi- component.

1. Color: Standard colors matching finished surfaces.
  2. Applications: Use for:
    - a. Joints between concrete and other materials.
    - b. Joints between metal frames and other materials.
    - c. Other exterior joints for which no other sealant is indicated.
- D. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
1. Applications: Use for:
    - a. Concealed sealant bead in sheet metal work.
    - b. Concealed sealant bead in siding overlaps.
- E. General Purpose Interior Sealant: Acrylic emulsion latex; ASTM C 834, Type OP, Grade NF single component, paintable.
1. Color: Standard colors matching finished surfaces.
  2. Applications: Use for:
    - a. Interior wall and ceiling control joints.
    - b. Joints between door and window frames and wall surfaces.
    - c. Other interior joints for which no other type of sealant is indicated.
- F. Tile Sealant: White silicone; ASTM C 920, Uses I, M and A; single component, mildew resistant.
1. Applications: Use for:
    - a. Joints between plumbing fixtures and floor and wall surfaces.
    - b. Joints between kitchen and bath countertops and wall surfaces.
- G. Acoustical Sealant: Butyl or acrylic sealant; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; single component, solvent release curing, non-skinning.
1. Applications: Use for concealed locations only:
    - a. Sealant bead between top stud runner and structure and between bottom stud track and floor.

## **2.03 ACCESSORIES**

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

### **3.02 PREPARATION**

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Clean and prime joints in accordance with manufacturer's instructions.
- C. Perform preparation in accordance with manufacturer's instructions and ASTM C 1193.
- D. Protect elements surrounding the work of this section from damage or disfigurement.

### **3.03 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C 1193.
- C. Perform acoustical sealant application work in accordance with ASTM C 919.
- D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- E. Install bond breaker where joint backing is not used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave.
- I. Precompressed Foam Sealant: Do not stretch; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

### **3.04 CLEANING**

- A. Clean adjacent soiled surfaces.

### **3.05 PROTECTION**

- A. Protect sealants until cured.

**END OF SECTION**

## SECTION 081113

### HOLLOW METAL DOORS AND FRAMES

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Non-fire-rated steel doors and frames.
- B. Steel frames for wood doors.
- C. Fire-rated steel doors and frames.
- D. Sound-rated steel doors and frames.
- E. Steel glazing frames.

##### 1.02 RELATED REQUIREMENTS

- A. Section 087100 - Door Hardware.
- B. Section 088000 - Glazing: Glass for doors and borrowed lites.
- C. Section 099000 - Painting and Coating: Field painting.

##### 1.03 REFERENCE STANDARDS

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.
- B. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames; 2003.
- C. ANSI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 1998 (R2004).
- D. ASTM A 653/A 653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2007.
- E. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus; 2005.
- F. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2004.
- G. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
- H. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).
- I. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2006.
- J. NAAMM HMMA 840 - Guide Specifications for Installation and Storage of Hollow Metal Doors and Frames; The National Association of Architectural Metal Manufacturers; 2007.
- K. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.
- L. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- M. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; 1998.
- N. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; 2001.

##### 1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes.
- C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and identifying location of different finishes, if any.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Maintain at the project site a copy of all reference standards dealing with installation.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Store in accordance with NAAMM HMMA 840.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion.

## **PART 2 PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Steel Doors and Frames:
  - 1. Assa Abloy Ceco, Curries, or Fleming: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Windsor Republic Doors: [www.republicdoor.com](http://www.republicdoor.com).
  - 3. Steelcraft: [www.steelcraft.com](http://www.steelcraft.com).
  - 5. Substitutions: See Section 016000 - Product Requirements.

### **2.02 DOORS AND FRAMES**

- A. Requirements for All Doors and Frames:
  - 1. Accessibility: Comply with ANSI/ICC A117.1.
  - 2. Door Top Closures: Flush with top of faces and edges.
  - 3. Door Edge Profile: Beveled on both edges.
  - 4. Door Texture: Smooth faces.
  - 5. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
  - 6. Hardware Preparation: In accordance with BHMA A156.115, with reinforcement welded in place, in addition to other requirements specified in door grade standard.
  - 7. Galvanizing for Units in Wet Areas: All components hot-dipped zinc-iron alloy-coated (galvannealed), manufacturer's standard coating thickness.
  - 8. Finish: Factory primed, for field finishing.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with all the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

### **2.03 STEEL DOORS**

- A. Interior Doors, Non-Fire-Rated:
  - 1. Grade: ANSI A250.8 Level 1, physical performance Level C, Model 1, full flush.
  - 2. Core: Cardboard honeycomb.
  - 3. Thickness: 1-3/4 inches (44 mm).

3. Galvanizing: All components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A 653/A 653M, with manufacturer's standard coating thickness at doors in Shower Areas.

C. Interior Doors, Fire-Rated:

1. Grade: ANSI A250.8 Level 2, physical performance Level B, Model 1, full flush.
2. Fire Rating: As indicated on Door and Frame Schedule, tested in accordance with UL 10C ("positive pressure").
  - a. Provide units listed and labeled by UL.
  - b. Attach fire rating label to each fire rated unit.

## 2.04 STEEL FRAMES

A. General:

1. Comply with the requirements of grade specified for corresponding door, except:
  - a. ANSI A250.8 Level 1 Doors: 16 gage frames.
  - b. ANSI A250.8 Level 3 Doors: 14 gage frames.
  - c. Frames for Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 18 gage
  - d. Frames for Sound-Rated Wood Doors: Comply with frame requirements specified in ANSI A250.8 for Level 1, 16 gage
2. Finish: Same as for door.
3. Frames Installed Back-to-Back: Reinforce with steel channels anchored to floor and overhead structure.

B. Interior Door Frames, Non-Fire-Rated: Fully welded type.

1. Terminated Stops: Provide at locations indicated; closed end stop terminated 6 inches (150 mm) above floor at 45 degree angle.

D. Interior Door Frames, Fire-Rated: Fully welded type.

1. Fire Rating: Same as door, labeled.

E. Frames for Interior Glazing or Borrowed Lights: Construction and face dimensions to match door frames, and as indicated on drawings.

## 2.05 ACCESSORY MATERIALS

- A. Glazing: As specified in Section 088000, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Silencers: Resilient rubber, fitted into drilled hole; 3 on strike side of single door, 3 on center mullion of pairs, and 2 on head of pairs without center mullions.
- D. Temporary Frame Spreaders: Provide for all factory- or shop-assembled frames.

## 2.06 FINISH MATERIALS

- A. Primer: Rust-inhibiting, complying with ANSI A250.10, door manufacturer's standard.
- B. Bituminous Coating: Asphalt emulsion or other high-build, water-resistant, resilient coating.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.

### 3.03 INSTALLATION

- A. Install in accordance with the requirements of the specified door grade standard and NAAMM HMMA 840.
- B. In addition, install fire rated units in accordance with NFPA 80.
- C. Coordinate frame anchor placement with wall construction.
- D. Coordinate installation of hardware.
- E. Coordinate installation of glazing.
- F. Coordinate installation of electrical connections to electrical hardware items.

#### **3.04 TOLERANCES**

- A. Clearances Between Door and Frame: As specified in ANSI A250.8.
- B. Maximum Diagonal Distortion: 1/16 in (1.5 mm) measured with straight edge, corner to corner.

#### **3.05 ADJUSTING**

- A. Adjust for smooth and balanced door movement.
- B. Adjust sound control doors so that seals are fully engaged when door is closed.

#### **3.06 PROTECTION**

- A. Protect installed doors and frames from damage by subsequent construction activities until Date of Substantial Completion.
- B. Repair components damaged by subsequent construction activities in accordance with manufacturer's recommendations.

**END OF SECTION**

## SECTION 081416

### FLUSH WOOD DOORS

#### PART 1 GENERAL

##### 1.01 RELATED REQUIREMENTS

- A. Section 081113 - Hollow Metal Doors and Frames.
- B. Section 081213 - Hollow Metal Frames.
- C. Section 087100 - Door Hardware.
- D. Section 088000 - Glazing.

##### 1.02 REFERENCE STANDARDS

- A. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
- B. ASTM E 1408 - Standard Test Method for Laboratory Measurement of the Sound Transmission Loss of Door Panels and Door Systems; 1991 (Reapproved 2000).
- C. AWI/AWMAC (QSI) - Architectural Woodwork Quality Standards Illustrated; Architectural Woodwork Institute and Architectural Woodwork Manufacturers Association of Canada; 2005, 8th Ed., Version 2.0.
- D. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc.; current edition.
- E. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.
- F. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association; 2008.
- G. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.
- H. UL 10B - Standard for Fire Tests of Door Assemblies; 2008.
- I. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; 2001.

##### 1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Specimen warranty.
- D. Test Reports: Show compliance with specified requirements for the following:
  - 1. Sound-retardant doors and frames; sealed panel tests are not acceptable.
- E. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing.
- F. Samples: Submit two samples of door construction, 6 by 6 inch (150 x 150 mm) in size cut from top corner of door.
- G. Samples: Submit two samples of door veneer, 6 by 6 inch (150 by 150 mm) in size illustrating wood grain, stain color, and sheen.
- H. Manufacturer's Installation Instructions: Indicate special installation instructions.
- I. Warranty, executed in Owner's name.

#### **1.04 QUALITY ASSURANCE**

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
- C. Installed Fire Rated Door Assembly: Conform to NFPA 80 for fire rated class as indicated.
- D. Smoke and Draft Control Doors None - N/A: In addition to required fire rating, comply with air leakage requirements of UL 1784; with "S" label; if necessary, provide additional gasketing or edge sealing.

#### **1.05 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

#### **1.06 PROJECT CONDITIONS**

- A. Coordinate the work with door opening construction, door frame and door hardware installation.

#### **1.07 WARRANTY**

- A. See Section 017800 - Closeout Submittals for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Wood Veneer Faced Doors:
  - 1. Eggers Industries: [www.eggersindustries.com](http://www.eggersindustries.com).
  - 2. Marshfield DoorSystems, Inc: [www.marshfielddoors.com](http://www.marshfielddoors.com).
  - 3. VT Industries, Inc: [www.vtindustries.com](http://www.vtindustries.com).
  - 6. Substitutions: See Section 016000 - Product Requirements.

#### **2.02 DOORS**

- A. All Doors: See drawings for locations and additional requirements.
  - 1. Quality Level: Premium Grade, in accordance with AWI/AWMAC Architectural Woodwork Quality Standards Illustrated, Section 1300.
  - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches (44 mm) thick unless otherwise indicated; flush construction.
  - 1. Provide solid core doors at all locations.
  - 2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with NFPA 252, UL 10B, or UBC Standard 7-2-94 ("neutral pressure"); UL or WH (ITS) labeled without any visible seals when door is open.
  - 3. Smoke and Draft Control Doors: In addition to required fire rating, provide door assemblies tested in accordance with UL 1784 with maximum air leakage of 3.0 cfm per sq ft (0.01524 cu m/s/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure at both ambient and elevated temperatures; with "S" label; if necessary, provide additional gasketing or edge sealing.



4. Wood veneer facing with factory transparent finish.

### **2.03 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard with no added urea formaldehyde, plies and faces as indicated above.
- B. Fire Rated Doors: Mineral core, Type FD, plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.
  1. Provide composite products containing no added urea-formaldehyde.

### **2.04 DOOR FACINGS**

- A. Wood Veneer Facing for Transparent Finish: Clear Maple, veneer grade as specified by quality standard, plain sliced, book veneer match, running assembly match; unless otherwise indicated.
  1. Vertical Edges: Same species as face veneer.
- B. Facing Adhesive: Type II - water resistant.

### **2.05 ACCESSORIES**

- A. Glazing Stops: Wood, of same species as door facing, butted corners; prepared for countersink style tamper proof screws.

### **2.06 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- C. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- D. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

### **2.07 FACTORY FINISHING - WOOD VENEER DOORS**

- A. Factory finish doors in accordance with approved sample.
- B. Seal door top edge with color sealer to match door facing.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### **3.02 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Coordinate installation of glazing.

### **3.03 TOLERANCES**

- A. Conform to specified quality standard for fit and clearance tolerances.

- B. Conform to specified quality standard for maximum diagonal distortion.

#### **3.04 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

#### **3.05 PROTECTION**

- A. Protect installed doors from damage by subsequent construction activities until Date of Substantial Completion.
- B. Repair doors damaged by subsequent construction activities in accordance with manufacturer's recommendations.

**END OF SECTION**

**SECTION 081433  
STILE AND RAIL WOOD DOORS**

**PART 1. General**

1.01 Section Includes

- A. Glazed stile and rail wood doors.

1.02 Related Sections

- A. Section 081100 – Hollow Metal Doors and Frames
- B. Section 087100 - Finish hardware
- C. Section 088000 – Glazing

1.03 References and Regulatory Requirements

- A. Quality Standards:
  - 1. WDMA Industry Standard I.S. 6A-99 (Window & Door Manufacturers Association).
  - 2. AWI Quality Standards 7th Edition, Version 1.0 1997.
  - 3. ANSI A115. W Series, Wood Door Hardware Standards. (American National Standard Institute)

1.04 Door Description:

- A. Interior Doors: (Non-rated), 1-3/4 inch thick

1.05 Submittals

- A. Submit under provisions of Section 013000.
- B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts, glass and glazing.
- C. Product Data: Indicate door core materials, thickness, construction, panel and sticking profile, veneer species, cut and matching requirements, factory machining and factory finishing criteria.
- D. Construction Samples: Submit one or more of manufacturer's standard samples demonstrating door construction.
- E. Finish Samples: A set of 3 illustrating the range of color and grain of the specified door face materials.
- F. Manufacturer's Limited Lifetime Warranty

1.06 Quality Assurance

- A. Meet or exceed WDMA I.S.1-A Premium Grade and/or AWI Version 7 Custom Grade.

1.07 Delivery, Storage, Handling, and Site Conditions

- A. Deliver, store, protect and handle products under provisions of WDMA, AWI and

manufacturer's instructions.

- B. Accept doors on site in manufacturer's standard packaging. Inspect for damage upon receipt.
- C. Do not store in damp or wet areas or in areas where light might cause oxidization.
- D. HVAC systems should be operating and balanced prior to arrival of doors. Acceptable humidity shall be no less than 25% nor greater than 55%.
- E. Break seal on packages while at site to permit ventilation.

#### 1.09 Warranty

A. Provide manufacturer's warranty to the following term:

- 1. Interior Stile and Rail Doors: Limited Lifetime.

### **PART 2. Products**

#### 2.01 Manufacturer

- A. Marshfield DoorSystems, Inc., quality as defined in this section.
- B. Eggers Industries, Neenah Wisconsin
- C. Algoma Hardwoods, Algoma, Wisconsin

#### 2.02 Workmanship

- A. Comply with WDMA/AWI workmanship for veneer faces, vertical edges, stiles and rails, panels, horizontal edges and dimensional tolerances.

#### 2.03 Materials

A. DOOR CONSTRUCTION GRADE

- 1. Except as may be otherwise shown on the drawings, fabricate the work of this section to WDMA "Custom Grade" AWI "Custom Grade".

B. STILE AND RAIL DOOR FACING, SLICE OR CUT, FINISH AND MATCHING

- 1. Wood Veneer: AWI - A Grade: The veneer species, slice or cut, and finish shall be:
  - a. White Maple, Plain sliced, clear finish, equal to Marshfield style as shown on the drawings for Door Type LG2.
- 2. Matching: Direction of veneer for all rails shall be horizontal and shall be vertical for mullions and stiles. Veneer match and sequence within and between all panels shall be mill option. All door components shall be selected for compatibility of grain and color.

C. DOORS IN PAIRS OR SETS

- 1. Specify per project requirements. Door schedule shall reflect pairs and sets by door numbers.

2. Veneered panel sequence between paired doors shall be mill option.
3. The veneer, slice or cut, finish and veneer matching shall match. Matching between paired doors shall be selected for compatibility of color.

#### 2.04 Fabrication

##### A. DOOR CORE CONSTRUCTION

1. Stiles, rails mullions and cross rails shall be veneered construction using Medium Density Fiberboard core. Joints to be tongue and grooved, doweled and glued under pressure.

##### B. VERTICAL EDGES (STILES)

1. Non-rated
  - a. Edges to match face veneer.

##### C. PANELS

1. Panels shall be Medium Density Fiberboard core with perimeter shaped to proper contour, and laminated with veneer to form a 3-ply panel. Panels shall be flat. Panels shall be raised. Panel edge concealed after assembly by solid lumber sticking bead.
2. One or more panels shall be replaced with glazing as indicated.

##### D. STICKING

1. Sticking shape shall be ogee profile. Sticking shall be coped at corners, same species as face veneer.

##### E. COMPONENT FACE DIMENSIONS

1. Component face dimensions, prior to cutting final door clearances, shall be per Marshfield Door Systems, Inc standard.

##### F. ADHESIVES

1. Facing Adhesive: Type 1 - Waterproof.

#### 2.06 Factory Finish

- A. Factory finish doors in accordance with WDMA Finish System Description or AWI Division 1500-S-4 - Finish System Standards. Factory finish to be an infrared cured waterborne lacquer to comply with DPA Title 5 guidelines for Volatile Organic Compound (VOC) emissions limitations. Finish must meet or exceed performance standards of TR-3 waterborne lacquer.
- B. Factory finished doors to be installed just prior to substantial completion.

### **PART 3. Execution**

### 3.01 Examination

- A. Verify substrate opening conditions.
- B. Verify that opening sizes and tolerances are acceptable and ready to receive this work.
- C. Do not install doors in frame openings that are not plumb or are out of tolerance for size or alignment.

### 3.02 Installation

- A. Trim non-rated door width by cutting equally on both jamb edges.
- B. Trim door height by cutting bottom edges to a maximum 3/4 inch (19 mm).
- D. Pilot drill screw and bolt holes using templates provided by hardware manufacturer.
- E. Coordinate installation of doors with installation of frames and hardware.
- F. Reseal or refinish any doors that required site alteration.

### 3.03 Warranty Tolerances

- A. Conform to WDMA standards and testing methods for warp, cup, bow and telegraphing.

### 3.04 Adjusting

- A. Adjust doors for smooth and balanced door movement.

**END OF SECTION**

## SECTION 085113

### ALUMINUM WINDOWS

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Extruded aluminum windows with fixed sash.
- B. Factory glazing.

##### 1.02 RELATED REQUIREMENTS

- A. Section 010300 - Alternates
- B. Section 055000 - Metal Fabrications: Steel lintels.
- C. Section 061000 - Rough Carpentry: Rough opening framing.
- D. Section 079005 - Joint Sealers: Perimeter sealant and back-up materials.
- E. Section 088000 - Glazing.

##### 1.03 REFERENCE STANDARDS

- A. AAMA/WDMA/CSA 101/I.S.2/A440 - Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors; American Architectural Manufacturers Association; 2005.
- B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association; 2009.
- C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2005.
- D. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association; 2004.
- E. ASTM A 123/A 123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2002.
- F. ASTM B 209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2007.
- G. ASTM B 209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2007.
- H. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2008.
- I. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2007.
- J. ASTM E 283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004.
- K. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000.
- L. ASTM E 1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2000 (Reapproved 2008).
- M. NFRC 100 - Procedure for Determining Fenestration Product U-Factors; 2004.

- N. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2004.
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

#### 1.04 PERFORMANCE REQUIREMENTS

- A. Design and size components to withstand the following load requirements without damage or permanent set:
  - 1. Design Wind Loads: Comply with requirements of applicable building code.
  - 2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
  - 3. Measure performance by testing in accordance with ASTM E 330, using test loads equal to 1.5 times the design wind loads and 10 second duration of maximum pressure.
  - 4. Deflection of members parallel to the plane of the wall, when carrying its full dead load, shall not exceed an amount that will reduce glass bite by less than 75 percent of the design dimension and shall not reduce edge clearance between itself and the panel, glass or other fixed member immediately below to less than 1/8 inch.
- B. Movement: Accommodate the following movement without damage to components or deterioration of seals:
  - 1. Movement of curtain wall relative to perimeter framing.
  - 2. Deflection of structural support framing, under permanent and dynamic loads.
- C. Thermal Transmittance (with Vision Glass):
  - 1. Glass U-Factor: 0.30 per NFRC 100.
  - 2. Overall U-Factor: 0.42 per NFRC 100.
- D. Solar Heat Gain Coefficient (SHGC):
  - 1. Glass SHGC: 0.25 to 0.30 per NFRC 200.
  - 2. Overall SHGC: 0.23 to 0.27 per NFRC 200.
- E. Air Infiltration: Limit air infiltration through assembly to 0.06 cu ft/min/sq ft (0.3 L/s/sq m) of wall area, measured at a reference differential pressure across assembly of 1.57 psf (75 Pa) as measured in accordance with ASTM E 283.
- F. Condensation Resistance Factor: CRF of not less than 75 for frame, and not less than 67 for glass when measured in accordance with AAMA 1503.1.
- G. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 8.0 lbf/sq ft (390 Pa).
- H. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly.
- I. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, or migrating moisture occurring within system.
- J. Sound Attenuation: STC of 50, minimum, from exterior to interior, calculated in accordance with ASTM E 413, tested in accordance with ASTM E 90.

#### 1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide component dimensions.



- C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, and installation requirements.
- D. Samples: Submit two samples, 12 x 12 inch (300 x 300 mm) in size illustrating typical corner construction, accessories, and finishes.
- E. Certificates: Certify that windows meet or exceed specified requirements.
- F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.
- G. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Comply with requirements of AAMA/WDMA/CSA 101/I.S.2/A440 Designation AW65.
- B. Manufacturer and Installer: Company specializing in fabrication of residential aluminum windows of types required, with not fewer than five years of experience.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

#### **1.08 FIELD CONDITIONS**

- A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

#### **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective Work within a five year period after Date of Substantial Completion.
- C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- D. Provide five year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

### **PART 2 PRODUCTS**

#### **2.01 MANUFACTURERS**

- A. Kawneer North America: [www.kawneer.com](http://www.kawneer.com).
- B. Substitutions: See Section 016000 - Product Requirements.

#### **2.02 WINDOWS**

- A. Windows: Tubular aluminum sections, factory fabricated, factory finished, thermally broken, vision glass, related flashings, anchorage and attachment devices.
  - 1. Frame Depth: 4 ½ inches.
  - 2. Air Infiltration: Limit air infiltration through assembly to: \_\_\_\_\_ of wall area, measured at a specified differential pressure across assembly in accordance with ASTM E 283.
  - 3. Water Infiltration Test Pressure Differential: \_\_\_\_\_ pounds per square foot ( \_\_\_\_\_ Pa).

- B. Fixed, Non-Operable Type:
  - 1. Construction: Thermally broken.
  - 2. Glazing: Double; clear; transparent.
  - 3. Interior and Exterior Finish: Color Anodized, to match existing windows,
- C. Basis of Design: Tubelite 14000 series deep flush glaze, interior glazed, dry glazed, internally drained storefront designed for 1" glazing.

### **2.03 COMPONENTS**

- A. Frames: 2 inch (43 mm) wide x 4 1/2 inch (115 mm) deep profile; thermally broken with interior portion of frame insulated from exterior portion; flush glass stops of snap-on type.
- B. Reinforced Mullion: 2 inch (50 mm) profile of extruded aluminum with integral reinforcement of shaped steel structural section.
- C. Sills: 1/16 inch (1.5 mm) thick, extruded aluminum; sloped for positive wash; fit under sash leg to 1/2 inch (12 mm) beyond wall face; one piece full width of opening jamb angles to terminate sill end.
- D. Glass and Glazing Materials: As specified in Section 088000.
- E. Sealant and Backing Materials: As specified in Section 079005.
- F. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.
- G. Protective Coatings: Cold applied asphalt mastic complying with SSPC-Paint 12, compounded for 30 mil thickness for each coat; or alkyd type zinc chromate primer complying with FS TT-P-645.

### **2.04 MATERIALS**

- A. Extruded Aluminum: ASTM B 221 (ASTM B 221M), 6063 alloy, T6 temper.
- B. Sheet Aluminum: ASTM B 209 (ASTM B 209M), 5005 alloy, H12 or H14 temper.
- C. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A 123/A 123M.

### **2.05 FABRICATION**

- A. Fabricate components with smallest possible clearances and shim spacing around perimeter of assembly that will enable window installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices.
- D. Arrange fasteners and attachments to ensure concealment from view.
- E. Provide steel internal reinforcement in mullions as required to meet loading requirements.
- F. Provide internal drainage of glazing spaces to exterior through weep holes.
- G. Factory glaze window units.

### **2.06 FINISHES**

- A. Color Anodized conforming to AA-M12C22A44 and AAMA 611. Architectural Class I, etched, medium matte, Dark Bronze colored anodic Coating, 0.4 mil thickness.
- B. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

### **3.02 INSTALLATION**

- A. Install windows in accordance with manufacturer's instructions.
- B. Install window assembly in accordance with AAMA/WDMA/CSA 101/I.S.2/A440.
- C. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- D. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- E. Install sill and sill end angles.
- F. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- G. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.
- H. Install glass in accordance with requirements specified in Section 088000.
- I. Install perimeter sealant in accordance with requirements specified in Section 079005.

### **3.03 TOLERANCES**

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

### **3.04 FIELD QUALITY CONTROL**

- A. Test installed windows for compliance with performance requirements for water penetration, in accordance with ASTM E 1105 using uniform pressure and the same pressure difference as specified for laboratory testing.
  - 1. Test 5 percent of installed windows.
  - 2. If any window fails, test additional windows at Contractor's expense.
- B. Replace windows that have failed field testing and retest until performance is satisfactory.

### **3.05 CLEANING**

- A. Remove protective material from factory finished aluminum surfaces.
- B. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.
- C. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

### **3.06 PROTECTION**

- A. Protect installed products from damage during subsequent construction.
- B. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

**END OF SECTION**

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## SECTION 086300

### METAL-FRAMED SKYLIGHTS

#### PART 1 - GENERAL

##### 1.01 RELATED DOCUMENTS

- A. Furnish and install aluminum skylights (Alternate 3).

##### 1.02 SUMMARY

- A. This Section includes the following:
  - 1. Aluminum-framed pyramid skylights.
  - 2. Aluminum-framed hipped end skylights.
- B. Related Sections:
  - 1. Section 010300 - Alternates
  - 2. Section 052100 – Steel Joist Framing
  - 3. Section 079000 – Joint Sealants

##### 1.03 PERFORMANCE REQUIREMENTS

- A. General: Provide metal-framed skylights capable of withstanding loads and thermal and structural movements indicated without failure. Failure includes the following:
  - 1. Deflection exceeding specified limits.
  - 2. Thermal stresses transferred to the building structure.
  - 3. Skylight framing members transferring stresses, including those caused by thermal and structural movement, to glazing.
  - 4. Noise or vibration created by thermal and structural movement and wind.
  - 5. Weakening of fasteners, attachments, and other components.
- B. Deflection of the entire length of framing members in direction normal to glazing plane is limited to 1/175 of clear span.
- C. Structural Loads: Provide metal-framed skylights, including anchorage, capable of withstanding the effects of the following design loads when supporting full dead loads:
  - 1. Roof Loads: As follows:
    - a. Concentrated Load: 250 lb applied to framing members at location that produces the most severe stress or deflection.
    - b. Wind Loads: As indicated.
    - c. Snow Loads: As indicated.
  - 2. Seismic Loads: As indicated.

- D. Structural Performance: Provide metal-framed skylights, including anchorage, capable of withstanding test pressure indicated without material and deflection failures and permanent deformation of structural members exceeding 0.2 percent of span when tested according to ASTM E 330-97.
  - 1. Test Pressure: 100 PSF positive and 90 PSF negative.
- E. Thermal Movement: Provide metal-framed skylights that allow for thermal movements resulting from the following maximum change (100<sup>∞</sup>) in ambient temperatures by preventing buckling, sealant failure, and other detrimental effects.
  - 1. Temperature Change (Range): 100 deg F.
- F. Air Infiltration: Provide metal-framed skylights with maximum air leakage of 0.10 cfm/sq. ft. of surface when tested according to ASTM E 283-91 at a minimum static-air-pressure differential of 6.24 lbs/sq. ft. when glass at perimeter sill is silicone flush glazed. Max air leakage, .06 @ 6.24 PSF, if glass at perimeter sill is capped.
- G. Water Penetration: Provide metal-framed skylights that do not evidence water penetration when tested according to ASTM E 331-00 and E 547-00 at a minimum differential static pressure of 20 percent of positive design wind load, but not less than 12 lbs/sq. ft.
- H. Condensation Resistance: Provide aluminum-framed systems with fixed glazing and framing areas having condensation-resistance factor (CRF) of not less than 54 when tested according to AAMA 1503.

#### 1.04 SYSTEM DESCRIPTION

- A. The following model numbers are available in standard size options. Custom sizes available up to 6'-6".
- B. Aluminum-framed pyramid skylights: Provide Classic System Model CPY meeting the following requirements:
  - 1. Size: Outside curb dimensions 6'-0" by 6'-0" O.D. of curb
  - 2. Pitch: 5:12
- C. Aluminum-framed hipped end skylights: Provide Classic System Model CPYH meeting the following requirements:
  - 1. Size: Outside curb dimensions minimum 4'-0" wide by 6'-0" length.
  - 2. Pitch: 5:12

#### 1.05 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions and profiles of components, and finishes for metal-framed skylights.

- B. Shop Drawings: For metal-framed skylights. Include plans, elevations, sections, details, and attachments to other Work.
  - 1. Include air, water, and structural test data signed and sealed by the qualified professional engineer responsible for their preparation licensed in state of manufacturer.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available for factory-finished aluminum.
- D. Samples for Verification: Finish samples if required are to be provided on pieces of 2"x3" aluminum sheet
- E. Installer Certificates: If required, signed by manufacturer certifying that installers comply with requirements – reference installer program.
- F. Product Test Reports: From a qualified testing agency indicating skylights comply with requirements, based on comprehensive testing of current products.
- G. Sealant Compatibility and Adhesion Test Reports: From sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with sealants; include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed for adhesion.
- H. Field Test Reports: Not required

## 10.6 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer to assume engineering responsibility who has specialized in installing metal-framed skylights similar to those indicated for this Project and who is acceptable to manufacturer.
- B. Professional Engineer Qualifications: A professional engineer who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of skylights that are similar to those indicated for this project in material, design, and extent.
- C. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- D. Pre-construction Testing: Not required
- E. Pre-construction Sealant Compatibility and Adhesion Testing: Not required
- F. Welding: Qualify procedures and personnel according to AWS D1.2, "Structural Welding Code–Aluminum."
- G. Pre-installation Conference: When required, conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to metal-framed skylights including, but not limited to, the following:

1. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
2. Review structural load limitations.
3. Review skylight curb structural requirements.
4. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review required testing procedures.
6. Review weather and forecasted weather conditions and procedures for unfavorable conditions.
7. Review protection of adjacent roof areas.
8. Review preparation and other requirements for installing structural silicone sealant.

#### 1.07 PROJECT CONDITIONS

- A. Field Measurements: Where metal-framed skylights are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
  1. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating skylights without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.08 WARRANTY

- A. Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of metal-framed skylights that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
  1. Structural failures.
  2. Sealant failures.
  3. Failure of systems to meet performance requirements.
  4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
  5. Water leakage; defined as uncontrolled water appearing on normally exposed interior surfaces of skylights from sources other than condensation resulting from defects in skylight materials or workmanship. (Water controlled by flashing and



gutters and drained back to the exterior and that cannot damage adjacent materials or finishes is not water leakage) Water leakage resulting from improper installation is not part of this warranty.

6. Warranty Period: Five years from date of shipment from manufacturers.

## **PART 2 - PRODUCTS**

### **2.01 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by Wasco Products, Inc., Commercial Division, Sanford, ME (800-388-0293)
- B. Substitutions: Manufacturers shall not be considered without prior approval in writing no later than ten (10) calendar days prior to bid. Substitute manufacturers must have been in the custom skylight business for not less than a period of 15 years and must submit to the Architect the following:
  1. List of similar projects successfully completed within the last five years.
  2. Proof of financial capability.
  3. Complete details of proposed skylight.
  4. Complete specifications for Architect's review.

### **2.02 FRAMING MATERIALS**

- A. Framing Members: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 (ASTM B 221M) with minimum effective thickness of 0.109 inches. Sill member to be extruded with thermal break to isolate interior framing section from exterior framing surfaces.
- B. Exterior Pressure Caps: Extruded aluminum alloy 6063-T5 or T6, ASTM B 221 (ASTM B 221M) with minimum effective thickness of 0.090 inches.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding flashing; compatible with adjacent materials.
- D. Exposed Flashing and Closures: Aluminum sheet alloy and temper of 1100-H14, thickness as require for proper performance.
  1. Minimum Thickness: 0.032 inch. Apron Flashings
  2. Minimum Thickness: 0.062 inch. Closures
- E. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories; compatible with adjacent materials.
  1. Aluminum Retaining Cap Fasteners and Framing Members Fasteners: ASTM A 193/A 193M, Series 300 stainless-steel screws; type as recommended by manufacturer.
  2. Connections to Supporting Structure: Series 300 Stainless Steel.

- F. Framing-System Sealants: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane sealant furnished by skylight manufacturer.
  - 1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
  - 2. Sealant conforms to USDA approval standards.
  - 3. Color: Dark Bronze.
- G. Bituminous Paint: Cold-applied asphalt mastic paint complying with SSPC-Paint 12, except containing no asbestos, and formulated for 30-mil thickness per coat.

## 2.03 GLAZING MATERIALS

- A. Insulating Glass: 1-1/8 inch consisting of 1/4 inch clear tempered exterior lite, 1/2 inch sealed air space, and 3/8 inch clear laminated safety glass interior lite. (\*other as required-specified) \*Glass must meet the requirements of AAMA for the project.
- B. Glazing Gaskets: Manufacturer's proprietary pressure-glazing gaskets of elastomer type and hardness selected by skylight manufacturer to comply with requirements. Glazing gaskets to be extruded Thermoplastic Elastomer by the skylight manufacturer.
- C. Spacers, Edge Blocks, and Setting Blocks: Manufacturer's standard permanent non-migrating type of elastomer type and hardness selected to comply with requirements. Spacers, Edge Blocks and Setting Blocks to be extruded thermoplastic elastomer by the skylight manufacturer.
- D. Glazing Weatherseal Sealant: Neutral-curing silicone sealant recommended by skylight and sealant manufacturers for this use.
  - 1. Sealant is capable of withstanding 50 percent movement in both extension and compression (total of 100 percent movement) when tested for adhesion and cohesion under maximum cyclic movement according to ASTM C 719.
  - 2. Sealant complies with ASTM C 920 for Type S, Grade NS, Class 25, Uses NT, G, A, and O, as applicable to substrates including other sealants with which it comes in contact.
  - 3. Color: Black.
- E. Flashing Sealant: Single-component, non-sag, high performance, non-priming, gun-grade elastomeric polyurethane furnished by skylight manufacturer.
  - 1. Sealant complies with ASTM C920, Type S, Grade NS, Class 25, Use T, NT, M, A, G, and O. Canadian Specification CAN/CGSB-19.13-M87, Classification MCG-2-25-A-N.
  - 2. Sealant conforms to USDA approval standards.
  - 3. Color: Gray or Dark Bronze.

## 20.4 FABRICATION

### A. Framing Components: As follows:

1. Factory fit and assemble, where practical.
  2. Fabricate components that, when assembled, will have accurately fitted joints with ends coped or mitered to produce hairline joints free of burrs and distortion.
  3. Fabricate components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
  4. Fabricate components to accommodate expansion, contraction, and field adjustment, and to provide for minimum clearance and shimming at skylight perimeter.
  5. Fabricate components to ensure that glazing is thermally and physically isolated from framing members.
  6. Form shapes with sharp profiles, straight and free of defects or deformations, before finishing.
  7. Fit and assemble components to greatest extent practicable before finishing.
  8. Fit and secure joints by heliarc welding.
  9. Reinforce members as required to retain fastener threads.
  10. Attach retainer bars with gasketed stainless steel fasteners spaced at a maximum of 12 inches on center.
  11. Weld components before finishing and in concealed locations to greatest extent practicable to minimize distortion.
  12. Before shipping, shop assemble, mark, and disassemble components that cannot be permanently shop assembled.
- B. Provide continuous aluminum curb with weatherproof joints sealed and fully welded corners. Locate weep holes in the curb at each rafter connection to drain condensation.
- C. Prepare framing to receive anchor and connection devices and fasteners.
- D. Field/Factory Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners.

## 2.05 ALUMINUM FINISHES

- A. General: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- C. Mill Finish: Manufacturer's standard mill finish.

## **PART 3 - EXECUTION**

### **3.01 EXAMINATION**

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting skylight performance.
  - 1. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.02 PREPARATION**

- A. Metal Protection: As follows:
  - 1. Where aluminum will contact dissimilar metals, protect against galvanic action by painting contact surfaces with primer or by applying sealant or tape recommended by manufacturer for this purpose.
  - 2. Where aluminum will contact concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
  - 3. Where aluminum will contact pressure-treated wood, separate dissimilar materials by methods recommended by manufacturer.

### **3.03 INSTALLATION**

- A. General: Comply with manufacturer's written instructions for protecting, handling, and installing skylight components.
  - 1. Fit frame joints to produce hairline joints free of burrs and distortion.
  - 2. Rigidly secure non-movement joints.
  - 3. Accommodate thermal and mechanical movements.
  - 4. Install framing components to drain water passing joints and to drain condensation and moisture occurring or migrating within skylight system to the exterior.
  - 5. Coordinate installation of flashings at skylight perimeters to maintain continuity of water barriers.
  - 6. Set continuous curbs and flashings in a full sealant bed, unless otherwise indicated. Comply with requirements in Division 7 Section "Joint Sealants."
- B. Erection Tolerances: Install skylight components true in plane, accurately aligned, and without warp or rack. Adjust framing to comply with the following tolerances:
  - 1. Variation from Plane: Limit variation from plane or location shown to 1/8 inch in 10 feet; 1/4 inch over total length.

2. Alignment: Where surfaces abut in line and at corners and where surfaces are separated by less than 3 inches, limit offset from true alignment to less than 1/32 inch; otherwise, limit offset from true alignment to 1/8 inch.
- C. Field Glazing: Locate and size extruded elastomeric setting blocks and spacers in accordance with the glazing manufacturer's recommendations. At no point shall the glazing come in contact with the skylight frame or fasteners
- D. Install secondary-sealant weatherseal according to sealant manufacturer's written instructions to provide weatherproof joints. Install joint fillers behind sealant as recommended by sealant manufacturer.

### 3.04 CLEANING

- A. Clean skylights inside and outside, immediately after installation and after sealants have cured, according to manufacturer's written recommendations.
  1. Remove temporary protective coverings and strippable coatings from pre-finished metal surfaces. Remove labels and markings from all components.
- B. Remove excess sealant according to sealant manufacturer's written recommendations.

**END OF SECTION**

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## **SECTION 087100**

### **DOOR HARDWARE**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Hardware for wood doors.
- B. Hardware for fire-rated doors.
- C. Electrically operated and controlled hardware.
- D. Weatherstripping, seals and door gaskets.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 081213 - Hollow Metal Frames.
- B. Section 081416 - Flush Wood Doors.

##### **1.03 REFERENCE STANDARDS**

- A. ANSI/ICC A117.1 - American National Standard for Accessible and Usable Buildings and Facilities; International Code Council; 2003.
- B. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; Door and Hardware Institute; 2004.
- C. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; Door and Hardware Institute; 1993; also in WDHS-1/WDHS-5 Series, 1996.
- D. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association; 2007.
- E. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; National Fire Protection Association; 2006.
- F. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc.; current edition.

##### **1.04 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the manufacture, fabrication, and installation of products onto which door hardware will be installed.
- B. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.
- C. Convey Owner's keying requirements to manufacturers.
- D. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

##### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate locations and mounting heights of each type of hardware, schedules, catalog cuts, electrical characteristics and connection requirements.
  - 2. Submit manufacturer's parts lists and templates.

- C. Samples: Prior to preparation of hardware schedule:
  - 1. Submit 1 sample of hinge, latchset, lockset, closer, and exit device illustrating style, color, and finish.
  - 2. Samples will be returned to supplier.
- D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention.
- E. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.
- F. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.
- G. Keys: Deliver with identifying tags to Owner by security shipment direct from hardware supplier.
- H. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- I. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Lock Cylinders: One for each master keyed group.
  - 3. Tools: One set of all special wrenches or tools applicable to each different or special hardware component, whether supplied by the hardware component manufacturer or not.

#### **1.06 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years of documented experience.
- B. Hardware Supplier Qualifications: Company specializing in supplying commercial door hardware approved by manufacturer.
- C. Hardware Supplier Personnel: Employ an Architectural Hardware Consultant (AHC) to assist in the work of this section.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Package hardware items individually; label and identify each package with door opening code to match hardware schedule.
- B. Deliver materials to project site in manufacturer's original, unopened undamaged containers, with identification labels intact.
- C. Store materials in original packaging, protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by the manufacturer.

#### **1.08 PROJECT CONDITIONS**

- A. Coordinate the work with door opening construction, door and frame installation.

#### **1.09 WARRANTY**

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Provide ten year warranty for door closers.



## PART 2 PRODUCTS

### 2.01 HARDWARE

#### A. Hinges:

1. Assa Abloy McKinney: [www.assaabloydss.com](http://www.assaabloydss.com).
2. Hager Companies: [www.hagerco.com](http://www.hagerco.com).
3. Stanley Hardware: [www.stanleyworks.com](http://www.stanleyworks.com).
4. Hinges for interior use shall be cold rolled steel, brass or bronze of specified finish.
5. Pins for interior hinges shall be of hospital tip, non-rising, except as noted.
6. Hinges shall be square-cornered, full mortise, to template.
7. Interior Hinges:
  - a. Doors 1-3/4" thick, up to and including 3'-0" wide, regular weight, 4-1/2" x 4-1/2", ball bearing: three hinges per door leaf.
  - b. Doors 1-3/4" thick, over 3'-0" wide, extra heavy weight, 4-1/2" x 4-1/2", ball bearing: three hinges per door leaf.
  - c. Electric: EPT10

#### B. Lock and Latch Sets:

1. Sargent: 10 Line LL design.
2. Locksets and latch sets with 2-3/4" backset shall have cases of uniform size to allow interchangeability.
3. Mechanically actuated anti-friction latch bolts and deadbolts shall have at least 1/2" throws. For double doors and doors under UL label requirements, latch bolt throws shall be 3/4".
4. Provide standard ASA strikes with curved lips of lengths to suit door and jamb conditions, with wrought box strikes.
5. Cylindrical Locks: Match to Owner's existing system.
  - a. Basis of Design: Medeco full size interchangeable cores
6. Lock functions as indicated in the hardware schedule shall be as follows:

Function	10 Line
A(Storeroom)	04
B(Storeroom)	04 (Knurled)
C(Office)	05
D(Passage)	15
E(Classroom)	37
F(Privacy)	65
G(Electric)	71

7. Push pull latches: Glynn Johnson HL6-2 SOC

#### C. Closers:

1. Assa Abloy Sargent: [www.assaabloydss.com](http://www.assaabloydss.com).
2. LCN: [www.lcnclosers.com](http://www.lcnclosers.com).
3. Door closers shall be of rack-and-pinion full hydraulic type with the following features:
  - a. Key-operated hydraulic valve adjustment for back-check, general closing speed and latching speed.
  - b. Mechanical adjustment to increase unit spring power and mechanically reversible arm-mounting shoe to increase latching power.
4. Primary shells shall be cast-iron or aluminum alloy. Arms shall be forged steel. Arms shall be factory painted, color to be selected from manufacturer's standard palette.
5. Covers shall not project more than 2-3/8" from door face. Color of plastic cases for door closer covers to be selected from manufacturer's standard palette.
6. Arm selection shall follow the requirements of the schedule below, with brackets, drop plates and miscellaneous accessories provided as necessary. Corner brackets will not be permitted.

7. The sweep period of a closer shall be adjusted so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3" from the latch, measured to the leading edge of the door.
  8. The maximum force for pushing or pulling open a door shall be:
    - a. non-fire rated interior doors: 5 lbf (22.2 N)
    - b. fire rated interior doors: as required by code.
  9. Door closers meeting this specification are as follows:  
  
LCN  
  

Exterior	4111S-CUSH 4111S-H-CUSH
Interior	4011 4111
  10. Provide hard wired actuators.
- D. Mag Locks:
1. Locknetics 390+ Series
- E. Magnetic Holders:
1. Wall mounted electromagnetic door release with minimum 25 pounds of holding force.
    - a. Connect to fire alarm system for fail-safe operation.
  2. Die cast housing, low profile recessed wall mount.
    - a. Color: As selected from manufacturer's standard powder coat finishes.
  3. UL listed for smoke barrier or labeled fire doors.
  4. Assa Abloy Sargent: Model 1560; [www.assaabloydss.com](http://www.assaabloydss.com).
  5. LCN: Model 7840 [www.lcnclosers.com](http://www.lcnclosers.com).
- F. Gasketing and Thresholds: Smoke.
1. National Guard Products, Inc: [www.ngpinc.com](http://www.ngpinc.com).
  2. Pemko Manufacturing Co: [www.pemko.com](http://www.pemko.com).
  3. Reese Enterprises: [www.reeseusa.com](http://www.reeseusa.com).
  4. Astragals NGP 136P
- G. Wall Stops:
1. Glynn Johnson: Product 50C or 60C; [www.glynn-johnson.com](http://www.glynn-johnson.com).
  2. Ives: Product WS407CCV; [www.consumer.schlage.com](http://www.consumer.schlage.com).
  3. Rockwood Manufacturing Company: [www.rockwoodmfg.com](http://www.rockwoodmfg.com).
- H. Protection Plates:
1. Kick plates shall be 10" high. Armor plates 34" high.
  2. For single doors, plate widths shall be actual door width less 2"; for double doors, actual door width less 1-1/2" per leaf.
  3. Plates shall be fabricated of .050" thick type 430 stainless steel with top and side edges beveled.
  4. Flat goods shall be glued and mechanically fastened with #6 x 5/8" oval head stainless steel screws.
  5. Ives: [www.consumer.schlage.com](http://www.consumer.schlage.com).
  6. Rockwood Manufacturing Company: [www.rockwoodmfg.com](http://www.rockwoodmfg.com).
- I. Silencers:
1. Glynn Johnson: Product 64/65; [www.glynn-johnson.com](http://www.glynn-johnson.com).
  2. Ives: Product 20/21; [www.consumer.schlage.com](http://www.consumer.schlage.com).
  3. Rockwood Manufacturing Company: Product 608/609; [www.rockwoodmfg.com](http://www.rockwoodmfg.com).

J. EXIT DEVICES:

1. Shall be Von Duprin or Sargent as follows:

Function	Von Duprin	Sargent
A	CD99NL-OP	16-8804
B	9927EO	8710
C	99L	8813ET
D	99L-BE	8815ET
E	99EO-F	12-8810
F	99L-NL-F	12-8804ET
G	99L-F-BE	12-8815ET
H	CD9927EO	16-8710
I	9927L	8713ET
J	9927L-BE	8715ET
K	CD9927EO x LBR	16-PP/PR8710
L	9927L x LBR	PP/PR8713ET
M	9927L-BE x LBR	PP/PR8715ET
N	9927EO-F	12-8710
O	9927L-F	12-8713ET
P	9927L-F-BE	12-8715ET
Q	9927EO-F x LBR	12-PP/PR8710
R	ELR9927L	56-8713ET
S	9927L-F-BE x LBR	12PP/PR8715ET
T	CD9927L	16-8713ET
U	EL99L-F	56-12 8813 ETL
V	EL98L	56-8813ET
W	EL9927LNL-F	56-8704FET

NOTE: Lever design shall match lock trim

- K. Substitutions: See Section 016000 - Product Requirements.

L. Flushbolts:

1. Rockwood 555 for metal 557 for wood.

M. Pivots:

1. Stanley DAP 3, DLS double lipped strike, ES1 emergency stop.

**2.02 GENERAL REQUIREMENTS FOR DOOR HARDWARE PRODUCTS**

A. Provide products that comply with the following:

1. Applicable provisions of federal, state, and local codes.
2. ANSI/ICC A117.1, American National Standard for Accessible and Usable Buildings and Facilities.
3. Applicable provisions of NFPA 101, Life Safety Code.
4. Fire-Rated Doors: NFPA 80.
5. All Hardware on Fire-Rated Doors: Listed and classified by UL as suitable for the purpose specified and indicated.
6. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide hardware that enables door assembly to comply with air leakage requirements of the applicable code.
7. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

- B. Typical Hardware Finish: Satin chromium/stainless, dependent upon base metal:
  - 1. BHMA Finish Standard #626 (US Standard Finish US26D).
  - 2. BHMA Finish Standard #628 (US Standard Finish US28).
  - 3. BHMA Finish Standard #652 (US Standard Finish US26D).
  - 4. BHMA Finish Standard #630 (US Standard Finish US32D).

### **2.03 KEYING**

- A. Door Locks: Grand master keyed.
  - 1. Include construction keying.
  - 2. Key to existing keying system.
- B. Supply keys in the following quantities:
  - 1. 5 master keys.
  - 2. 5 grand master keys.
  - 3. 6 construction keys.
  - 4. 3 change keys for each lock.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that doors and frames are ready to receive work and dimensions are as indicated on shop drawings.
- B. Verify that electric power is available to power operated devices and of the correct characteristics.

### **3.02 INSTALLATION**

- A. Install hardware in accordance with manufacturer's instructions and applicable codes.
- B. Use templates provided by hardware item manufacturer.
- C. Install hardware on fire-rated doors and frames in accordance with code and NFPA 80.
- D. Mounting heights for hardware from finished floor to center line of hardware item:
  - 1. For steel doors and frames: Comply with DHI "Recommended Locations for Architectural Hardware for Steel Doors and Frames."
  - 2. For wood doors: Comply with DHI "Recommended Locations for Architectural Hardware for Wood Flush Doors."

### **3.03 FIELD QUALITY CONTROL**

- A. Provide an Architectural Hardware Consultant to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

### **3.04 ADJUSTING**

- A. Adjust work under provisions of Section 017000.
- B. Adjust hardware for smooth operation.

### **3.05 PROTECTION**

- A. Protect finished Work under provisions of Section 017000.
- B. Do not permit adjacent work to damage hardware or finish.

PAVILION "A" SHEET 1A1-1

GROUP 1

Door #'s 2212  
Each Leaf Shall Have: Hinges, Privacy (Function F), Door Stop, Silencers

GROUP 2

Door #'s 2204, 2214, 2207, 2209  
Each Leaf Shall Have: Hinges, Lockset (Function E), Door Stop, Silencers

PAVILION "C" SHEET 2A1-1

GROUP 3

New Pair by Elevator – Door #DC-20PC1  
Each Pair Shall Have: Hinges with Hospital Tip, Exit Device (Function I), Door Closer, Mag Lock, Kick Plate, Door Stop, Power Supply, Silencers  
Card Reader by Others

GROUP 4

Existing Pair in the Corridors – Door #'s DC-20PC2, DC-20PC5  
Each Pair Shall Have: Mag Locks, Power Supply  
Card Readers by Others  
Balance of Hardware is Existing

GROUP 5

Existing Door #'s ST217, ST218, 2410, 2410A  
Each Leaf Shall Have: Lockset (Function A)  
Balance of Hardware is Existing

GROUP 6

18 Existing Unit Entry's – Door #'s 256, 257, 258, 259, 260, 261, 263, 264, 265, 266, 268, 270, 272, 274, 276, 278, 280, 281  
Each Leaf Shall Have: Hinges with Hospital Tips, Push Pull Latches  
Balance of Hardware is Existing

GROUP 7

19 Existing Bathrooms – Door #'s 256A, 257A, 258A, 259A, 260A, 261A, 263A, 264A, 265A, 266A, 268A, 270A, 272A, 274A, 276A, 278A, 280A, 281A, 2407  
Each Leaf Shall Have: Hinges with Hospital Tips, Push Pull Latches  
Balance of Hardware is Existing  
Note: Add Grade One Cylindrical Deadlock Tag 280A, Keyed to Existing System

GROUP 7A

Door # 2402

Each Leaf Shall Have: Hinges with Hospital Tip, Lockset (Function A), Closer, Mag Lock, Kick Plate,  
Door Stop, Power Supply  
Card Reader by Others

GROUP 7B

Door #'s 2403, 2408, 2330, ST216

Each Leaf Shall Have: Mag Lock, Power Reader  
Balance of Hardware is Existing  
Card Reader by Others

PAVILION "6" SHEET 3A1-1

GROUP 8

Unit Entry's

Door #'s 670, 671, 672, 673, 674, 675, 676, 677, 681, 682, 683, 684, 686

Each Leaf Shall Have: Pivot Set, Protection Plate, Push/Pull Latches, Double Lipped Strike, Emergency  
Stop, Astragal (2)

GROUP 9

Bathrooms

Door #'s 6327, 670A, 671A, 672A, 673A, 674A, 675A, 676A, 677A, 681A, 682A, 683A, 684A, 686A, 6309

Each Leaf Shall Have: Pivot Set, Protection Plate, Push/Pull Latches, Double Lipped Strike, Emergency  
Stop, Astragal (2)

GROUP 10

Door #'s C1, C2

Each Leaf Shall Have: Hinges with Hospital Tips, Exit Device (Function F), Closer, Mag Lock, Kick Plate,  
Door Stop, Power Supply, Silencers  
Card Reader by Others

GROUP 11

Door #'s 6316, C3, 6316A, 6218, 6307

Each Leaf Shall Have: Hinges with Hospital Tip, 1 EL Hinge with Hospital Tip, Lockset (Function G),  
Closer, Kick Plate, Door Stop, Power Supply, Silencers  
Card Reader by Others

GROUP 12

Door #'s 6331, 6331A, 6331B, 6331C

Each Pair Shall Have: Hinges with Hospital Tip, Flush Bolts x Extension Top Rod, Dead Lock, Door  
Pulls, Kick Plates, Silencers

GROUP 13

Door #'s 6321

Each Leaf Shall Have: Hinges with Hospital Tip, Privacy Set (Function F), Kick Plate, Door Stop,  
Silencers

GROUP 14

Door #'s 6213, 6220, 6316B, 6318, 6212A, 6212B, 6221, 6227, 6325  
Each Leaf Shall Have: Hinges with Hospital Tip, Lockset (Function E), Closer, Kick Plate, Door Stop, Silencers

GROUP 15

Door #'s 680, 680A, 680B  
Each Leaf Shall Have: Hinges with Hospital Tip, Push Pull Latches, Kick Plate, Door Stop, Silencers

GROUP 16

Door #'s S17, S20  
Each Leaf Shall Have: Hinges with Hospital Tip, Lockset (Function A), Closer, Kick Plate, Door Stop, Silencers

GROUP 17

Door #'s 6317  
Each Pair Shall Have: Hinges with Hospital Tip, Lockset (Function A), Flush Bolts, Closers, Kick Plates, Silencers

GROUP 18

Door #'s 6315  
Each Pair Shall Have: Hinges with Hospital Tip, 1 – EL Hinge with Hospital Tip, 1 - Lockset (Function G), Flush Bolts x Extension Top Rod, Closers, Kick Plates, Silencers

**END OF SECTION**

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## SECTION 088000

### GLAZING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Glass.
- B. Glazing compounds and accessories.
- C. Insulated Metal Panels.
- D. See Alternate 1 for window glazing options.

##### 1.02 RELATED REQUIREMENTS

- A. Section 062000 - Finish Carpentry: Interior trim components with requirement for glass.
- B. Section 072500 - Weather Barriers.
- C. Section 079005 - Joint Sealers: Sealant and back-up material.
- D. Section 081113 - Hollow Metal Doors and Frames: Glazed doors and borrowed lites.
- E. Section 081416 - Flush Wood Doors: Glazed doors.
- F. Section 081433 - Stile and Rail Wood Doors: Glazed doors.
- G. Section 085113 - Aluminum Windows: Glazed windows.
- H. Section 086300 - Metal-Framed Skylights.
- I. Section 010300 - Alternates

##### 1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.
- B. ASTM C 864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005.
- C. ASTM C 920 - Standard Specification for Elastomeric Joint Sealants; 2005.
- D. ASTM C 1036 - Standard Specification for Flat Glass; 2006.
- E. ASTM C 1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass; 2004.
- F. ASTM C 1172 - Standard Specification for Laminated Architectural Flat Glass; 2003.
- G. ASTM C 1193 - Standard Guide for Use of Joint Sealants; 2009.
- H. ASTM E 1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2007.
- I. ASTM E 2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2008.
- J. GANA (GM) - GANA Glazing Manual; Glass Association of North America; 2004.
- K. GANA (SM) - FGMA Sealant Manual; Glass Association of North America; 1990.
- L. NFRC 100 - Procedure for Determining Fenestration Product U-Factors; 2004.
- M. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2004.
- N. NFRC 300 - Test Method for Determining the Solar Optical Properties Determining the Solar

Optical Properties; 2009.

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. Provide glazing systems capable of withstanding normal thermal movements, wind loads and impact loads, without failure, including loss due to defective manufacture, fabrication and installation; deterioration of glazing materials; and other defects in construction.
- B. Glass Strength: Select type and thickness of glass to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with applicable building codes.
  - 1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
  - 2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
  - 3. Thicknesses listed are minimum.
- C. Thermal and Optical Performance: Provide glass products with performance properties as indicated. Performance properties to be manufacturer's published data as determined according to the following procedures:
  - 1. Center of glass U-Value: NFRC 100 methodology using LBNL WINDOW 5.2 computer program.
  - 2. Center of glass solar heat gain coefficient: NFRC 200 methodology using LBNL-35298 WINDOW 5.2 computer program.
  - 3. Solar optical properties: NFRC 300

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- D. Samples: Submit two samples 12 x 12 inch (300 x 300 mm) in size of glass units, showing coloration and design.
- E. Samples: Submit 12 inch (300 mm) long bead of glazing sealant, showing color.
- F. Certificates: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Certificate: Certify that sealed insulated glass meets or exceeds specified requirements.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Insulating Glass Units: One of each glass size and each glass type.
- I. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

#### **1.06 QUALITY ASSURANCE**

- A. Perform Work in accordance with GANA Glazing Manual and FGMA Sealant Manual for glazing installation methods.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- C. Installer Qualifications: Company specializing in performing the work of this section approved by manufacturer.

#### **1.07 DELIVERY, STORAGE AND HANDLING**

- A. Protect glass from edge damage during handling. For insulating units exposed to substantial altitude changes, comply with insulating glass manufacturers written recommendations for venting and sealing to avoid hermetic seal ruptures.
- B. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun or other causes.

### 1.08 FIELD CONDITIONS

- A. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by the glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation or other causes.
- B. Do not install liquid glazing sealants when ambient and substrate temperature conditions are outside limits permitted by glazing sealant manufacturer or below 40°F.
- C. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

### 1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.
- C. Laminated Glass: Provide a ten (10) year warranty to include coverage for delamination, including replacement of failed units.

## PART 2 PRODUCTS

### 2.01 GLAZING TYPES

- A. Type 1 - Sealed Insulating Glass Units (for windows): Vision glazing, low-E.
  - 1. Application(s): All exterior glazing unless otherwise indicated.
  - 2. Total Thickness: 1 inch (25 mm).
  - 3. Inboard Lites: Same as other vision glazing except use ½ inch fully tempered float glass.
  - 4. Outboard Lite: Low "E" Heat Strengthened float glass, 1/4 inch (6 mm) thick, minimum.
- B. Insulated Metal Panels for designated locations of exterior window unit frames: 1 inch thick Omega Ply insulated metal panels, distributed by Hart Supply. and inboard lites.
- C. Type 2 - Single Safety Glazing: Non-fire-rated.
  - 1. Applications: Provide this type of glazing in the following locations:
    - a. Glazed lites in doors, except fire doors.
    - b. Glazed sidelights to doors, except in fire-rated walls and partitions.
    - c. Other locations required by applicable federal, state, and local codes and regulations.
    - d. Other locations indicated on the drawings.
  - 2. Type: Fully tempered float glass as specified.
  - 3. Tint: Clear.
  - 4. Thickness: 1/4 inch (6 mm).
  - 5. Glazing Method: Interior dry method, tape and tape.
- D. Type 3 – FireLite Single Safety Glazing: Fire-rated.
  - 1. Applications: Provide this type of glazing in the following locations:
    - a. Glazed lites in doors.
    - d. Other locations required by applicable federal, state, and local codes and regulations.
    - e. Other locations indicated on the drawings.
  - 2. Type: Fully tempered float glass as specified.
  - 3. Tint: Clear.

4. Thickness: 1/4 inch (6 mm).
- E. Type 4 – Impact Resistant Glazing: ½ inch Lexan Acrylic Sheet
- F. Type 5 – Patterned Glass: (to be determined).

## 2.02 EXTERIOR GLAZING ASSEMBLIES

- A. Structural Design Criteria: Select type and thickness to withstand dead loads and wind loads acting normal to plane of glass at design pressures calculated in accordance with applicable building code.
  1. Use the procedure specified in ASTM E 1300 to determine glass type and thickness.
  2. Limit glass deflection to 1/200 or flexure limit of glass, whichever is less, with full recovery of glazing materials.
  3. Thicknesses listed are minimum.
- B. Air and Vapor Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier:
  1. In conjunction with vapor retarder and joint sealer materials described in other sections.
  2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.

## 2.03 GLASS MATERIALS

- A. Float Glass Manufacturers:
  1. AGC Flat Glass North America, Inc: [www.afgglass.com](http://www.afgglass.com).
  2. Guardian Industries Corp: [www.sunguardglass.com](http://www.sunguardglass.com).
  3. Pilkington North America Inc: [www.pilkington.com](http://www.pilkington.com).
  4. PPG Industries, Inc: [www.ppg.com](http://www.ppg.com).
  5. Substitutions: Refer to Section 016000 - Product Requirements.
- B. Low E Glass: Float type, heat strengthened, clear.
  1. Coating on inner surface.
  2. Comply with ASTM C 1036, Type I, transparent flat, Quality Q3 (glazing select).
  3. Comply with ASTM C 1048.
  4. 6 mm minimum thick.  
installed in.

## 2.04 SEALED INSULATING GLASS UNITS

- A. Sealed Insulating Glass Units: Types as indicated.
  1. Durability: Certified by an independent testing agency to comply with ASTM E 2190.
  2. Edge Spacers: Aluminum, bent and soldered corners.
  3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
  4. Purge interpane space with dry hermetic air.

## 2.05 GLAZING COMPOUNDS

- A. Manufacturers:
  1. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  2. Dow Corning Corp: [www.dowcorning.com](http://www.dowcorning.com).
  3. GE Plastics: [www.geplastics.com](http://www.geplastics.com).
  4. Momentive Performance Materials, Inc (formerly GE Silicones): [www.momentive.com](http://www.momentive.com).
  5. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
  6. BASF Construction Chemicals-Building Systems: [www.chemrex.com](http://www.chemrex.com).
  7. Substitutions: Refer to Section 016000 - Product Requirements.
- B. Butyl Sealant: Single component; ASTM C 920, Grade NS, Class 12-1/2, Uses M and A; Shore A hardness of 10 to 20; black color; non-skinning.

- C. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C 920, Type S, Grade NS, Class 25, Uses M, A, and G; cured Shore A hardness of 15 to 25.

## 2.06 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C 864 Option I. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) x width of glazing rabbet space minus 1/16 inch (1.5 mm) x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch (75 mm) long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape for Fire Rated Glass: Closed cell polyvinyl chloride foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent, designed for compression of 25 percent to effect an air barrier and vapor retarder seal.
  - 1. Manufacturers:
    - a. Pecora Corporation: [www.pecora.com](http://www.pecora.com).
    - b. Saint-Gobain Performance Plastics: [www.plastics.saint-gobain.com](http://www.plastics.saint-gobain.com).
- D. Glazing Gaskets: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C 864 Option I; black color.
- E. Glazing Clips: Manufacturer's standard type.

## 2.07 FABRICATION - INSULATED GLASS UNITS

- A. Units shall be certified for compliance by the IGCC in accordance with ASTM E 2190.
- B. Unit Overall Thickness Tolerance:  $-1/16"/ +1/32"$ . Unit constructed with laminated glass shall be  $\pm 1/16"$ .
- C. Comply with ASTM E 546 Standard Test Method for Frost Point of Sealed Insulating Glass Units
- D. Comply with ASTM E 576 Standard Test Method for Frost Point of Sealed Insulating Glass Units in the Vertical Position
- E. Sealed insulating glass units shall be double sealed with a primary seal of polyisobutylene and a secondary seal of silicone.
  - 1. Minimum thickness of the secondary seal:  $1/16"$ .
  - 2. Target width of the primary seal:  $5/32"$ .
  - 3. There shall be no voids or skips in the primary seal.
  - 4. Gaps or skips between primary and secondary sealant are permitted to a maximum width of  $1/16"$  by maximum length of 2" with gaps separated by at least 18". Continuous contact between the primary seal and the secondary seal is desired.
  - 5. Both primary and secondary sealant adhesion shall exhibit continuous, tenacious adhesion to both glass and spacer contact areas.
- F. Separate lites by an aluminum spacer with three bent corners and one keyed-soldered corner or four bent corners and one straight butyl injected zinc plated steel straight key joint to provide a hermetically sealed and dehydrated space.

## 2.08 SOURCE QUALITY CONTROL AND TESTS

- A. Provide shop inspection and testing for each type of glass.
- B. Test samples in accordance with ANSI Z97.1.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that openings for glazing are correctly sized and within tolerance.
- B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.

### **3.02 PREPARATION**

- A. Clean contact surfaces with solvent and wipe dry.
- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C 1193 and FGMA Sealant Manual.
- E. Install sealant in accordance with manufacturer's instructions.

### **3.03 INSTALLATION - EXTERIOR/INTERIOR DRY METHOD (GASKET GLAZING)**

- A. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
- B. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.
- C. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

### **3.04 INSTALLATION - EXTERIOR DRY METHOD (TAPE AND GASKET SPLINE GLAZING)**

- A. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
- C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.
- D. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.
- E. Trim protruding tape edge.

### **3.05 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)**

- A. Cut glazing tape to length and set against permanent stops, 3/16 inch (5 mm) below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 3/16 inch (5 mm) below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.

- F. Fill gap between glazing and stop with sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch (9 mm) below sight line.
- G. Apply cap bead of sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

### **3.06 INSTALLATION - INTERIOR DRY METHOD (TAPE AND TAPE)**

- A. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches (150 mm) from corners.
- C. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.
- D. Place glazing tape on free perimeter of glazing in same manner described above.
- E. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.
- F. Knife trim protruding tape.

### **3.07 INSTALLATION - INTERIOR WET METHOD (COMPOUND AND COMPOUND)**

- A. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (600 mm) centers, kept 1/4 inch (6 mm) below sight line.
- B. Locate and secure glazing pane using glazers' clips.
- C. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

### **3.08 MANUFACTURER'S FIELD SERVICES**

- A. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

### **3.09 CLEANING**

- A. Clean excess sealant or compound from glass and framing members immediately after application using solvents or cleaners recommended by manufacturers.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces.

### **3.10 PROTECTION**

- A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

**END OF SECTION**

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## SECTION 092116

### GYPSUM BOARD ASSEMBLIES

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- F. Gypsum sheathing.
- G. Cementitious backing board.
- H. Gypsum wallboard.
- I. Glass mat faced gypsum board.
- J. Joint treatment and accessories.
- K. Add stud bracing at all inside and outside corners and spot weld metal corners to enhance wall strength. All corners shall be tied together. See below for specific stud gage in Patient Areas.

##### 1.02 RELATED REQUIREMENTS

- A. Section 054000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.
- B. Section 061000 - Rough Carpentry: Building framing and sheathing.
- C. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.
- D. Section 072130 – Building Insulation
- E. Section 078400 - Firestopping: Top-of-wall assemblies at fire rated walls.
- F. Section 079005 - Joint Sealers: Acoustic sealant.

##### 1.03 REFERENCE STANDARDS

- A. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 1999 (R2005).
- B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (R2005).
- C. ASTM C 475/C 475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2002 (Reapproved 2007).
- D. ASTM C 645 - Standard Specification for Nonstructural Steel Framing Members; 2007.
- E. ASTM C 665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2006.
- F. ASTM C 754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2007.
- G. ASTM C 840 - Standard Specification for Application and Finishing of Gypsum Board; 2007.
- H. ASTM C 954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2007.
- I. ASTM C 1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the

Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2007.

- J. ASTM C 1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2005.
- K. ASTM C 1278/C 1278M - Standard Specification for Fiber-Reinforced Gypsum Panel; 2007a.
- L. ASTM C 1325 - Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cement Substrate Sheets; 2004.
- M. ASTM C 1396/C 1396M - Standard Specification for Gypsum Board; 2006a.
- N. ASTM C 1629/C 1629 - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2006.
- O. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000 (Reapproved 2005).
- P. ASTM E 72 - Standard Test Methods of Conducting Strength Tests of Panels for Building Construction; 2005.
- Q. ASTM E 90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2004.
- R. ASTM E 413 - Classification for Rating Sound Insulation; 2004.
- S. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association; 2007.
- T. GA-226 - Application of Gypsum Board to Form Curved Surfaces; Gypsum Association; 1996.
- U. GA-600 - Fire Resistance Design Manual; Gypsum Association; 2006.
- V. ICC (IBC) - International Building Code; 2006.
- W. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc.; current edition.

#### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on metal framing, gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- D. Test Reports: For all stud framing products that do not comply with ASTM C 645 or C 754, provide independent laboratory reports showing maximum stud heights at required spacings and deflections.

#### **1.05 QUALITY ASSURANCE**

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.
- C. Installer Qualifications: Company specializing in performing gypsum board application and finishing, with minimum five years of experience.

### **PART 2 PRODUCTS**

#### **2.01 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C 840 and GA-216.
- B. Interior Partitions Indicated as Acoustic: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.
  - 2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E 413, based on tests conducted in accordance with ASTM E 90.
- C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.
  - 1. ICC IBC Item Numbers: Comply with applicable requirements of ICC IBC for the particular assembly.
  - 2. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.
  - 3. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL Fire Resistance Directory.

## 2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
  - 1. Clark Western Building Systems: [www.clarkwestern.com](http://www.clarkwestern.com).
  - 2. Dietrich Metal Framing: [www.dietrichindustries.com](http://www.dietrichindustries.com).
  - 3. MarinoWare: [www.marinoware.com](http://www.marinoware.com).
  - 4. Substitutions: See Section 016000 - Product Requirements.
- B. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 10 psf (480 Pa).
  - 1. Exception: The minimum metal thickness and section properties requirements of ASTM C 645 are waived provided steel of 40 ksi (275 MPa) minimum yield strength is used, the metal is continuously dimpled, the effective thickness is at least twice the base metal thickness, and maximum stud heights are determined by testing in accordance with ASTM E 72 using assemblies specified by ASTM C 754.
    - a. Acceptable Products:
      - 1) Dietrich Metal Framing; UltraSteel (tm): [www.dietrichindustries.com](http://www.dietrichindustries.com).
      - 2) Clark Western Building Systems; UltraSteel (tm): [www.clarkwestern.com](http://www.clarkwestern.com).
  - 2. Studs: "C" shaped with flat or formed webs with knurled faces.
  - 3. Runners: U shaped, sized to match studs.
  - 4. Ceiling Channels: C shaped.
  - 5. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
  - 6. 16 gauge door jambs shall be used at Patient accessible areas for door jambs.
- C. Loadbearing Studs for Application of Gypsum Board: As specified in Section 054000.
- D. Shaft Wall Studs and Accessories: ASTM C 645; galvanized sheet steel, of size and properties necessary to comply with ASTM C 754 and specified performance requirements.
- E. Ceiling Hangers: Type and size as specified in ASTM C 754 for spacing required.
- F. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and screwed to secondary deflection channel set inside but unattached to top track.
- G. Radius Framing: Steel sheet runner for non-structural curves:
  - 1. Minimum 3 5/8" 20 gage material.
  - 2. Basis of Design: Ultrasteel Framing Contour Track CNTB manufactured by Dietrich Metal Framing.

## 2.03 BOARD MATERIALS

- A. Manufacturers - Gypsum-Based Board:

1. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com).
  2. Georgia-Pacific Gypsum LLC: [www.gp.com/gypsum](http://www.gp.com/gypsum).
  3. Lafarge North America Inc: [www.lafargenorthamerica.com](http://www.lafargenorthamerica.com).
  4. National Gypsum Company: [www.nationalgypsum.com](http://www.nationalgypsum.com).
  5. USG Corporation: [www.usg.com](http://www.usg.com).
  6. Substitutions: See Section 016000 - Product Requirements.
- B. Wallboard: Paper-faced gypsum wallboard as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
    - a. Mold-resistant board is required at all locations.
  3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  4. Lead Lined Gypsum Wallboard: As specified in Section 134905 - X-Ray Radiation Protection.
  5. Thickness:
    - a. Vertical Surfaces: 5/8 inch (16 mm).
    - b. Ceilings: 5/8 inch (16 mm).
    - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
- C. Impact-Rated Wallboard: Tested to Level 3 soft-body and hard-body impact in accordance with ASTM C 1629.
1. Application: High-traffic areas indicated.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
  3. Paper-Faced Type: Gypsum wallboard as defined in ASTM C 1396/C 1396M.
  4. Unfaced Type: Interior fiber-reinforced gypsum panels as defined in ASTM C 1278/C 1278M.
  5. Type: Fire-resistance rated Type X, UL or WH listed.
  6. Thickness: 5/8 inch (16 mm).
  7. Edges: Tapered.
  8. Products:
    - a. National Gypsum Company; Gold Bond Hi-Impact Brand XP Wallboard.
    - b. USG Corporation; Fiberock Brand Panels--VHI Abuse-Resistant.
    - c. Substitutions: See Section 016000 - Product Requirements.
- D. Backing Board For Wet Shower Areas:
1. Application: Surfaces behind tile in wet areas including shower walls and ceilings.
  2. Mold Resistance: Score of 10, when tested in accordance with ASTM D 3273.
  3. ANSI Cement-Based Board: Non-gypsum-based; aggregated portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C 1325.
    - a. Thickness: 1/2 inch (12.7 mm).
    - b. Products:
      - 1) National Gypsum Company; PermaBase Brand Cement Board.
      - 2) USG Corporation; Durock Brand Cement Board.
      - 3) Substitutions: See Section 016000 - Product Requirements.
- D. Ceiling Board: Special sag-resistant gypsum ceiling board as defined in ASTM C 1396/C 1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
  2. Thickness: 5/8 inch (16 mm).
  3. Edges: Tapered.
  4. Products:
    - a. CertainTeed Corporation; ProRoc Interior Ceiling.
    - b. Georgia-Pacific Gypsum LLC; ToughRock CD Ceiling Board.
    - c. Lafarge North America Inc; Sagcheck.

- d. National Gypsum Company; High Strength Brand Ceiling Board.
- e. USG Corporation; Sheetrock Brand Sag-Resistant Interior Gypsum Ceiling Board.
- f. Substitutions: See Section 016000 - Product Requirements.

E. Exterior Sheathing Board: As specified in Section 061000.

## 2.04 FIBERGLASS REINFORCED BOARD MATERIALS

- A. Glass Mat Gypsum Board: Gypsum panels with moisture-resistant core and coated inorganic fiberglass mat back surface designed to resist growth of mold and mildew, per ASTM D 3273.
  - 1. Application: Exterior wall sheathing, unless otherwise indicated.
  - 2. Glass Mat Board: Comply with performance requirements of ASTM C 1396/C 1396M for water-resistant gypsum backing board and ASTM C 1177/C 1177M for sheathing; tapered long edges.
    - a. Basis of Design: Dens-Glass Gold manufactured by G-P Gypsum Corporation: [www.gp.com](http://www.gp.com).
    - b. Standard Type: Thickness 1/2 inch (12.7 mm).
    - c. Fire-Resistant Type: Type X core, thickness 5/8 inch (16 mm).
    - d. Substitutions: See Section 01600 - Product Requirements.

## 2.06 ACCESSORIES

- A. Insulation: Specified in Section 07213.
- B. Acoustic Sealant: Non-hardening, non-skinning, for use in conjunction with gypsum board.
- C. Water-Resistive Barrier: No. 15 asphalt felt.
- D. Finishing Accessories: ASTM C 1047, galvanized steel or rolled zinc, unless otherwise indicated.
  - 1. Types: As detailed or required for finished appearance.
  - 2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
- E. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions.
  - 1. Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners.
  - 2. Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
  - 3. Ready-mixed vinyl-based joint compound.
  - 4. Chemical hardening type compound.
- F. High Build Drywall Surfacers: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- G. Screws for Attachment to Steel Members Less Than 0.03 inch (0.7 mm) In Thickness, to Wood Members, and to Gypsum Board: ASTM C 1002; self-piercing tapping type; cadmium-plated for exterior locations.
- H. Screws for Attachment to Steel Members From 0.033 to 0.112 inch (0.8 to 2.8 mm) in Thickness: ASTM C 954; steel drill screws for application of gypsum board to loadbearing steel studs.
- I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.

### **3.02 FRAMING INSTALLATION**

- A. Metal Framing: Install in accordance with ASTM C 754 and manufacturer's instructions.
- B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
  - 1. Level ceiling system to a tolerance of 1/1200.
  - 2. Laterally brace entire suspension system.
  - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches (400 mm) on center.
  - 1. Extend partition framing to structure where indicated and to ceiling in other locations.
  - 2. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete walls scheduled to receive gypsum board, not more than 4 inches (100 mm) from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches (600 mm) on center.
  - 1. Orientation: Horizontal.
  - 2. Spacing: At 16 inches (400 mm) on center.
- F. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install concealed wood blocking for support of items indicated or required.

### **3.03 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install in accordance with manufacturer's instructions.
  - 1. Place one bead continuously on substrate before installation of perimeter framing members.
  - 2. Place continuous bead at perimeter of each layer of gypsum board.
  - 3. In non-fire-rated construction, seal around all penetrations by conduit, pipe, ducts, and rough-in boxes.

### **3.04 BOARD INSTALLATION**

- A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  - 1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- D. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- E. Moisture Resistant Gypsum Board: Install in toilet rooms on plumbing walls and at "not wet" tile locations.
- F. Installation on Metal Framing: Use screws for attachment of all gypsum board except face layer of non-rated double-layer assemblies, which may be installed by means of adhesive lamination.

- H. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.
- I. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board and exterior gypsum soffit board with sealant.

### **3.06 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  - 1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
  - 2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

### **3.07 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.
- B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.
- C. Finish gypsum board in accordance with levels defined in ASTM C 840, as follows:
  - 1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 2. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 3. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 4. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 5. Level 0: Temporary partitions and surfaces indicated to be finished in later stage of project.
- D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).
  - 2. Taping, filling, and sanding is not required at surfaces behind adhesive applied ceramic tile.
  - 3. Taping, filling and sanding is not required at base layer of double layer applications.
- E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.08 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

**END OF SECTION**

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## SECTION 093000

### TILING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Tile for floor applications.
- B. Tile for wall applications.
- C. Tile for shower areas.
- D. Cementitious backer board as tile substrate.
- E. Stone thresholds.
- F. Ceramic trim.
- G. Waterproofing membrane for shower room floors over finished spaces.

##### 1.02 RELATED REQUIREMENTS

- A. Section 079005 - Joint Sealers.
- B. Section 092116 - Gypsum Board Assemblies: Installation of tile backer board.

##### 1.03 REFERENCE STANDARDS

- A. ANSI A108 Series/A118 Series/A136.1 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2005.
  - 1. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2005.
  - 2. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex Portland Cement Mortar; 1999 (R2005).
  - 3. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex Portland Cement Mortar; 1999 (R2005).
  - 4. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 1999 (R2005).
  - 5. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (R2005).
  - 6. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (R2005).
  - 7. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (R2005).
  - 8. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (R2005).
  - 9. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 1999 (R2005).
  - 10. ANSI A108.11 - American National Standard for Interior Installation of Cementitious Backer Units; 1999 (R2005).
  - 11. ANSI A118.1 - American National Standard Specifications for Dry-Set Portland Cement Mortar; 1999 (R2005).
  - 12. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 1999 (R2005).
  - 13. ANSI A118.4 - American National Standard Specifications for Latex-Portland Cement Mortar; 1999 (R2005).

14. ANSI A118.7 - American National Standard Specifications for Polymer Modified Cement Grouts for Tile Installation; 1999 (R2005).
  15. ANSI A118.8 - American National Standard Specifications for Modified Epoxy Emulsion Mortar/Grout; 1999 (R2005).
  16. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 1999 (R2005).
  17. ANSI A136.1 - American National Standard for Organic Adhesives for Installation of Ceramic Tile; 1999 (R2005).
  18. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2008.
- B. ASTM C 847 - Standard Specification for Metal Lath; 2006.
- C. TCA (HB) - Handbook for Ceramic Tile Installation; Tile Council of North America, Inc.; 2007/2008.

#### **1.04 PERFORMANCE REQUIREMENTS**

- A. Static Coefficient of Friction: Tile on walkway surfaces shall meet or exceed the following values as determined by testing in conformance with ASTM C 1028.
1. Level Surfaces: Minimum of 0.6 (Wet).
  2. Ramp Surfaces: Minimum of 0.8 (Wet).

#### **1.05 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.
- C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.
- D. Samples: Mount tile and apply grout on two plywood panels, minimum 18 x 18 inches (450 x 450 mm) in size illustrating pattern, color variations, and grout joint size variations.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.

#### **1.06 QUALITY ASSURANCE**

- A. Maintain one copy of TCA Handbook and ANSI A108 Series/A118 Series on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 5 years of documented experience.
- C. Installer Qualifications: Company specializing in performing tile installation, with minimum of 5 years of documented experience.

- D. Single Source Responsibility: Obtain each type and color of tile from a single source. Obtain each type and color of mortar, adhesive and grout from the same source.
- E. General: Provide tile that complies with ANSI A137.1 where applicable for types, compositions and other characteristics indicated.
  - 1. Factory Blending: For tile exhibiting color variations within the ranges selected under submittal of samples, blend tile in the factory and package so tile taken from one package shows the same range of colors as those taken from other packages.
  - 2. Mounting: For factory mounted tile, provide back or edge mounted tile assemblies as standard with the manufacturer, unless otherwise specified.

#### **1.07 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.
- C. Store tile and setting materials on elevated platforms, under cover and in a dry location and protect from contamination, dampness, freezing or overheating.

#### **1.08 FIELD CONDITIONS**

- A. Do not install adhesives in an unventilated environment.
- B. Maintain ambient and substrate temperature of 50 degrees F (10 degrees C) during installation of mortar materials.

### **PART 2 PRODUCTS**

#### **2.01 TILE**

- A. Manufacturers:
  - 1. American Olean: [www.americanolean.com](http://www.americanolean.com).
  - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Floor and Wall Tiles: ANSI A137.1, listed as designated in the Finish Schedule.
  - 1. Moisture Absorption: 0.5 to 3.0 percent.
  - 2. Size and Shape: 2 inch by 2 inch.
  - 3. Surface Finish: Unglazed.
  - 5. Colors: As selected.

#### **2.02 TRIM AND ACCESSORIES**

- A. Ceramic Trim: Matching bullnose, cove base, and cove ceramic shapes in sizes coordinated with field tile.
  - 1. Applications: Use in the following locations:
    - a. Open Edges: Bullnose.
    - b. Inside Corners: Jointed.
    - c. Floor to Wall Joints: Cove base.
  - 2. Manufacturer: Same as for tile.
    - a. Transition between floor finishes of different heights.
    - b. Expansion and control joints, floor and wall.
  - 3. Manufacturer:
    - a. Schluter-Systems: [www.schluter.com](http://www.schluter.com).
    - b. Genesis APS International: [www.genesis-aps.com](http://www.genesis-aps.com).

#### **2.03 ADHESIVE MATERIALS**

- A. Manufacturers:
  - 1. Bonsal American, Inc: [www.sakrete.com](http://www.sakrete.com)
  - 2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).

3. Mapei Corporation: [www.mapei.com](http://www.mapei.com).
4. Substitutions: See Section 016000 - Product Requirements.

- B. Organic Adhesive: ANSI A136.1, thinset bond type; use Type I in areas subject to prolonged moisture exposure.
- C. Epoxy Adhesive: ANSI A118.3, thinset bond type.

#### **2.04 MORTAR MATERIALS**

- A. Manufacturers:
  1. Bonsal American, Inc: [www.sakrete.com](http://www.sakrete.com)
  2. Bostik Inc: [www.bostik-us.com](http://www.bostik-us.com).
  3. Substitutions: See Section 016000 - Product Requirements.
- B. Mortar Bed Materials: Portland cement, sand, latex additive, and water.
- C. Mortar Bond Coat Materials:
  1. Dry-Set Portland Cement type: ANSI A118.1.
  2. Latex-Portland Cement type: ANSI A118.4.
  3. Epoxy: ANSI A118.3.

#### **2.05 GROUT MATERIALS**

- A. Manufacturers:
  1. Laticrete International, Inc.; Product PermaColor Grout: [www.laticrete.com](http://www.laticrete.com).
  2. Substitutions: See Section 016000 - Product Requirements.
- B. Standard Grout: Polymer modified cement grout, sanded or unsanded, as specified in ANSI A118.7.
  1. Color: As selected.
- C. Epoxy Grout: ANSI A118.8, modified epoxy emulsion grout, color as selected; use for toilet and shower room floor applications.

#### **2.06 ACCESSORY MATERIALS**

- A. Uncoupling Membrane: 1/8 inch (3 mm) thick polyurethane matting with three-dimensional grid structure with dovetail shaped cavities and fleece webbing laminated to the underside to provide a mechanical bond to the substrate adhesive (DITRA).
  1. Manufacturers:
    - a. Schluter Systems; DITRA; [www.schluter.com](http://www.schluter.com).
    - b. Substitutions: See Section 01600 - Product Requirements.
- B. Waterproofing Membrane: Trowel applied, load bearing crack isolation membrane complying with ANSI A118.10.
  1. Material: Asphalt modified neoprene latex elastomer with polyester fabric reinforcing.
  2. Thickness: 30 mil minimum.
  3. Basis of Design: Hydro-Guard 2000 Membrane manufactured by Mer-Krete Systems: [www.merkrete.com](http://www.merkrete.com).
- C. Reinforcing Mesh: 2 x 2 inch (50 x 50 mm) size weave of 16/16 wire size; welded fabric, galvanized.
- D. Metal Lath: ASTM C 847, Flat diamond mesh, of weight to suit application, galvanized finish.
- E. Cementitious Backer Board: ANSI A118.9; High density, cementitious, glass fiber reinforced, 1/2 inch (13 mm) thick; 2 inch (50 mm) wide coated glass fiber tape for joints and corners.
- F. Mesh Tape: 2-inch (50 mm) wide self-adhesive fiberglass mesh tape.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify that sub-floor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.
- C. Verify that sub-floor surfaces are dust-free and free of substances that could impair bonding of setting materials to sub-floor surfaces.
- D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within limits recommended by tile manufacturer and setting materials manufacturer.
- E. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Protect surrounding work from damage.
- B. Vacuum clean surfaces and damp clean.
- C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.
- D. Install cementitious backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of dry-set mortar to a feather edge.
- E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

### **3.03 INSTALLATION - GENERAL**

- A. Install tile, thresholds, and grout in accordance with applicable requirements of ANSI A108.1 through A108.13, manufacturer's instructions, and TCA Handbook recommendations.
- B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.
- C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.
- D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make joints watertight, without voids, cracks, excess mortar, or excess grout.
- E. Form internal angles square and external angles bullnosed.
- F. Install ceramic accessories rigidly in prepared openings.
- G. Install non-ceramic trim in accordance with manufacturer's instructions.
- H. Sound tile after setting. Replace hollow sounding units.
- I. Keep expansion joints free of adhesive or grout. Apply sealant to joints.
- j. Allow tile to set for a minimum of 48 hours prior to grouting.
- K. Grout tile joints. Use standard grout unless otherwise indicated.
- L. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.

### **3.04 INSTALLATION - FLOORS - THIN-SET METHODS**

- A. Over interior concrete substrates, install in accordance with TCA Handbook Method F113, dry-set or latex-portland cement bond coat, with standard grout, unless otherwise indicated.
  - 1. Use uncoupling membrane under all tile unless other underlayment is indicated.
  - 2. Where waterproofing membrane is indicated, install in accordance with TCA Handbook

Method F122, with latex-portland cement grout.

3. Where epoxy bond coat and grout are indicated, install in accordance with TCA Handbook Method F131.

### **3.05 INSTALLATION - FLOORS - THICKSET-SET METHODS**

1. Where Shower Rooms occur, use Membrane Waterproofing with Cement Mortar Bed F121-05, pitched to floor drains.

### **3.06 INSTALLATION - WALL TILE**

- A. Over cementitious backer units on studs, install in accordance with TCA Handbook Method W244, using membrane at toilet rooms.
- B. Over gypsum wallboard on wood or metal studs install in accordance with TCA Handbook Method W243, thin-set with dry-set or latex-portland cement bond coat, unless otherwise indicated.
  1. Where waterproofing membrane is indicated, install in accordance with TCA Handbook Method W222, one coat method.

### **3.07 CLEANING**

- A. Clean tile and grout surfaces.

### **3.08 PROTECTION**

- A. Do not permit traffic over finished floor surface for the amount of time recommended by manufacturer after installation.
- B. Protect finished floor surface from construction dirt and debris with heavy-duty, non-staining construction paper, masked in place.

**END OF SECTION**

## SECTION 095100

### ACOUSTICAL CEILINGS

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Suspended metal grid ceiling system.
- B. Acoustical units.

##### 1.02 RELATED REQUIREMENTS

- A. Section 079005 - Joint Sealers: Acoustical sealant.

##### 1.03 REFERENCE STANDARDS

- A. ASTM C 635 - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2004.
- B. ASTM C 636/C 636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2006.
- C. ASTM E 580/E 580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2008a.
- D. ASTM E 1264 - Standard Classification for Acoustical Ceiling Products; 2008.
- E. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).
- F. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at [www.greenguard.org](http://www.greenguard.org).

##### 1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on suspension system components and acoustical units.
- C. Samples: Submit two samples 4 x 4 inch (100 x 100 mm) in size illustrating material and finish of acoustical units.
- D. Samples: Submit two samples each, 6 inches (150 mm) long, of suspension system main runner.
- E. Manufacturer's Installation Instructions: Indicate special procedures.
- F. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- G. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.
- H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

##### 1.05 QUALITY ASSURANCE

- A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Store tile and suspension materials on elevated platforms, under cover and in a dry location and protect from contamination and dampness.
- C. Handle components to prevent panel edge damage and other damage to components.

### **1.07 FIELD CONDITIONS**

- A. Maintain uniform temperature and humidity as recommended by manufacturer prior to, during, and after acoustical unit installation.

### **1.08 PROJECT CONDITIONS**

- A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.
- B. Install acoustical units after interior wet work is dry.

### **1.09 WARRANTY**

- A. See Section 01780 - Closeout Submittals for additional warranty requirements.
- B. Provide 30-Year System Warranty to withstand conditions up to 104 °F/90% relative humidity without visible sag.

## **PART 2 PRODUCTS**

### **2.01 ACOUSTICAL UNITS**

- A. Manufacturers:
  - 1. Armstrong World Industries, Inc: [www.armstrong.com](http://www.armstrong.com).
  - 2. Substitutions: See Section 016000 - Product Requirements.
- B. Acoustical Units - General: ASTM E 1264, Class A.
- C. Acoustical Tile Type ACT1: Painted mineral fiber, ASTM E 1264 Type III, with the following characteristics:
  - 1. VOC Content: Certified as Low Emission by one of the following :
    - a. GreenGuard Children and Schools; [www.greenguard.org](http://www.greenguard.org).
    - b. Product listing in the CHPS Low-Emitting Materials Product List at; [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).
  - 2. Size: 24 x 24 inches (600 x 600 mm).
  - 3. Thickness: 3/4 inches (19 mm).
  - 4. Composition: Water felted.
  - 5. Weight: 1.02 lb/sq ft.
  - 6. Light Reflectance: 85 percent, determined as specified in ASTM E 1264.
  - 7. NRC Range: 0.55 to 0.65, determined as specified in ASTM E 1264.
  - 8. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E 1264.
  - 9. Edge: Square.
  - 10. Surface Color: White.
  - 11. Surface Pattern: No pattern.
  - 12. Product: Cortega No. 747, Armstrong World Industries, Inc.
  - 13. Suspension System: Exposed grid Type 1.
- D. Acoustical Tile Type ACT2: Painted mineral fiber, ASTM E 1264 Type IV, with the following characteristics:
  - 1. VOC Content: Certified as Low Emission by one of the following :
    - a. GreenGuard Children and Schools; [www.greenguard.org](http://www.greenguard.org).
    - b. Product listing in the CHPS Low-Emitting Materials Product List at;



[www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).

2. Size: 24 x 24 inches (600 x 600 mm).
  3. Thickness: 5/8 inches (15 mm).
  4. Composition: Water felted.
  5. Weight: 0.92 lb/sq ft.
  6. Light Reflectance: 90 percent, determined as specified in ASTM E 1264.
  7. NRC Range: 0.65 to 0.75, determined as specified in ASTM E 1264.
  8. Ceiling Attenuation Class (CAC): 35, determined as specified in ASTM E 1264.
  9. Edge: Beveled.
  10. Surface Color: White.
  11. Surface Pattern: No pattern.
  12. Product: Cirrus No. 550 by Armstrong World Industries, Inc.
  13. Suspension System: Exposed grid Type 1.
- E. Acoustical Panels Type ACT3: Secure Ceiling with 2' x 2' Fiberglass panels and Armstrong Hold Down Clips No.'s EHDC50, 58 or 75, depending on ceiling.

Fiberglass Ceiling Panels: Class A Fire-Rated Panel. Comply with ASTM E-84 Tunnel Test.  
(FRP) Fiberglass Reinforced Plastic Panel.

1. Manufacturer: Kemlite Co., Fire -X Glasbord.
2. Weight: 0.7 lb/sq ft.
3. Nominal Thickness: 0.09"
4. Barcol Hardness: 55
5. Water Absorption: .08%
6. Impact Strength: 12 ft - lbs/in. notched
7. Color: White

## 2.02 SUSPENSION SYSTEM(S)

- A. Manufacturers:
1. Same as for acoustical units.
  2. Substitutions: See Section 016000 - Product Requirements.
- B. Suspension Systems - General: ASTM C 635; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.
- C. Exposed Steel Suspension System Type 1: Formed steel, commercial quality cold rolled; intermediate-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
  2. Construction: Double web.
  3. Finish: White painted.
  4. Product: 15/16" Prelude by Armstrong World Industries, Inc.
- D. Exposed Aluminum Suspension System Type 2: Extruded aluminum; heavy-duty.
1. Profile: Tee; 15/16 inch (24 mm) wide face.
  2. Finish: Painted white.
  3. Product: 15/16" Co-Extruded Clean Room by Armstrong World Industries, Inc.

## 2.03 ACCESSORIES

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.
- B. Perimeter Moldings: Same material and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.
- C. Acoustical Sealant For Perimeter Moldings: Specified in Section 079005.

- D. Touch-up Paint: Type and color to match acoustical and grid units.

### **PART 3 EXECUTION**

#### **3.01 EXAMINATION**

- A. Verify existing conditions before starting work.  
B. Verify that layout of hangers will not interfere with other work.

#### **3.02 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C 636/C 636M, ASTM E 580/E 580M, and manufacturer's instructions and as supplemented in this section.  
B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.  
C. Locate system on room axis according to reflected plan.  
D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.  
E. Provide hanger clips during steel deck erection. Provide additional hangers and inserts as required.  
F. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.  
G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.  
H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.  
I. Support fixture loads using supplementary hangers located within 6 inches (150 mm) of each corner, or support components independently.  
J. Do not eccentrically load system or induce rotation of runners.  
K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.  
    1. Install in bed of acoustical sealant.  
    2. Use longest practical lengths.  
    3. Overlap and rivet corners.

#### **3.03 INSTALLATION - ACOUSTICAL UNITS**

- A. Install acoustical units in accordance with manufacturer's instructions.  
B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.  
C. Fit border trim neatly against abutting surfaces.  
D. Install units after above-ceiling work is complete.  
E. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.  
F. Cutting Acoustical Units:  
    1. Cut to fit irregular grid and perimeter edge trim.  
    2. Make field cut edges of same profile as factory edges.  
    3. Double cut and field paint exposed reveal edges.  
G. Where round obstructions occur, provide preformed closures to match perimeter molding.

- H. Install hold-down clips on panels within 20 ft (6 m) of an exterior door.
- I. Install hold-down clips on panels to hold acoustical panels tight to suspension system in the following areas:
  - 1. Within 20 ft (6 mm) of an exterior door.
  - 2. Toilet rooms.
  - 3. Locations with Type ACT3 panels.

### **3.04 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.
- C. Deflection of any grid components shall not exceed 1/360 of the span.

### **3.05 CLEANING AND PROTECTION**

- A. Clean surfaces after installation, according to manufacturer's written instructions.
- B. Protect installed products until completion of project.
- C. Touch-up, or replace damaged products before Substantial Completion.

**END OF SECTION**

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## SECTION 096500

### RESILIENT FLOORING

#### PART 1 GENERAL

##### 1.01 SECTION INCLUDES

- A. Resilient sheet flooring.
- B. Resilient tile flooring.
- C. Resilient base.
- D. Installation accessories.
- E. Furnish and install floor leveling underlayment to allow all floor transitions to be level, at no additional cost to the Owner.

##### 1.02 REFERENCE STANDARDS

- A. ASTM E 648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2008b.
- B. ASTM F 710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2008.
- C. ASTM F 1066 - Standard Specification for Vinyl Composition Floor Tile; 2004.
- D. ASTM F 1303 - Standard Specification for Sheet Vinyl Floor Covering with Backing; 2004.
- E. ASTM F 1861 - Standard Specification for Resilient Wall Base; 2008.
- F. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; [www.baaqmd.gov](http://www.baaqmd.gov); 2002.
- G. CAL (CHPS LEM) - Low-Emitting Materials Product List; California Collaborative for High Performance Schools (CHPS); current edition at [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).
- H. FS RR-T-650 - Treads, Metallic and Nonmetallic, Skid Resistant; Federal Specifications and Standards; Revision E, 1994.
- I. GEI (SCH) - GREENGUARD "Children and Schools" Certified Products; GREENGUARD Environmental Institute; current listings at [www.greenguard.org](http://www.greenguard.org).
- J. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; National Fire Protection Association; 2006.
- K. RFCI - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; 1998.
- L. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; [www.aqmd.gov](http://www.aqmd.gov).
- M. SCS (CPD) - SCS Certified Products; Scientific Certification Systems; current listings at [www.scs-certified.com](http://www.scs-certified.com).

##### 1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.
- C. Shop Drawings: Indicate seaming plan.

- D. Verification Samples: Submit two samples, 6 x 6 inch (150 x 150 mm) in size illustrating color and pattern for each resilient flooring product specified.
- E. Concrete Testing Standard: Submit a copy of ASTM F 710.
- F. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of sub-floor is acceptable.
- G. Certifications: Manufacturer's certifications that products comply with specified requirements, including laboratory reports showing compliance with specified tests and standards.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 016000 - Product Requirements, for additional provisions.
  - 2. Extra Flooring Material: 10 square feet (1.0 square meters) of each type and color.
  - 3. Extra Wall Base: 20 linear feet (3 linear meters) of each type and color.

### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section approved by manufacturer.

### **1.06 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver and store products in manufacturer's unopened packaging until ready for installation.
- B. Store materials on elevated platforms, under cover and in a dry location and protect from contamination and dampness.
- C. Handle components to prevent edge damage and other damage to components.
- D. Protect roll materials from damage by storing on end.

### **1.07 FIELD CONDITIONS**

- A. Maintain uniform temperature and humidity as recommended by manufacturer prior to, during, and after resilient flooring installation.

## **PART 2 PRODUCTS**

### **2.01 SHEET FLOORING**

- A. Toli Wood Vinyl Sheet Flooring Type (VWS): Filled face.
  - 1. Heat welded seams.
- B. Rubber Sheet Flooring (RS1 & 2): 100 percent rubber composition, color and pattern through total thickness:
  - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/25, maximum, when tested in accordance with ASTM E 84
  - 2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E 648 or NFPA 253.
  - 3. VOC Content: Certified as Low Emission by one of the following :
    - a. GreenGuard Children and Schools; [www.greenguard.org](http://www.greenguard.org).
    - b. SCS Floorscore; [www.scs-certified.com](http://www.scs-certified.com).
    - c. Product listing in the CHPS Low-Emitting Materials Product List at; [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm).
  - 4. Heat welded seams.
    - a. Total Thickness: 0.12 inch (3.0 mm) minimum.
    - b. Pattern and Color: As selected from manufacturer's standard palette.

- c. Manufacturers:
  - 1) Nora Systems, Inc; Product Noraplan Surgi-Flor: [www.norarubber.com](http://www.norarubber.com).
7. Rubber Sheet Flooring RS3 (For Seclusion Room only):
  - a. Total Thickness: 0.16 inch (4.0 mm) minimum.
  - b. Pattern and Color: As selected from manufacturer's standard palette.
  - c. Manufacturers:
    - 1) Nora Systems, Inc; Product Mega Acoustic: [www.norarubber.com](http://www.norarubber.com).
- D. Vinyl Welding Rod: Solid vinyl bead produced by manufacturer of vinyl flooring for heat welding seams, in color matching field color.

## 2.02 TILE FLOORING

- A. Vinyl Composition Tile: Armstrong or Mannington, Homogeneous, with color extending throughout thickness, and:
  1. Minimum Requirements: Comply with ASTM F 1066, of Class corresponding to type specified.
  2. Size: 12 x 12 inch (305 x 305 mm).
  3. Thickness: 0.125 inch (3.2 mm).
  4. Pattern: Solid color.

## 2.03 RESILIENT BASE

- A. Resilient Base: ASTM F 1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove, and as follows:
  1. Height: 4 inch (100 mm).
  2. Thickness: 0.125 inch (3.2 mm) thick.
  3. Finish: Satin.
  4. Length: Roll.
  5. Color: Color as selected from manufacturer's standards.
  6. Accessories: Premolded external corners and end stops.
  7. Manufacturers:
    - a. Burke Flooring: [www.burkemercer.com](http://www.burkemercer.com).
    - b. Johnsonite, Inc: [www.johnsonite.com](http://www.johnsonite.com).
    - c. Roppe Corp: [www.roppe.com](http://www.roppe.com).
    - d. Substitutions: See Section 016000 - Product Requirements.

## 2.04 ACCESSORIES

- A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.
- B. Primers, Adhesives, and Seaming Materials: Waterproof; types recommended by flooring manufacturer.
  1. Provide only products having lower volatile organic compound (VOC) content than required by the more stringent of the South Coast Air Quality Management District Rule No.1168 and the Bay Area Air Quality Management District Regulation 8, Rule 51.
- C. Transition Strips:
  1. 3/8" Carpet Tile to Resilient Flooring (Vinyl Tile and Sheet Vinyl): Model #179 Snap Down Super Edge (must use track #155 for straight edge or #178 for radius) manufactured by Roppe Corporation.
  2. 3/8" Carpet Tile to 3/8" Ceramic Tile: #159 Tile/Cpt joiner manufactured by Roppe Corporation.
  3. 3/8" Carpet Tile to Concrete Sealer (Edge Guard): #196 Carpet Reducer manufactured by Roppe Corporation.
- D. Moldings, Transition and Edge Strips: Same material as flooring.
- E. Filler for Coved Base: Plastic.
- F. Sealer and Wax: Types recommended by flooring manufacturer.

## **PART 3 EXECUTION**

### **3.01 EXAMINATION**

- A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.
- B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.
- C. Verify that concrete sub-floor surfaces are dry enough and ready for resilient flooring installation by testing for moisture emission rate and alkalinity in accordance with ASTM F 710; obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- D. Verify that required floor-mounted utilities are in correct location.

### **3.02 PREPARATION**

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI Recommended Work Practices for Removal of Resilient Floor Coverings.
- B. Prepare sub-floor surfaces as recommended by flooring and adhesive manufacturers.
- C. Remove sub-floor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with sub-floor filler to achieve smooth, flat, hard surface.
- D. Prohibit traffic until filler is cured.
- E. Clean substrate.
- F. Apply primer as required to prevent "bleed-through" or interference with adhesion by substances that cannot be removed.

### **3.03 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Spread only enough adhesive to permit installation of materials before initial set.
- C. Fit joints tightly.
- D. Set flooring in place, press with heavy roller to attain full adhesion.
- E. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.
- F. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.
  - 1. Resilient Strips: Attach to substrate using adhesive.
- G. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.
- H. Install feature strips where indicated.

### **3.04 SHEET FLOORING**

- A. Lay flooring with joints and seams in accordance with seaming plan. Lay out seams to avoid widths less than 1/3 of roll width; match patterns carefully at seams.
- B. Lay flooring with tightly butted seams, without any seam sealer.
- C. Double cut sheet; provide heat welded seams.



- D. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

### **3.05 TILE FLOORING**

- A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless manufacturer's instructions say otherwise.

### **3.06 RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### **3.07 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean, seal, and wax in accordance with manufacturer's instructions.

### **3.08 PROTECTION**

- A. Prohibit traffic on resilient flooring as required by manufacturer.

**END OF SECTION**

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**SECTION 099000  
PAINTING**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Painting of interior and exterior materials.

1.02 SUBMITTALS

- A. Submit a list of materials to be used for each surface to be painted.
- B. Samples:
  - 1. Submit manufacturer's product data for coatings specified.
  - 2. Submit 8" x 8" samples of each paint color on sample cards of colors selected by the Architect.
- C. Submit manufacturer's recoating recommendations for future repair and recoating for materials, preparation, and application.

**PART 2 - PRODUCTS**

2.01 MATERIALS

- A. Manufacturer: ICI Paints
- B. Compatibility:
  - 1. Paint materials and equipment shall be compatible in use; finish coats shall be compatible with prime coats; prime coats shall be compatible with surface to be coated. Tools and equipment shall be compatible with coatings to be applied.
  - 2. Thinners, when used, shall be only those thinners recommended for that purpose by manufacturer of material to be thinned.

**PART 3 - EXECUTION**

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop applied primer for compatibility with subsequent coating materials.

3.02 PREPARATION

- A. Mildew removal: scrub with an approved cleaning/bleaching solution; rinse with potable water; allow to thoroughly dry before applying coatings.
- B. Prior to surface preparation and painting, completely mask, remove or otherwise protect hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces but not scheduled to receive paint.
- C. Job site tint finish coats only when approved by the Architect. Tinting colors shall be of type recommended by manufacturer of paint or coating whose products are being used.

- D. Spot prime exposed nails and other metals which are to be painted with emulsion paints, using a primer recommended by manufacturer of coating system.
- E. Before applying paint or other surface treatment, thoroughly clean surfaces involved.
- F. Schedule cleaning and painting so that dust and other contaminants from cleaning process will not fall on wet, newly painted surfaces.
- G. Preparation of metal surfaces:
  - 1. Hollow metal doors and frames: smooth surfaces by filling dents/depressions and sanding smooth before applying paint or coating.
  - 2. Remove rust and mill scale from ferrous metal surfaces requiring exposed finish coat of paint or coating. After removal spot prime with recommended primer.
  - 3. Galvanized steel surfaces requiring painting: solvent cleaned to remove traces of grease or oil before priming.

### 3.03 APPLICATION

- A. Do not paint over UL, FM or other code-required labels or equipment name, identification, performance rating or nomenclature plates.
- B. Apply each coat of paint or coating as a different shade of the same color.
- C. If paint or coating is not hiding substrate or has non-uniform appearance, apply additional coats until results are satisfactory to the Architect.
- D. Allow each coat of paint to dry before applying succeeding coats, unless specifically allowed by the material manufacturer.
- E. Apply each coat of paint or coating at the spreading rate recommended by paint manufacturer.
- F. When paint or coating is brush applied, brush uniformly to eliminate laps, skips, and excess brush marks; runs, sags, curtains or other evidence of poor application are not acceptable.
- G. When paint or coating is roller applied, avoid lapping and excess paint lines from edge of roller.
- H. When paint or coating is applied by spray, it must be done before installation of fixtures, hardware, flooring and other finish items, unless thoroughly protected.
- I. Final coat of paint or coating shall have visual evidence of solid hiding and uniform appearance.
- J. Make edges of paint or coating adjoining other materials or colors, sharp and clean, with no overlapping.
  - I. Environmental Conditions:
    - 1. Comply with manufacturer's recommendations as to environmental conditions under which paint and coatings may be applied.
    - 2. Do not apply paint in areas where dust is generated.

### 3.04 DRY MIL THICKNESS

- A. Apply paint to dry film thickness as recommended by manufacturer.

### 3.05 CLEAN UP

- A. Following completion of painting in each area, reinstall items which were removed for painting by the Contractor.
- B. During progress of work, do not allow accumulation of empty containers or other excess items except in areas designated for that purpose.
- C. In event of accidental spilling of paint, immediately remove spilled paint and wash surfaces to original undamaged condition.
- D. Spot painting to correct soiled or damaged paint surfaces will be allowed only when touch-up spot is blended into surrounding finish and is not visible to normal viewing. If not possible, re-coat entire surface to corners or visible stopping point.

### 3.06 SCHEDULE

- A. Paint: ICI Paints
  - 1. Gypboard Walls:
    - 1 coat latex primer/sealer Acrylic Gripper 3210
    - 2 coats acrylic latex. Ultra-Hide Latex Eggshell Interior Wall and Trim Enamel – 1412-XXXX
    - Use waterborne epoxy (EPT) as designated.
  - 2. Gypboard Ceilings:
    - 1 coat latex primer/ sealer Acrylic Gripper 3210
    - 2 coats latex (flat) Ultra-Hide Latex Flat Interior Wall Paint
    - 2 coats latex (Washable Eggshell for Patient Rooms and Toilets, and Activity Rooms)  
Ultra-Hide Latex Low Lustre Interior Wall and Trim Enamel – 1414-XXXX
    - Use waterborne epoxy (EPT) as designated.
  - 3. Interior Metal Doors, Metal Frames:
    - Shop primer
    - 1 coat latex primer/ sealer Waterborne Metal Primer
    - 2 coats acrylic latex. Ultra-Hide Latex Low Lustre Interior Wall and Trim Enamel – 1414-XXXX
  - 4. Maple Trim and chair rails, Maple Bench, Maple Edge at Countertops, Maple ceiling coves:
    - Handrails at Corridors, Refinish oak handrails at P6A Corridor (clear finish)
    - 4 coats non-yellowing polyurethane varnish (satin) WoodPride Interior Aquacrylic Satin Varnish-1802-0000
    - (Fill existing oak hand rails before sealing).
  - 5. MDF (Medium Density Fiberboard) Interior Wood to be painted:
    - 1 coat acrylic latex primer. Acrylic Gripper 3210
    - 2 coats acrylic latex (semi-gloss). Ultra-Hide Latex Semi-Gloss Interior Wall and Trim Enamel 1416-XXXX
  - 6. Exposed Piping, Conduit and Ductwork
    - Universal primer
    - 1 coat undercoater
    - 1 coat alkyd enamel (eggshell)
- B. Exterior Surfaces to be painted:
  - 1. Exterior handrails, guardrails and ladders:
    - (1) ICI Gripper Primer No. 3210-1200, one coat.
    - (2) ICI Dulux Professional No. 2406, semi-gloss finish, two coats.

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END OF SECTION

**SECTION 101960  
CUBICLE CURTAIN TRACKS**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Cubicle curtain tracks.
- B. Shower curtain tracks.
- C. Coordinate locations of solid blocking for cubicle curtain track installation.

1.2 SUBMITTALS

- A. Submit shop drawings indicating a reflected ceiling plan view of curtain track and attachment details.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Acceptable manufacturers:
  - 1. Imperial Fastener Company, Inc. 800-582-7130.

2.2 MATERIALS

- A. Cubicle curtain track: IFC-69 Jiffy Break Away Ceiling Mounted Track with three (3) velcro safety tabs per foot
  - 1. Track: Extruded aluminum sections, one piece per cubicle track run.
- B. Cubicle Curtains: By Owner.

2.3 FABRICATION

- A. Fabricate track as shown on drawings, without deforming track section, or impeding movement of carriers.

**PART 3 - EXECUTION**

3.1 INSTALLATION

- A. Install curtain track secure and rigid, true to ceiling line.
- B. Secure track to solid blocking.

**END OF SECTION**

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**SECTION 102600  
WALL AND CORNER GUARDS**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Corner guards
- B. Wall protection

1.02 SUBMITTALS

- A. Product data: indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.
- B. Samples: Submit sample sections of corner guard, 24" long illustrating component design, configuration, and color and finish.

1.03 PERFORMANCE REQUIREMENTS

- A. Corner guards shall resist lateral impact force of 100 pounds at any point without permanent damage.

**PART 2 - PRODUCTS**

1.01 MATERIALS

- A. Wall Protection Corner Guards (CG) Surface Mounted: IPC GT Series non-pvc Wall Protection and Corner Guards. Corner Guards surface mounted with aluminum retainer, or equal by Construction Specialties or Pawling. Corner guards shall run from floor to ceiling. Color shall be selected by Architect.

Wall Protection shall be .040 inch thick.

- B. Mounting brackets and attachment hardware: As recommended by manufacturer for component and substrate.

1.04 FABRICATION

- A. Fabricate components with tight joints, corners and seams.
- B. Form end trim closure by capping and finishing smooth.

**PART 3 - EXECUTION**

3.01 EXAMINATION

- A. Verify that rough-in for components are correctly sized and located.

3.02 INSTALLATION

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- A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position.
- B. Locate components at heights indicated on the drawings.
- C. Corner guards shall be continuous from top of base to ceiling.

**END OF SECTION**

**SECTION 102800  
TOILET ACCESSORIES**

**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Furnish and install Toilet Accessories.
- B. Install Owner furnished toilet accessories (Soap, Paper towel, and Toilet tissue dispensers in all Areas).
- C. Verify that solid blocking in place for all accessories.

1.02 SUBMITTALS

- A. Submit product data for each item of defining materials, size, shape, finish, location and relation to adjacent materials.

**PART 2 - PRODUCTS**

2.01 MANUFACTURERS

- A. Acceptable manufacturers, based on ability to meet specifications:
  - 1. American Specialties
  - 2. Bobrick
  - 3. Bradley

2.02 ACCESSORIES IN PUBLIC AND ADMINISTRATION AREAS

- A. Grab Bars:
  - 3. Grab bars: constructed of stainless steel with satin finish, peened finish. Wall thickness: 18 gage and outside diameter 1-1/4". Stainless steel flanges: 11 gage 3" diameter with four stainless steel vandal-proof set screws, concealed mounting.
  - 4. Anchor plate: 12 gage steel, 3" wide, in lengths to accommodate all grab bar configurations.
  - 5. Horizontal mounting: Bobrick B-5507-42
  - 6. Horizontal mounting: Bobrick B-5507-36
- B. Mirrors:
  - 1. Frame: one piece, roll formed 3/4" x 5/8" 18 gage (minimum) stainless steel angles with welded and ground corners, satin finish. Provide concealed wall hanger for theft-proof mounting. Corners: welded, ground and polished smooth.
  - 2. Mirror: No. 1 quality, 1/4" polished glass, electrolytically copper plated. Mirror: warranted against silver spoilage for a minimum 15 years. Protect back of mirror with 1/4" polystyrene padding and 20 gage galvanized steel back attached to frame with concealed screws.
  - 3. Mirror size: 24 inches by 36", unless noted otherwise on drawings.
    - a. Bobrick B-290
- C. Single Robe Hook: Bobrick B2116, stainless steel, heavy duty clothes hook with concealed mounting, one for staff toilet room door.

2.03 ACCESSORIES IN PATIENT ACCESSIBLE AREAS

- A. Grab Bars: Safebar -42" and 36"

- B. Mirrors: American Specialties No. 8026 vandal –resistant stainless steel frameless mirrors (Shower Rooms only).
- C. Shower Curtain Tracks: Imperial IFC-69 Jiffy Break Away Ceiling mounted track, clear anodized aluminum track with velcro tabs. Shower curtains by Owner.

#### 2.04 FABRICATION

- A. Weld and grind smooth joints of fabricated components.
- B. Form exposed surfaces from single sheet of stock, free of joints.
- C. Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- D. Back paint components where contact is made with building finishes to prevent electrolysis.
- E. Shop assemble components and package complete with anchors and fittings.

### **PART 3 - EXECUTION**

#### 3.01 EXAMINATION

- A. Verify that site conditions are ready to receive work and blocking is in the proper locations.

#### 3.02 PREPARATION

- A. Deliver inserts and rough-in frames to site at appropriate time for building-in.
- B. Provide templates and rough-in measurements as required.
- C. Verify exact location of accessories for installation.

#### 3.03 INSTALLATION

- A. Install fixtures, accessories and items in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.

### **END OF SECTION**

## **SECTION 104400**

### **FIRE PROTECTION SPECIALTIES**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire extinguisher cabinets.
- C. Accessories.

##### **1.02 RELATED REQUIREMENTS**

- A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

##### **1.03 REFERENCE STANDARDS**

- A. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association; 2007.
- B. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

##### **1.04 SUBMITTALS**

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate cabinet physical dimensions.
- C. Product Data: Provide extinguisher operational features.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- F. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

##### **1.05 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum five years documented experience.
- B. Conform to NFPA 10.
- C. Provide extinguishers and cabinets classified and labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.

##### **1.06 DELIVERY, STORAGE, AND PROTECTION**

- A. Deliver materials to project site in manufacturer's original, unopened undamaged containers, with identification labels intact.
- B. Store materials in original packaging, protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by the manufacturer.

##### **1.07 FIELD CONDITIONS**

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.
- B. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

#### **PART 2 PRODUCTS**

## 2.01 MANUFACTURERS

- A. Fire Extinguisher Cabinets and Accessories:
  - 1. JL Industries, Inc: [www.jlindustries.com](http://www.jlindustries.com).
  - 2. Larsen's Manufacturing Co: [www.larsensmfg.com](http://www.larsensmfg.com).
  - 3. Substitutions: See Section 016000 - Product Requirements.

## 2.02 FIRE EXTINGUISHERS

- A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
  - 1. Provide extinguishers labeled by Underwriters Laboratories Inc. for the purpose specified and indicated.
- B. Dry Chemical Type Fire Extinguishers: Stainless steel tank, with pressure gage.
  - 1. Class ABC.
  - 2. Size 10.
  - 3. Finish: Baked enamel, red color.
  - 4. Basis of Design: Larsen's Manufacturing Co.; Cosmic Series.

## 2.03 FIRE EXTINGUISHER CABINETS

- A. Cabinet Configuration: Recessed type.
  - 1. Sized to accommodate accessories.
- B. Door: 0.036 inch (0.9 mm) thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
- C. Door Glazing: Plastic, clear, 1/8 inch (3 mm) thick acrylic. Set in resilient channel gasket glazing.
- D. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
- E. Weld, fill, and grind components smooth.
- F. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color.
- G. Finish of Cabinet Interior: White enamel.
- H. Handle: Standard handle, satin finish.
- I. Locking mechanism: Cylinder lock, capable to be opened in fire situation with sharp pull on handle.
- J. Lettering: Thermal, die-cut vinyl; black, type A.
- K. Basis of Design: JL Industries, Inc; Cavalier Series.
  - 1. For installations in non fire-rated partitions, provide standard cabinet construction.
  - 2. For installations in fire-rated partitions, provide fire-rated cabinets.

## 2.04 ACCESSORIES

- A. Extinguisher Brackets: Formed steel, chrome-plated.
  - 1. Provide bracket for all fire extinguishers not located in cabinets.
  - 2. Basis of Design: Larsen's Manufacturing Co.; Model 862.
- B. Cabinet Signage: 14" x 12" 90° angle projecting wall mounted sign with vertical arrows and lettering.
  - 1. Basis of Design: JL Industries, Inc; Model PWM108.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Verify existing conditions before starting work.

- B. Verify rough openings for cabinet are correctly sized and located.

### **3.02 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, \_\_\_\_ inches (\_\_\_\_ mm) from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers in cabinets.
- E. Install brackets at locations where fire extinguishers are not indicated to be in cabinets.
  - 1. Secure rigidly in place.
  - 2. Mount extinguishers on brackets.

**END OF SECTION**

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**SECTION 105150  
PLASTIC LAMINATE LOCKERS**

**PART 1 - GENERAL**

1.1 SECTION INCLUDES

- A. Furnish and install plastic laminate lockers and accessories.

1.2 SUBMITTALS

- A. Product data and installation instructions for plastic laminate locker units.
- B. Color Samples on squares of same wood to be used for fabrication of lockers.
- C. Shop drawings that show wood lockers in dimensioned relation to adjacent surfaces. Show lockers in detail, method of installation, fillers, trim, base, and accessories. Include locker numbering sequence information.

1.3 QUALITY ASSURANCE

- A. Uniformity: Provide plastic laminate lockers that are standard products of single manufacturer, with interchangeable like parts. Include necessary mounting accessories, fittings, and fastenings.

1.4 JOB CONDITIONS.

- A. Do not deliver metal lockers until building is enclosed and ready for locker installation. Protect from damage during delivery, handling, storage, and installation.

**PART 2 - PRODUCTS**

2.1 MANUFACTURERS

- A. Wood Lockers: Hollman, Inc.
- B. Ideal Products, Inc.

2.2 MATERIALS

- A. Plastic Laminate Locker Interiors:
  - 1. Interior constructed of 5/8" high density, high impact, stain and abrasion resistant thermally fused almond colored melamine.
  - 2. Wood locker Frame: Exposed edge entirely finished with a 2 millimeter PVC edgebanding to closely match locker doors. Tops, bottoms, sides, backs and shelves are precision machined. Dowel and glue assembly provides greater strength and stability.
  - 3. Hooks: One (1) hook and one (1) coat rod are standard on all full length and half length lockers.

Available in either a brass or chrome finish.

4. Venting: 12 millimeter openings between door and top and bottom of locker and dividers on multiple opening frames provide continuous natural air flow.
5. Hinges: Two (2) nickel finished, concealed, heavy duty European steel hinges allowing a 130 degree door opening on all doors 42" or less, three on all doors over 42".
6. Number Plates: 1 ½" disc, with engraved black numbers, routed in flush with door. Finish available in brass or chrome.
7. Lock Systems: Heavy duty keyed cam lock standard on all lockers. Furnished with (2) master keys and two (2) keys per lock.

## B. DOORS

1. Laminate: 5/8" high-industrial grade core with .30" vertical grade plastic laminate. Door edges shall be radiused and protected by PVC edgebanding, colors shall be selected by Architect.

## 2.02 FABRICATION

- A. Locker shall be fabricated using doweled and glued assembly process.
- B. Fabricate locker parts square, rigid and without warp, with the finished faces flat and free of scratches and chips.
- C. Machine attachment holes accurate and free of chips. Attach fasteners as standard with Manufacturer.
- C. Fabricate corners and fillers as required for installation.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install wood lockers at locations shown in strict accordance with manufacturer's instructions for plumb, level, rigid, and flush installation.
- B. Install trim and wood filler panels and end panels using concealed fasteners. Provide flush, hairline joints against adjacent surfaces.
- C. Anchor locker units to wall studs (or furring strips attached to concrete or concrete block) Through the locker back and to the base through the locker floor using #8 1 ½" coated steel bugle head wood screws. Lockers are joined side to side by attaching fasteners
- D. furnished), through pre-drilled holes. Adjust doors and latches to operate easily without bind.
- E. Replace any defective doors or other components.
- F. Attach number plates in sequence after the lockers are in place.

### 3.2 WARRANTY

All materials shall be structurally sound and free from defects in material and workmanship under normal

Use and service for a period of three (3) years after the date of delivery of the product. All lock parts are

PLASTIC LAMINATE LOCKERS

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warranted by the manufacturer for a period of three (3) years.

Manufacturer reserves the right to change the design or specifications to improve product or process at any time, without notice.

### 3.2 ADJUST AND CLEAN

- A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices are operating properly.
- B. Touch up marred finishes, but replace units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

**END OF SECTION**

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## SECTION 21 00 00 – FIRE PROTECTION

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. Consult in detail all other sections relative to the work, including Bidding Requirements, Contract Forms General Conditions, Supplementary Conditions, and Division 1 General Requirements.
- B. Consult all drawings, note Architectural details and all conditions that may affect the work and care for same in executing the work under this Section. Cooperate and coordinate with all trades.

#### 1.2 WORK INCLUDED

- A. The scope of the work under this Section, without limiting the generality thereof, consists of furnishing all labor, material, equipment, scaffolding, power, tools and rigging, except as otherwise specified and performing all work as necessary to fully complete the Fire Protection Work shown on the drawings and as specified herein.
- B. Work Included: The Fire Protection Work will include but not be limited to the following:
  - 1. Complete wet-type standpipe/sprinkler and dry sprinkler systems in the building as indicated. The fire protection work shall extend and connect to the existing system within the renovated area. The entire fire protection system within the renovated areas shall be hydraulically designed, furnished and installed by the Fire Protection Subcontractor, based on Light hazard criteria.
  - 2. Furnishing and setting of all pipe sleeves.
  - 3. Furnishing only of access panels to General Contractor.
  - 4. Fire and Smoke Stopping. Coordinate materials and methods with Division 7.
  - 5. Provide working drawings showing all sprinklers and piping, with drawings stamped and approved by the Owner's insurer and the local fire department.
  - 6. Conduct a flow test of the existing water main to which the existing fire protection service is directly connecting to, in order to obtain current static and residual pressure and flow data for hydraulic calculations.

#### 1.3 RELATED WORK

- A. Examine all other sections of the Specifications and all drawings for the relationship of the work under this Section and the work of other trades. Cooperate with all trades and coordinate all work under this section therewith. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The following related items are included under sections listed below:
  - 1. Except as specified herein, cutting shall be the responsibility of the General Contractor and patching shall be performed by the respective trades. Refer to the respective sections.

2. The Fire Protection Subcontractor shall provide all hoisting and rigging for equipment and materials specified herein.
3. Core drilling, cutting and channeling for Fire Protection systems and equipment for holes five (5) inches and less in diameter.
4. Furnish and maintain in safe and adequate condition, all staging and scaffolding that is required for work of this section.
5. Woodgrounds (Blocking) for fastening air devices and radiation. Refer to Architectural drawings and Division 6 -, ROUGH CARPENTRY to determine if these items are provided. Secure to woodgrounds if provided or directly to wall or ceiling surface if not provided. Provide expansion bolts for masonry - concrete - block wall mounting.
6. Painting of all exposed piping Division 9 - PAINTING
7. In general, all wiring required for equipment provided by the Fire Protection Contractor and all interlock wiring for this Fire Protection equipment that is not shown or indicated on the Electrical Drawings of Division 26 - ELECTRICAL, shall be provided under Division 21 – Fire Protection.
8. Fire and Smoke stopping at penetrations through fire-rated assemblies. Fire-stop materials and methods are specified in Division 7.

C. Furnish the following materials to be installed under other SECTIONS.

1. Psych Safe Access Doors and Panels to be installed under applicable sections.

1.4 INTENT

- A. It is the intention of the Drawings and this Specification to show and specify a complete fire protection system. Anything that is not shown on the Drawings but is mentioned in the Specifications, or vice-versa or anything not expressly set forth in either, but which is reasonably implied, shall be furnished and performed as though specifically shown and mentioned in both.
- B. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fitting, valves, etc., which may be required to complete the work. The Fire Protection Subcontractor shall study the drawings showing the structural and finished design of the buildings and shall furnish and install all fittings, etc., to fully complete the Fire Protection Work.
- C. Before submitting prices, thoroughly examine all the Contract Documents and the site with special emphasis on all the adjoining work upon which this work depends.
- D. If for any reason the Fire Protection Subcontractor finds that the work cannot be done in any area in accordance with the Plans and Specifications he must immediately notify the Architect in writing of his findings. If for any reason the Fire Protection Subcontractor fails to do this it shall become his responsibility and he shall bear any and all costs for any work involved, at no extra cost to the Owner.

1.5 INFORMATION

- A. The Fire Protection Subcontractor shall obtain detailed information from the manufacturers of apparatus which he is to furnish and/or install as to the proper method of installation and connections. He shall obtain all information from the General Contractor and the other contractors which may be necessary to facilitate his work and the completion of the project.
- B. He shall keep himself fully informed as to the shape, size and position of all openings required for his apparatus and shall give full information to other contractors as required sufficiently in



advance of the work so that all openings may be built on schedule. The Fire Protection Subcontractor shall also furnish all sleeves and supports hereinafter specified, shown or implied and shall set same in place.

- C. In the case of failure on the part of the Fire Protection Subcontractor to give proper information as noted above, he will be required to do his own cutting and patching to the satisfaction of the General Contractor and without additional expense to the Owner.

#### 1.6 CODES, PERMITS AND FEES

- A. All fire protection work shall be installed in accordance with the NFPA Code and any regulations of the City Portland as they apply to the installation. Such laws and ordinances are to be considered a part of this Specification.
- B. The above Fire Protection Ordinances and Building Laws shall be considered as minimum requirements for the fire protection installation. Where specifications call for work to be done in excess of the above requirements, the Specifications shall be followed.
- C. The Fire Protection Subcontractor shall file all required notices and plans and shall secure and pay for all necessary permits for his work.
- D. If any portion of the Fire Protection Plans or Specifications conflict with any rules and regulations with regard to type of materials, equipment, or fixtures to be used, the Fire Protection Subcontractor shall bring it to the Architect's attention. Otherwise, the cost of all work necessary to make the installation comply with the above rules and regulations shall be paid for by the Fire Protection Subcontractor without additional expense to the Owner.

#### 1.7 COORDINATION

- A. Fully coordinate with other trades to ensure that work is carried out in the best interests of all concerned. Install work in proper sequence to conserve headroom and space.
- B. Coordinate work with other trades to provide maximum accessibility for maintenance and operation of all equipment installed by all trades.
- C. Give notices of requirements for holes, recessed openings, pits and chases before structure is to be erected.
- D. Set all necessary sleeves and inserts before concrete is scheduled to be poured.
- E. Furnish all items to be built-in, in ample time to allow schedules progress of work.
- F. Refer to the Coordination Drawing Section of Specification for Coordination drawing process.
- G. Provide the Electrical contractor and Plumbing Contractor with all requirements within Two (2) weeks from date of Contract to allow proper coordination of trades by the Contractor.
- H. Verify with the Electrical contractor available electrical characteristics before ordering any equipment.
- I. Verify Fire Alarm interlock requirements before ordering any equipment.

- J. Furnish to the Electrical Contractor all starters, control devices, relays, pilot lights, accessories, contactors, wiring diagrams, and the like required for proper operation, connection and control of motorized equipment, as specified and/or shown on the drawings.
- K. Electrical Contractor shall be responsible for the following:
  - 1. Provide fire alarm wiring and control of devices requiring fire alarm control or status indication. Provides fire alarm wiring and control for motors requiring shutdown.
  - 2. Provide power wiring to control transformers and control panels.
- L. Fire Protection contractor provides low voltage control wiring to all Fire Protection requiring control.

#### 1.8 GUARANTEE

- A. The Fire Protection Subcontractor shall refer to the applicable requirements of the GENERAL CONDITIONS which shall be strictly enforced.

#### 1.9 WORKMANSHIP, MATERIALS AND DELIVERY

- A. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade.
- B. The Fire Protection Subcontractor shall use only new materials free from defects and of good quality. He shall see that all his materials are delivered at the building when required so as to carry on the work in the most effective manner.
- C. Substitute materials will be considered on the basis of quality function and cost to the Owners. In all cases where approved substitute materials are furnished, the Fire Protection Subcontractor shall pay for any additional work or changes required by him or by the other Subcontractors on the job.
- D. The Fire Protection System shall be delivered to the Owner complete and in perfect working order; tested in full accordance with the Plans and Specifications.

#### 1.10 SHOP DRAWINGS

- A. Submit complete Shop Drawings in accordance with the provisions of the GENERAL CONDITIONS.
- B. Shop Drawings shall include information to prove that the requirements of the Specifications and Drawings are complied with and include installation instructions and wiring diagrams. Shop Drawings submittals shall include but not be limited to the following:
  - 1. Sprinkler Heads.
  - 2. Pipe and Fittings.
  - 3. Fire Department Valves.
  - 4. Floor Control Assembly.
  - 5. Approved working drawings, stamped by the Owners insurer and the local Fire Department.

#### 1.11 RECORD DRAWINGS

- A. The Fire Protection Subcontractor shall note the requirements of the SPECIAL CONDITIONS, which shall be strictly enforced.

#### 1.12 JURISDICTIONAL DISPUTES

- A. In order to avoid any jurisdictional disputes and work stoppages that could arise during the installation of the work shown on the Drawings or as specified herein, the Fire Protection Subcontractor shall be held responsible to do any sub-letting work that might be required to furnish and install the work shown or specified herein.

#### 1.13 CARTING, HANDLING AND CLEAN-UP

- A. The Fire Protection Subcontractor shall do all carting, handling, hoisting, etc., for his material and equipment at his expense in a safe and satisfactory manner. Any damage resulting there from shall be repaired or paid for by this Subcontractor to the satisfaction of the General Contractor.
- B. Clean-up requirements as specified under the SUPPLEMENTARY CONDITIONS will be strictly enforced.

#### 1.14 PROTECTION OF WORK AND PROPERTY

- A. The Fire Protection Subcontractor shall be responsible for the care and protection of all work included in this Section of the Specification and Drawings until it has been tested and accepted.
- B. After delivery and before, during and after installation, the Fire Protection Subcontractor shall protect all equipment and materials from injury or damage of all causes, as well as from theft. Such loss or damage shall be made good without expense to the Owner.

#### 1.15 COORDINATION DRAWINGS

- A. Prepare Coordination Drawings according to the requirements outlined in Division 1 to a 1/4-inch-equals-1-foot scale or larger. Detail major elements, components, and systems of plumbing equipment and piping in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations are important to the efficient flow of the Work. Coordinate drawing preparation with effort specified in other Specification Sections. Include the following:
  - 1. Provisions for scheduling, sequencing, moving, and positioning large equipment in the building during construction.
  - 2. Floor plans, elevations, and details, including the following:
    - a. Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    - b. Equipment support details.

- c. Exterior wall, roof, and foundation penetrations of piping; and their relation to other penetrations and installations.
  - d. Fire-rated interior wall and floor penetrations by fire protection piping.
  - e. Sizes and locations of required concrete pads and bases.
3. Reflected ceiling plans to coordinate and integrate installing air outlets and inlets, light fixtures, alarm and communication systems components, sprinklers, and other ceiling-mounted items.

#### 1.16 REQUESTS FOR INTERPRETATION (RFIs)

- A. Prepare Requests for Interpretation (RFIs) in accordance to Division 1 and, in addition, adhere to the following:
- B. RFIs shall originate with the Contractor. RFIs submitted directly by sub-contractors will be returned with no response. RFIs sent directly to engineer will be returned with no response. Incomplete RFIs will not be reviewed and will be returned for additional information.
- C. If email RFI submissions are allowed by Division 1 then the RFI and Attachment(s) shall be in Adobe Acrobat PDF format.
- D. Submit RFIs in format specified and in addition include:
  1. Specification Section number and title and related paragraphs, as appropriate.
  2. Drawing number, room name, structural grid coordinates and detail references, as appropriate.
  3. Field dimensions and conditions, as appropriate.
  4. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  5. Attachments: Include 8 1/2" x 11" copies of construction documents highlighting areas requiring interpretation. Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation and suggested solution(s).
    - a. Supplementary drawings prepared by Contractor shall be to scale and shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

## PART 2 - PRODUCTS

### 2.1 SLEEVES, HANGERS, INSERTS AND EQUIPMENT SUPPORTS

- A. Pipe sleeves, pipe hangers and equipment supports for all piping shall be furnished and set by the Fire Protection Subcontractor and this Subcontractor shall be responsible for their proper and permanent location.
- B. Sleeves - Cast iron or steel pipe sleeves shall be furnished and set in walls, floor and roof where pipes are to pass through. Sleeves shall be two (2) nominal sizes larger than pipe and shall finish flush with walls.
- C. All pipe openings through floors, exterior building walls; two-hour rated walls or partitions and designated "FIRE RATED PARTITIONS", SHALL BE SEALED. Materials and systems shall be as specified herein.

1. Masonry walls indicated on the General Construction Plans as two-hour rated shall have openings sealed by packing around the pipe with glass fiber rope and sealing each end with 1" fire resistant caulking. Other walls shall be sealed with glass fiber rope only. Seal openings in floors with glass fiber rope and fire resistant caulking as required to make watertight. Sleeves through exterior walls shall be watertight and shall be flexible.
- D. Hangers: All piping shall be rigidly supported from the building structure by means of approved hangers, inserts, and supports. Pipes shall be supported to maintain required grading and pitching of lines to prevent vibration and to secure piping in place and shall be arranged so as to provide for proper expansion and contraction of pipe. All horizontal piping shall be hung with approved adjustable, malleable iron pipe hangers, unless otherwise specified and spaced according to code requirements and manufacturer's recommendations for each type and size of piping.
- E. Hangers for piping of sizes 4 inches and smaller shall be Carpenter Patterson Type No. IA Band, or approved equal, black steel and hanger rods with machine threads; for piping of sizes larger than 4 inches shall be the adjustable clevis hanger type, malleable iron, with extension rod to structure. Hanger rods shall be secured to concrete floor slabs by means of approved type inserts wherever possible.
- F. In addition to normal concrete inserts, beam clamps, etc., the Fire Protection Subcontractor shall furnish and install steel angle hanger supports to meet special conditions where hangers are required under ductwork. PIPING SHALL NOT BE SUPPORTED FROM DUCTWORK OR STRUCTURAL STEEL DECKS.
- G. Vertical risers shall be supported at each floor level with long leg, bolted pipe clamps. In addition each riser shall be supported with a pipe hanger at the top and at offset locations.

## 2.2 PIPE, FITTINGS AND FABRICATION

- A. Piping Above Ground
  1. Fire Protection piping 2-1/2" and larger shall be schedule 10 black steel, ASTM A 135 for the wet system, with working pressure of not less than 175 psi. Fittings, couplings and unions, reducers and bushings shall be of a type specifically approved for use in fire protection systems and shall comply with the above mentioned working pressure. Piping 2" and smaller shall be Schedule 40 black steel with working pressure same as above. Acceptable alternates: Allied, American Steel Pipe. Piping 2" and smaller shall have threaded joints. Piping 2-1/2" and larger shall have roll groove joints with mechanical couplings.
  2. Piping between Siamese connections and related check valves and drain and test piping subject to alternate wetting and drying shall be galvanized steel.
- B. Fabrication: Threaded fittings shall have an approved compound applied to male threads only and jointed watertight. Grooved piping shall be joined with cast iron couplings, with nuts, bolts and rubber gaskets and secured watertight according to manufacturer's recommendations.

## 2.3 VALVES

- A. Gate valves 2" and smaller shall be all bronze with rising stem and threaded ends, similar to Jenkins 275-U.

- B. Gate valves larger than 2" shall be iron body, bronze mounted, outside screw and yoke type, threaded or flanged end type, similar to Jenkins 824A, 825A.
- C. Where permissible, valves 3" and larger may be butterfly type, iron body, wafer closure with crank handle, indicator and supervisory switch, similar to Grinnell 12427-151.
- D. Check valves 2" and smaller shall be all bronze with threaded ends, swing check type.
- E. Check valves larger than 2" shall be iron body, bronze mounted, swing check type, threaded or flanged end type similar to Jenkins 629.
- F. All valves shall be of the same manufacturer and be UL approved, Milwaukee, Kennedy or Grinnell.

#### FIRE DEPARTMENT VALVE (FDV)

- A. Fire Department Valve: shall be similar to Elkhart Model UP-25-2.5 brass angle valve, 2-1/2" rough brass, with A-327 2-1/2" x 1-1/2" reducer and #310 1-1/2" brass cap and chain. Male threads shall meet the local Fire Department Standards.

#### 2.4 SPRINKLER HEADS

- A. Sprinkler heads generally shall be of the wet automatic closed type and of temperature rating to satisfy immediate conditions.
  - 1. Heads located in finished ceilings, except where noted otherwise shall be institutional pendent type, factory chromium-plated escutcheons. Tyco Raven or approved equal. All heads installed in 2' x 2' ceiling tiles shall be placed in the center of the tile. Use swing joints if necessary to insure center of tile installation.
  - 2. Heads on exposed piping or in concealed spaces may be upright or pendant type with rough brass finish.

#### 2.5 SPARE HEADS

- A. Spare heads shall be furnished in a quantity as required by Underwriters or as otherwise directed. Heads shall be packed in a suitable container and shall be representative of, and in proportion to, the number of each type and temperature rating heads installed, in addition, one sprinkler-head shall be provided.

#### 2.6 FIRE PROTECTION SYSTEM ACCESSORIES

- A. The Fire Protection Subcontractor shall furnish and install all accessories necessary to fully complete the fire protection system, as specified or implied, which shall include but not be limited to the following:
  - 1. Sprinkler test connection, similar to Elkhart No. 112. Potter Romer, Seco.
  - 2. Supervisory switches, where indicated on the Drawings, type that attaches directly to O.S.& Y. gate valves or butterfly valves, with retard. Autocall, Potter Romer or equal.
  - 3. Flow switches with retard feature.
  - 4. Inspectors test connection.

## 2.7 VALVE TAGS, CHARTS AND PIPE MARKINGS

- A. Furnish and install pipe identification markers on all exposed piping installed under this part of the Specification. Piping above removable suspended ceilings shall be considered exposed as well as piping located in mechanical equipment rooms or spaces. Pipe identification markers shall consist of labels or black letters imprinted on color coded background and 1-1/2" color bands. Labels and bands shall indicate the pipe fill and the direction of flow. Pipe identification labels shall be the coiled snap-on type, letters to be 2" high on all pipes 3" diameter and over, letters to be 3/4" high on all pipes under 3" diameter. Pipe identification markers shall be applied to the pipe on 15' centers and at each valve, whichever is closer. Pipe identification shall state "FIRE PROTECTION" in white letters on a Red Background. Pipe identification markers shall be W. H. Brady Co., Seton Co., or Bell Co.
- B. Furnish and install stamped or embossed 1-1/2" diameter brass tags or plastic identification plates for each valve, control entity or piece of equipment. These identification plates shall be permanently attached to their identifying equipment or valves with brass hooks or brass link chain. Each chain valve or plug shall be tagged "DRAIN".
- C. Each brass valve tag shall be lettered for its appropriate service and numbered in consecutive order "FP" for FIRE PROTECTION.
- D. The Fire Protection Subcontractor shall prepare in triplicate a complete listing of each valve, its number and describing its control function. These listings shall be presented to the Architect at the completion of the job.

## 2.8 SEISMIC RESTRAINTS

- A. Seismic restraints shall be furnished and installed by the Fire Protection Subcontractor in accordance with N.F.P.A. 13 requirements and manufacturers recommendations. This will be strictly enforced.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. All above ground piping shall be installed as closely, as possible to walls, ceilings, beams, columns, etc., consistent with proper space allowance for covering and removal of pipes.
- B. All piping shall be run approximately as indicated on the Drawings and to avoid conflicts, rigidly supported, aligned and/or graded and arranged without sags, pockets or low spots. Low ends of lines shall be fitted with drain leg tees fitted with drain valves.
- C. All piping connections to equipment shall be made with flanges or couplings and shall be suitable for the type of system it serves.
- D. Except where otherwise noted, all piping shall be concealed in walls, ceiling construction, access spaces and chases provided.

### 3.2 FIRE PROTECTION SYSTEM TESTS

- A. The Fire Protection system shall be tested by the Fire Protection Subcontractor in the presence of the Architect or his representative and the Fire Protection Inspector after completion and before concealing any section from view. Furnish labor, tools and all materials and do all testing as described herein.
- B. The Fire Protection system shall be pressure tested at pressure described herein and in a manner as described herein. Test pressures for each system shall be maintained as long as required by the Architect to determine the tightness of the system and/or as long as required to inspect the joints visually or with painted soap solutions. Wherever testing indicates leaks, the leaks shall be repaired in a manner prescribed by the Engineer and the test shall be reprocessed until the system is proven tight. Test in accordance with NFPA I3 Requirements. Test shall be conducted in the presence of a representative of the local Fire Department.
- C. Furnish and make temporary installation of all pumps, compressors and instruments for the testing. Test pressure shall be held for at least the minimum time periods noted above, or long enough thereafter to prove the system tight that is being tested. Any defects shall be repaired or replaced as directed and the expense shall be paid by the Fire Protection Subcontractor. All soap tested joints shall be washed clean after testing, and all tests water properly drawn off.
- D. Conduct all systems tests and submit reports as required by the local fire department.

### 3.3 CLEANING AND ADJUSTING

- A. At the completion of the work, all equipment apparatus and exposed trim for same included in this Section shall be cleaned, and where required, polished ready for use.

### 3.4 INSTRUCTIONS

- A. After completion of assembly and installation of all systems and equipment and piping required under this Section of the Specifications, the Owner's supervisory and operating personnel shall be instructed regarding the operation and maintenance of the systems. The instructions shall be given by the Fire Protection Subcontractor and other qualified personnel who are thoroughly familiar with all systems and shall be furnished for a time period as directed by the Architect.

END OF SECTION 21 00 00



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## SECTION 22 00 00 – PLUMBING

### PART 1 - GENERAL

#### 1.1 GENERAL PROVISIONS

- A. Consult in detail all other Sections relative to the work, including Bidding Requirements, Contract Forms, General Conditions, Supplementary Conditions, and Division 1 General Requirements.
- B. Consult all Drawings, note Architectural details and all conditions that may affect the work and care for same in executing the work under this Section. Cooperate and coordinate with all other trades.

#### 1.2 WORK INCLUDED

- A. The scope of the work under this Section, without limiting the generality thereof, consists of furnishing all labor, material, equipment, scaffolding, power, tools and rigging except as otherwise specified and performed all work as necessary to fully complete the plumbing work shown on the Drawings and as specified herein.
- B. Work Included: The Plumbing Work will include but not be limited to the following:
  - 1. A complete sanitary drainage and vent system throughout the renovated areas, connecting to all fixtures and pieces of equipment requiring drainage whether furnished under this Section of these specifications or under other Sections. The work shall extend and connect to the existing system in the building where indicated.
  - 2. Complete hot water and cold water systems throughout the renovated areas, connecting to all fixtures and equipment requiring hot and/or cold water. The cold water system work shall extend and connect to existing system in the building as indicated. The hot water system shall extend and connect to the existing system in the building as indicated.
  - 3. A complete storm drainage system throughout the renovated areas including fire protection inspector's test connection drains as indicated. The work shall extend and connect to the existing storm system as indicated.
  - 4. Complete medical gas and vacuum systems within the renovated area connecting to every medical gas outlet and inlet requiring gas or suction. The medical gas and vacuum systems work shall extend and connect to the existing medical gas and vacuum systems as indicated.
  - 5. Provide new security safe faucets, water and waste pipe stainless steel shields at existing sinks where indicated.
  - 6. Provide security safe stainless steel enclosure for flush valves at existing water closets where indicated.
  - 7. Provide new security safe shower valve, head, controls, thermostatic mixing valve and tamper proof drain at existing shower where indicated.
  - 8. Relocate plumbing fixtures where indicated.
  - 9. All plumbing fixtures, trim and accessories, complete with all necessary piping connections as specified.
  - 10. Furnishing and setting of all pipe sleeves.
  - 11. Installation of all pipe insulation for the systems specified to be insulated.
  - 12. Fire and Smoke Stopping. Coordinate materials and methods with Division 7.
  - 13. Connection to equipment or piping furnished by others: Items of special equipment will be furnished and set in place by the Owner and/or other Subcontractors. Make all final

connections to this equipment in such a manner to insure proper operation. Equipment shall be located as indicated on the Drawings or as established in the field at the time of construction. Equipment roughing drawings will be furnished to the Plumbing Subcontractor prior to his installation of finished roughing.

14. Furnishing only of access panels to the General Contractor.
15. Installation only of surface mounted toilet accessories and grab bars.

### 1.3 RELATED WORK

1. Examine all other sections of the Specifications and all drawings for the relationship of the work under this Section and the work of other trades. Cooperate with all trades and coordinate all work under this section therewith. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. The following related items are included under sections listed below:

1. Except as specified herein, cutting shall be the responsibility of the General Contractor and patching shall be performed by the respective trades. Refer to the respective sections.
2. The Plumbing Subcontractor shall provide all hoisting and rigging for equipment and materials specified herein.
3. Core drilling, cutting and channeling for Plumbing equipment for holes five (5) inches and less in diameter.
4. Furnish and maintain in safe and adequate condition, all staging and scaffolding that is required for work of this section.
5. Fuel, water and electricity for all tests and temporary operation of plumbing equipment. - Division 1 - TEMPORARY FACILITIES AND CONTROLS.
6. Temporary heat. Division 1 - TEMPORARY FACILITIES AND CONTROLS.
7. Painting of all exposed mechanical equipment not having enameled surfaces, stainless steel or chromed finishes. Division 9 - PAINTING
8. In general, all wiring required for equipment and all interlock wiring for this Plumbing equipment that is not shown or indicated on the Electrical Drawings of Division 26 - ELECTRICAL, shall be provided under Division 22 – PLUMBING.
9. Food Service Equipment: Division 11 - FOOD SERVICE EQUIPMENT.
10. Fire and Smoke stopping at penetrations through fire-rated assemblies. Fire-stop materials and methods are specified in Division 7.

C. Furnish the following materials to be installed under other SECTIONS.

1. Psych Safe Access Doors and Panels to be installed under applicable sections.

### 1.4 INTENT

- A. It is the intention of the Drawings and this Specification to show and specify complete systems of the plumbing. Anything that is not shown on the Drawings but is mentioned in the Specifications, or vice versa, or anything not expressly set forth in either, but which is reasonably implied, shall be furnished and performed as though specifically shown and mentioned in both.
- B. Due to the small scale of the Drawings, it is not possible to indicate all offsets, fittings, valves, etc., which may be required to complete the work. The Plumbing Subcontractor shall study the Drawings showing the structural and finished design of the building and shall furnish and install all fittings, etc., to fully complete the plumbing work.

- C. Before submitting prices thoroughly examine all the Contract Documents and the site with special emphasis on all the adjoining work upon which this work depends.
- D. If for any reason the Plumbing Subcontractor finds that the work cannot be done in any area in accordance with the Plans and Specifications he must immediately notify the Architect. If Plumbing Subcontractor fails to do this it shall become his responsibility and he shall bear any and all costs for any extra work involved, at no extra cost to the Owner.

## 1.5 ABBREVIATIONS AND DEFINITIONS

- A. "Plumbing" or "PC" as mentioned herein means specifically "Plumbing", when used in conjunction with contractor, equipment, work or articles within this specification.
- B. "Provide" may be used in place of "furnish and install" and where used shall mean to deliver, furnish, erect, and connect up complete in readiness for regular operation, the particular work or equipment referred to, unless otherwise specified.
- C. The term "Applicable Section Contractor" or "A.S.C." shall be understood to refer to a contractor or contractors other than the Plumbing Contractor or any Plumbing Subcontractor or Plumbing Sub-subcontractor.
- D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- E. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- F. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- G. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Defined as areas where piping or equipment is located in chases, shafts, and above ceilings whether furred or lay-in type.
  - 1. All other equipment and piping shall be considered "exposed".
- H. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated attics.
- I. The following are industry abbreviations for plastic materials:
  - 1. Retain abbreviations that remain after this Section has been edited.
  - 2. ABS: Acrylonitrile-butadiene-styrene plastic.
  - 3. CPVC: Chlorinated polyvinyl chloride plastic.
  - 4. PE: Polyethylene plastic.
  - 5. PVC: Polyvinyl chloride plastic.
- J. The following are industry abbreviations for rubber materials:
  - 1. Retain abbreviations that remain after this Section has been edited.
  - 2. EPDM: Ethylene-propylene-diene terpolymer rubber.
  - 3. NBR: Acrylonitrile-butadiene rubber.

## 1.6 REFERENCES

- A. All material and workmanship shall comply with all applicable codes, local and state ordinances, industry standards, and utility company regulations.
- B. All materials, equipment and apparatus shall be Underwriters Listed or Labeled for all components where such listing or label are available. Items which are not UL Listed or Labeled are not acceptable if labeled or listed equipment can be obtained from another acceptable manufacturer. Assemblies or components not labeled or listed shall be furnished with certification by the manufacturer that the wiring complies with UL safety requirements.
- C. STANDARDS: Except as modified by governing codes or this specification, the following applicable standards (latest editions regardless of years listed below) shall apply to materials, equipment and installation of components and systems furnished and/or installed as part of this Section:
  - 1. American Institute of Architects Academy for Health "Guidelines for Design and Construction of Hospital and Healthcare Facilities"
  - 2. American National Standards Institute (ANSI):
    - a. A13.1-81 Scheme for the Identification of Piping Systems
    - b. B16.3-85 Malleable-Iron Threaded Fittings, Classes 150 and 300
    - c. B16.22 89 Wrought Copper and Bronze Solder Joint Pressure Fittings
    - d. B40.1 85 Gauges Pressure Indicating Dial Type Elastic Element
  - 3. American Society for Testing and Materials (ASTM):
    - a. A47-84 Ferritic Malleable Iron Castings
    - b. A53-90b Pipe, Steel, Black and Hot-dipped, Zinc-Coated Welded and Seamless
    - c. A536-84 Ductile Iron Castings
    - d. B819-95 Seamless Copper Tube for Medical Gas Systems
    - e. D1785 89 Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
  - 4. American Society of Mechanical Engineers (ASME):
    - a. Boiler and Pressure Vessel Code
    - b. Section VIII Pressure Vessels, Division I
  - 5. American Welding Society (AWS):
    - a. AWS A5.8 89 Brazing Filler Metal
    - b. AWS B2.2-85 Standard for Brazing Procedure and Performance
  - 6. Compressed Gas Association (CGA):
    - a. C-9-88 Standard Color-Marking of Compress Gas Cylinders Intended for Medical Use
    - b. G-4.1-85 Cleaning Equipment for Oxygen Service
    - c. G 10.1 85 Nitrogen, Commodity
    - d. P 9 80 Inert Gases Argon, Nitrogen and Helium
    - e. V-1-91 Standard for Compressed Gas Cylinder Valve Outlet and Inlet Connection
    - f. V 5 89 Diameter Index Safety System (Non Interchangeable Low Pressure Connections For Medical Gas Applications)
  - 7. Manufacturers Standardization Society (MSS):
    - a. SP-73-86 Brazing Joints for Copper and Copper Alloy Fittings
  - 8. National Electrical Manufacturers Association (NEMA):
    - a. ICS 6 83 Enclosures for Industrial Control and Systems; (Revised 11/86)
  - 9. National Fire Protection Association (NFPA):
    - a. 50 96 Bulk Oxygen Systems at Consumer Sites
    - b. 99 05 Health Care Facilities
  - 10. United States Pharmacopoeia XXI/National Formulary XVI (USP/NF)
  - 11. National Association of Architectural Metal Manufacturers (NAAMM):
    - a. Metal Finishes Manual, Dated January 1986.
  - 12. Underwriters Laboratories Inc. (UL)

a. 94-1993 Flammability of Plastic Materials for Parts in Devices and Appliances

- D. CODES and ORDINANCES: Conform with the provisions of the latest editions of the following:
1. The Maine State Building Code.
  2. 2006 International Building Code.
  3. City/Town of Portland, ME fire protection codes and/or ordinances.
  4. 2006 International Mechanical Code.
  5. 2006 International Plumbing Code.
  6. The 2008 National Electric Code.
  7. American Institute of Architects Guidelines for Healthcare Construction.

1.7 INFORMATION

- A. The Plumbing Subcontractor shall obtain detailed information from the manufacturers of apparatus which he is to furnish and/or install as to the proper method of installation and connections. He shall obtain all information from the General Contractor and the other Subcontractors which may be necessary to facilitate his work and the completion of the whole project.
- B. He shall keep himself fully informed as to the shape, size and position of all openings required for his apparatus and shall give full information to other Subcontractors as required sufficiently in advance of the work so that all openings may be built on schedule. The Plumbing Subcontractor shall also furnish all sleeves and supports hereinafter specified, shown or implied and shall set same in place.
- C. In the case of failure on the part of the Plumbing Subcontractor to give proper information as noted Above, he will be required to do his own cutting and patching to the satisfaction of the General Contractor and without additional expense to the Owner.

1.8 CODES PERMITS AND FEES

- A. All plumbing work shall be installed in accordance with the 2006 International Plumbing Code and any regulations of the City of **Portland** as they apply to the installation. Such laws and ordinances are to be considered a part of the Specification.
- B. The above Plumbing Ordinances and Building Laws shall be considered as minimum requirements for the plumbing installation. Where Specifications call for work to be done in excess of the above requirements, the Specifications shall be followed.
- C. The Plumbing Subcontractor shall file all required notices and plans and shall secure and pay for all necessary permits for his work. He shall pay for all necessary fees or backcharges to utility companies or departments as required.
- D. If any portion of the Plumbing Plans or Specifications conflict with any rules and regulations with regard to type of materials, equipment, or fixtures to be used, the Plumbing Subcontractor shall bring it to the Architect's attention. Otherwise, the cost of all work necessary to make the installation comply with the above rules and regulations shall be paid for by the Plumbing Subcontractor without additional expense to the Owner.

1.9 COORDINATION

- A. Fully coordinate with other trades to ensure that work is carried out in the best interests of all concerned. Install work in proper sequence to conserve headroom and space.
- B. Coordinate work with other trades to provide maximum accessibility for maintenance and operation of all equipment installed by all trades.
- C. Give notices of requirements for holes, recessed openings, pits and chases before structure is to be erected.
- D. Set all necessary sleeves and inserts before concrete is scheduled to be poured.
- E. Furnish all items to be built-in, in ample time to allow schedules progress of work.
- F. Refer to the Coordination Drawing Section of Specification for Coordination drawing process.
- G. Provide the Electrical contractor with all requirements within Two (2) weeks from date of Contract to allow proper coordination of trades by the Contractor.
- H. Verify with the Electrical contractor available electrical characteristics before ordering any equipment.
- I. Verify Fire Alarm interlock requirements before ordering any equipment.
- J. Furnish to the Electrical Contractor all starters, control devices, relays, pilot lights, accessories, contactors, wiring diagrams, and the like required for proper operation, connection and control of motorized equipment, as specified and/or shown on the drawings.
- K. Electrical Contractor shall be responsible for the following:
  - 1. Mount and connect starters, controllers and disconnects, except where specified to be factory wired and mounted on the equipment.
  - 2. Provide all required power connections for all motor driven equipment.
  - 3. Provide fire alarm wiring and control of devices requiring fire alarm control or status indication. Provides fire alarm wiring and control for motors requiring shutdown.
  - 4. Provides power wiring to control transformers and control panels.
- L. Plumbing contractor provides low voltage control wiring to all Plumbing Equipment requiring control.

#### 1.10 GUARANTEE

- A. Furnish to Owner a written guarantee of the General Contractor and this Subcontractor, jointly and severally, against any defects in materials and workmanship in work of this Section for a period of one year from date of substantial completion of the project. Guarantee shall state that defective work shall be remedied without cost to Owner during the guarantee period promptly after written notice of such defects by the Owner, and shall be binding upon both the General Contractor and this Subcontractor.

#### 1.11 WORKMANSHIP, MATERIALS AND DELIVERY

- A. All work of a special nature shall be performed by skilled and qualified workmen who can present credentials showing experience in said trade.



- B. The Plumbing Subcontractor shall use only new materials free from defects and of good quality. He shall see that all his materials, including fixtures, are delivered at the building when required so as to carry on the work in the most effective manner.
- C. Substitute materials will be considered on the basis of quality, function and cost to the Owner. In all cases where approved and substitute materials are furnished, the Plumbing Subcontractor shall pay for any additional work or changes required by him or by other Subcontractors on the job.
- D. All plumbing systems shall be delivered to the Owner complete and in perfect working order; tested and balanced in full accordance with the Plans and Specifications.

#### 1.12 SHOP DRAWINGS

- A. Submit complete shop drawings in accordance with provisions of the GENERAL CONDITIONS.
- B. Shop drawings shall include enough information to prove that the requirements of the Specifications and Drawings are complied with and include installation instructions and wiring diagrams. Shop drawings submittals shall include but not be limited to the following:
  - 1. Fixtures, Trim and Accessories.
  - 2. Valves.
  - 3. Pipe Hangers.
  - 4. Fixture Supports.
  - 5. Wall Hydrants.
  - 6. Pipe Insulation.
  - 7. Floor Drains.
  - 8. Roof Drains.
  - 9. Pipe and Fittings.
  - 10. Pipe Markers.
  - 11. Medical Gas Outlets.
  - 12. Medical gas and vacuum valves.
  - 13. Psych Safe Medical Valve Boxes.
  - 14. Medical gas alarm panels.
  - 15. Backflow Preventers.
  - 16. Psych Safe Lavatory & Sink Guard.
  - 17. Psych Safe Flush Valve Enclosure.
  - 18. Psych Safe Shower Heads and Controls.

#### 1.13 IDENTIFICATION OF MECHANICAL SERVICES

- A. After finish painting complete, identify all mechanical services. Use terminology consistent with the Drawings and Specifications. Refer to Division 1. A line item on the schedule of values for equipment identification shall be included.
- B. Use Brady labels.
- C. Flow arrows shall be solid black. Arrows shall be six (6) inches long by two (2) inches wide.
- D. Locate Piping identification and flow arrows as follows:
  - 1. On vertical pipes approximately seven feet above floor.
  - 2. Behind each access door and panel.
  - 3. At each change of direction of piping.
  - 4. On each piping branch close to point of connection to main piping.

5. At valves.
  6. At no greater than intervals of 50 feet on straight runs of piping, and on both sides of walls.
- E. Do color coding of pipes with two (2) inch wide bands according to color schedule to be issued by the Owner during the progress of the work.
  - F. Labeling of new systems added to existing systems shall be consistent with the existing numbering system and terminology. Do not use valve numbers that have already been used.
  - G. Labeling on all exposed piping shall be on side or bottom of the piping, in line of sight.
  - H. Identify all pumps, controls, remote switches, starters, disconnects, pushbuttons and similar equipment as to service with white lamacoid engraved name-plates with black letters. Firmly secure with self-tapping screws. Submit sample plates and lettering for review.
  - I. Provide typewritten master lists in Operating and Maintenance Instruction Manuals; and shop equipment numbers on Record Prints and sepias.
  - J. Identification shall be consistent with Owner's standard methods of identification.
  - K. Supply and install 1-1/2 inch diameter, 1/16 inch thick brass tags with 3/8 inch die stamped black letters. Attach to valves with four (4) inch brass chains. Brass tags may be omitted on small valves which isolate a single piece of equipment such as unit heater, fan coil unit, and section of radiation.

#### 1.14 RECORD DRAWINGS

- A. The Plumbing Subcontractor shall note the requirements of the GENERAL CONDITIONS, which shall be strictly enforced.

#### 1.15 JURISDICTIONAL DISPUTES

- A. In order to avoid any jurisdictional disputes and work stoppages that could arise during the installation of the work shown on the Drawings or specified herein, the Plumbing Subcontractor shall be held responsible to do any sub-letting work that might be required to furnish and install the work shown or specified herein.

#### 1.16 CARTING, HANDLING AND CLEAN-UP

- A. The Plumbing Subcontractor shall do all carting, handling, hoisting, etc., for his material and equipment at his expense in a safe and satisfactory manner. Any damage resulting therefrom shall be repaired or paid for by this Subcontractor to the satisfaction of the general Contractor.
- B. Clean-up requirements as specified under the SPECIAL CONDITIONS will be strictly enforced.

#### 1.17 PROTECTION OF WORK AND PROPERTY

- A. The Plumbing Subcontractor shall be responsible for the care and protection of all work included in this Section of the Specification and Drawings until it has been tested and accepted.

- B. After delivery and before, during and after installation, the Plumbing Subcontractor shall protect all equipment and materials from injury or damage of all causes, as well as from theft. Such loss or damage shall be made good without expense to the Owner.

#### 1.18 FLASHINGS

- A. All floor drains, roof drains and vent piping through roofs shall be set by the Plumbing Subcontractor and shall be flashed by the work of the SECTION for FLASHING.

#### 1.19 COORDINATION DRAWINGS

- A. Prepare Coordination Drawings according to the requirements outlined in Division 1 to a 1/4-inch-equals-1-foot scale or larger. Detail major elements, components, and systems of plumbing equipment and piping in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations are important to the efficient flow of the Work. Coordinate drawing preparation with effort specified in other Specification Sections. Include the following:
  - 1. Provisions for scheduling, sequencing, moving, and positioning large equipment in the building during construction.
  - 2. Floor plans, elevations, and details, including the following:
    - a. Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
    - b. Equipment support details.
    - c. Exterior wall, roof, and foundation penetrations of piping; and their relation to other penetrations and installations.
    - d. Fire-rated interior wall and floor penetrations by fire protection piping.
    - e. Sizes and locations of required concrete pads and bases.
  - 3. Reflected ceiling plans to coordinate and integrate installing air outlets and inlets, light fixtures, alarm and communication systems components, sprinklers, and other ceiling-mounted items.

#### 1.20 REQUESTS FOR INTERPRETATION (RFIs)

- A. Prepare Requests for Interpretation (RFIs) in accordance to Division 1 and, in addition, adhere to the following:
- B. RFIs shall originate with the Contractor. RFIs submitted directly by sub-contractors will be returned with no response. RFIs sent directly to engineer will be returned with no response. Incomplete RFIs will not be reviewed and will be returned for additional information.
- C. If email RFI submissions are allowed by Division 1 then the RFI and Attachment(s) shall be in Adobe Acrobat PDF format.
- D. Submit RFIs in format specified and in addition include:
  - 1. Specification Section number and title and related paragraphs, as appropriate.
  - 2. Drawing number, room name, structural grid coordinates and detail references, as appropriate.
  - 3. Field dimensions and conditions, as appropriate.
  - 4. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.

5. Attachments: Include 8 ½" x 11" copies of construction documents highlighting areas requiring interpretation. Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation and suggested solution(s).
  - a. Supplementary drawings prepared by Contractor shall be to scale and shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

## PART 2 - PRODUCTS

### 2.1 SLEEVES, HANGERS, INSERTS AND FIXTURE SUPPORTS

- A. Pipe sleeves, pipe hangers and fixture supports for all piping shall be furnished and set by the Plumbing Subcontractor and this Subcontractor shall be responsible for their proper and permanent location.
- B. Sleeves - Cast iron or steel pipe sleeves shall be furnished and set in walls, floor and roof where pipes are to pass through. Sleeves shall be two (2) nominal sizes larger than pipe and large enough to provide approximately 1/4" clearance around insulation of insulated systems and shall finish flush with walls.
- C. All pipe openings through floors, exterior building walls, two hour rated walls or partitions and designated "FIRE RATED PARTITIONS", SHALL BE SEALED. Materials and systems shall be as specified herein.
  1. Masonry walls indicated on the General Construction Plans as two-hour rated shall have openings sealed by packing around the pipe with glass fiber rope and sealing each end with 1" fire resistant caulking. Other walls shall be sealed with glass fiber rope only. Seal floors with glass fiber rope and fire resistant caulking as required to make watertight. Sleeves through exterior building walls shall be water-tight and shall be flexible.
- D. Hangers: All piping shall be rigidly supported from the building structure by means of approved hangers, inserts, and supports. Pipes shall be supported to maintain required grading and pitching of lines to prevent vibration and to secure piping in place and shall be arranged so as to provide for proper expansion and contraction of pipe. All horizontal piping shall be hung with approved adjustable, malleable iron pipe hangers, unless otherwise specified and spaced according to code requirements and manufacturer's recommendations for each type and size of piping.
- E. Hangers for piping of sizes 4 inches and smaller shall be Carpenter Patterson Type No. 1A Band, or approved equal, black steel and hanger rods with machine threads; for piping of sizes larger than 4 inches shall be the adjustable clevis hanger type, malleable iron, with extension rod to structure. Hanger rods shall be secured to the building structure by means of approved type inserts or lag bolts.
- F. Common runs of supply piping shall be supported on a single cross hanger consisting or prefabricated channel with rod support fittings and pipe guides. The Plumbing Subcontractor may share his hangers or share the hangers of other Subcontractors for the support of piping only by prior permission of Architect.
- G. In addition to normal concrete inserts, beam clamps, etc., the Plumbing Subcontractor shall furnish and install steel angle hanger supports to meet special conditions where hangers are

required under ductwork. PIPING SHALL NOT BE SUPPORTED FROM DUCTWORK OR STRUCTURAL STEEL DECKS.

- H. Vertical risers shall be supported at each floor level with long leg, bolted pipe clamps. In addition each riser shall be supported with a pipe hanger at the top and at offset locations. Water risers shall have stiffeners attached equal-distant between each floor and secured to studs.
- I. On insulated piping, each hanger shall be equipped with an 18 gauge steel shield to support the insulation and prevent the hanger from deforming the insulation. Each hanger shall be oversized so that the hanger will allow the insulation to pass through undisturbed and uncut.
- J. Inserts: Inserts for concrete installation shall be cast-iron or steel of a type to receive a machine bolt head or nut after installation.
- K. Fixture Supports: All fixture and equipment shall be supported and fastened in a satisfactory manner. Where wall hung fixtures are backed up to light wall construction, they shall be supported with floor mounted fixture carriers. Floor mounted arm carriers for wall hung lavatories shall be securely fastened to the floor and be similar to Smith 700 or approved equal. Wall hung fixtures on masonry block walls shall be supported with wall mounted fixture carriers. In-wall supplies to each flush valve shall be supported.

## 2.2 STORM, SANITARY AND VENT PIPING ABOVE GROUND

- A. Hubless Cast-Iron Soil Pipe And Fittings
  1. Pipe and Fittings: ASTM A 74, CISPI 301, service weight class, labeled with trademark.
  2. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
    - a. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel (4) bands and tightening devices, and ASTM C 564, rubber sleeve. Manufacturer shall be Star Pipe Products, Clamp-All Corp or approved equal.
  3. Fabrication: Cast iron piping shall be joined with neoprene gaskets and stainless steel clamps as manufactured by Star Pipe Products, Clamp-All or approved equal and installed in strict accordance with manufacturer's recommendations.
  4. Sanitary and vent piping 2-inches and smaller may be Soft Copper Tube: ASTM B 88, Type L, water tube, annealed temper.
    - a. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.

## 2.3 INTERIOR DOMESTIC WATER PIPING

- A. Pipe: Copper tube, ASTM B88, type K or L, drawn.
- B. Fittings for Copper Tube:
  1. Wrought copper or bronze castings conforming to ANSI B16.18 and B16.22. Unions shall be bronze, Fed. Spec. WW U 516. Solder or braze joints.
  2. Grooved fittings, 50 to 150 mm (2 to 6 inch) wrought copper ASTM B75 C12200, 125 to 150 mm (5 to 6 inch) bronze casting ASTM B584, CDA 844. Mechanical grooved couplings, ductile iron, ASTM A536 (Grade 65-45-12), or malleable iron, ASTM A47 (Grade 32510) housing, with EPDM gasket, steel track head bolts, ASTM A183, coated with copper colored alkyd enamel.
  3. Mechanically formed tee connection: Form mechanically extracted collars in a continuous operation by drilling pilot hole and drawing out tube surface to form collar, having a height

of not less than three times the thickness of tube wall. Adjustable collaring device shall insure proper tolerance and complete uniformity of the joint. Notch and dimple joining branch tube in a single process to provide free flow where the branch tube penetrates the fitting. Braze joints.

- C. Adapters: Provide adapters for joining screwed pipe to copper tubing.
- D. Solder: ASTM B32 Composition Sb5 HA or HB, lead free. Provide non corrosive flux.

## 2.4 EXPOSED WATER, WASTE, FUEL AND MEDICAL GAS PIPING

- A. Finished Room: Use full iron pipe size chrome plated brass piping for exposed water, waste, fuel gas, medical and laboratory gas piping connecting fixtures, casework, cabinets, equipment and reagent racks when not concealed by apron including those furnished by the Owner or specified in other sections.
  - 1. Pipe: Fed. Spec. WW P 351, standard weight.
  - 2. Fittings: ANSI B16.15 cast bronze threaded fittings, (125 and 250).
  - 3. Nipples: ASTM B 687, Chromium-plated.
  - 4. Unions: Fed. Spec. WW U 516, Brass or Bronze. Unions 65 mm (2 1/2 inches) and larger shall be flange type with approved gaskets.
  - 5. Valves: Fed. Spec. WW V 35, Brass or bronze.
- B. Unfinished Rooms, Mechanical Rooms and Kitchens: Chrome plated brass piping is not required. Paint piping systems as specified in Division 9, PAINTING.

## 2.5 TRAP PRIMER WATER PIPING:

- A. Pipe: Copper tube, ASTM B88, type K, hard drawn.
- B. Fittings: Bronze castings conforming to ANSI B16.18 Solder joints.
- C. Solder: ASTM B32 composition Sb5. Provide non-corrosive flux.

## 2.6 VALVES

- A. Furnish and install valves where indicated on the Drawings or specified, so located that they may be operated, repaired or replaced with a minimum effort and repacked under pressure.
- B. The following list of valves is intended only as guide for type and quality for this Contract.
- C. Cold Water, Hot Water and Recirculating Hot Water
  - 1. 3-inch and smaller - ball valve, bronze body and stainless steel trim, 200 psig, solder end, similar to Jenkins or approved equal.

## 2.7 BACKWATER VALVE

- A. Flap type, hinged or pivoted, with revolving disc. Cast iron body with cleanout of sufficient size to permit removal of interior parts. Hinge, pivot, disc and seat shall be nonferrous metal. Normal position of disc shall be slightly open. Extend the cleanout to the finished floor and fit with

threaded countersunk plug. Provide clamping device wherever the cleanout extends through the membrane waterproofing.

## 2.8 CLEANOUTS

- A. Cleanouts shall be iron body with heavy brass plug and raised nut, same size as pipe for piping up to 4 inches in size and no less than 4 inches for piping larger than 4 inches in size and closed gas tight.
- B. In horizontal runs above grade, cleanouts shall consist of cast brass tapered screw plug in fitting or caulked/no hub cast iron ferrule. Plain end (no-hub) piping in interstitial space or above ceiling may use plain end (no-hub) blind plug and clamp.

## 2.9 PIPE INSULATION

- A. Furnish and install the following type pipe covering and insulation on all hot water, cold water and interior horizontal storm water piping in the building, except stub-out supply piping immediately at fixtures and except as noted herein. No pipe coverings shall be installed on piping designated as chromium-plated brass pipe.
- B. Cold water and hot water piping insulation shall be 1/2" thick, with factory applied fiberglass cloth with integral vapor barrier and self-sealing lap. Fittings and valves shall be covered with pre-cut fiberglass inserts and fitted with molded PVC covers, secured with glass fabric tape with mastic. Insulation shall be fiberglass 25 ASJ or equal, and shall be installed as per manufacturer's recommendations to conform to the AUL non-combustible rating.
- C. Interior horizontal storm water piping, including fittings into the vertical and roof drain sumps shall be insulated similar to hot and cold water piping, except be 1-inch thick.
- D. All insulation installed shall pass through all walls, ceilings and floors continuously and shall not be applied to any piping system until that system has been tested, proved tight and furnished with a sheet metal shield provided by the Insulation Subcontractor to support the insulation.
- E. Fire Safety: Insulating materials as described above or approved equal materials shall meet Fire and Smoke Hazard Classification ratings on a COMPOSITE basis in accordance with NFPA 155 and UL 723. These products shall not exceed a flame spread and developed smoke rating minimum. Fitting covers shall not exceed maximum toxicity ratings.

## 2.10 FLOOR DRAINS

- A. Floor drains shall be furnished and installed by this Subcontractor and flashing installed by the Flashing Contractor. These drains shall be as manufactured by J.R. Smith, Zurn, Josam, or approved equal and shall be as scheduled on the Drawings. Sizes of drains shall be the same size as the piping it serves. This Subcontractor shall be responsible for correctly setting all drains at proper grades for proper drainage.
- B. ANSI A112.21.1. Provide a caulking flange for connection to cast iron pipe, screwed or no hub outlets for connection to steel pipe, and side outlet when shown. Provide membrane clamp and extensions if required, where installed in connection with waterproof membrane. Puncturing membrane other than for drain opening will not be permitted. Double drainage pattern floor drains shall have integral seepage pan for embedding into floor construction, and weep holes to

provide adequate drainage from pan to drain pipe. For drains not installed in connection with a waterproof membrane, provide a 16-ounce soft copper membrane, 24 inches square.

## 2.11 ROOF DRAINS AND CONNECTIONS

- A. Roof drains shall be furnished and installed by this Subcontractor and flashing installed by the Flashing Contractor. These drains shall be as manufactured by J.R. Smith, Zurn, Josam, or approved equal and shall be as scheduled on the Drawings. Sizes of drains shall be the same size as the piping it serves. This Subcontractor shall be responsible for correctly setting all drains at proper grades for proper drainage.
- B. Roof Drains: Cast iron with clamping device for making watertight connection. Free openings through strainer shall be twice area of drain outlet. For roof drains not installed in connection with a waterproof membrane, provide a soft copper membrane 12 inches in diameter greater than outside diameter of drain collar. Provide an integral gravel stop for drains installed on roofs having built up roofing covered with gravel or slag. Provide integral no-hub, soil pipe gasket or threaded outlet connection.
- C. Flat Roofs: Dome shaped strainer with integral flange not less than 12 inches in diameter. For insulated roofs, provide a roof drain with an adjustable drainage collar, which can be raised or lowered to meet required insulation heights, sump receiver and deck clamp. Bottom section shall serve as roof drain during construction before insulation is installed.

## 2.12 TRAPS

- A. Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps. Exposed brass shall be polished brass chromium plated with nipple and set screw escutcheons. Concealed traps may be rough cast brass or same material as pipe connected to. Slip joints not permitted on sewer side of trap. Traps shall correspond to fittings on cast iron soil pipe or steel pipe respectively, and size shall be as required by connected service or fixture.

## 2.13 TRAP PRIMERS

- A. Trap Primer (TP-1): Hydraulic.
  - 1. Fifteen millimeter (1/2 inch) Inlet/ fifteen millimeter (1/2 inch) Outlet fully automatic, all brass trap primer valve, activated by a drop in building water pressure, no adjustment required. Model for one (1) to four (4) traps with distribution unit, may be located anywhere in an active cold water line, as indicated on the drawings or as required by code. ASSE Standard 1018. Omit distribution unit when serving a single trap.

## 2.14 BACKFLOW PREVENTERS

- A. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination. Device shall be certified by the American Society of Sanitary Engineers. Listed below is a partial list of connection to the potable water system which shall be protected against backflow or back siphonage.
- B. Reduced Pressure Backflow Preventer: ASSE 1013.
  - 1. Water make up to heating systems.
- C. Pressure Type: ASSE 1020



1. Water make up to heating systems.

D. Atmospheric Vacuum Breaker: ASSE 1001

1. Hose bibs and sinks w/threaded outlets.
2. Showers (hand held type).
3. All kitchen equipment, if not protected by air gap.

2.15 WATERPROOFING

- A. Provide at points where pipes pass through membrane waterproofed floors or walls in contact with earth.
- B. Floors: Provide cast iron stack sleeve with flashing device and a underdeck clamp. After stack is passed through sleeve, provide a waterproofed caulked joint at top hub.

2.16 DIELECTRIC FITTINGS

- A. Provide dielectric couplings or unions between ferrous and non ferrous pipe.

2.17 STERILIZATION CHEMICALS

- A. Hypochlorite: Fed. Spec. O-C-114, or Fed. Spec. O-S-602, grade B.

2.18 WATER HAMMER ARRESTER:

- A. Closed copper tube chamber with permanently sealed 410 kPa (60 psig) air charge above a triple o-ring piston. Three high heat Buna-N O-rings pressure packed and lubricated with FDA approved Dow Corning No. 11 silicone compound. All units shall be designed in accordance with ASSE 1010 for sealed wall installations without an access panel. Size and install in accordance with Plumbing and Drainage Institute requirements. Unit shall be as manufactured by Precision Plumbing Products Inc., Watts or Sioux Chief. Provide water hammer arrestors at all solenoid valves, at all groups of two or more flush valves, at all quick opening or closing valves, and at all medical washing equipment.

2.19 WALL HYDRANTS

- A. Furnish and install wall hydrants, where indicated. Hydrants shall be set approximately 18 inches above finish grade. Wall hydrants shall be as manufactured by J. R. Smith Mfg. Co., Zurn Mfg. Co., or approved equal, and shall be similar to J.R. Smith 5609, non-freeze type with brass face, tee handle, integral vacuum breaker and nozzle for 3/4 inch hose connections. They shall be of sufficient length to go through wall, placing the shut-off valve inside the building. Stem and washer shall be movable from the front of the hydrant, and shall have heavy brass coupling and union elbow for 3/4 inch pipe. The outer casing shall be galvanized steel, and the inside operating rods shall be brass.

2.20 MECHANICAL IDENTIFICATION

- A. ACCEPTABLE MANUFACTURERS

1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Seton Name Plate Corp.

B. SUBMITTALS

1. Product Data: For each type of product indicated.
2. Valve numbering scheme.
3. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

C. MATERIALS

1. Unless specified otherwise, comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.
2. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background.
3. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
4. Plastic Pipe Markers: Factory fabricated, flexible, semi rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed.
5. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick, manufactured for direct burial service.
6. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - a. Data:
    - 1) Manufacturer, product name, model number, and serial number.
    - 2) Capacity, operating and power characteristics, and essential data.
    - 3) Labels of tested compliances.
  - b. Location: Accessible and visible.
  - c. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
  - d. Fasteners: As required to mount on equipment.
7. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - a. Terminology: Match schedules as closely as possible.
  - b. Data:
    - 1) Name and plan number.
    - 2) Equipment service.
    - 3) Design capacity.
    - 4) Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - c. Location: Accessible and visible.
  - d. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
8. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - a. Data: Instructions for operation of equipment and for safety procedures.
  - b. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - c. Thickness: 1/8 inch, unless otherwise indicated.
  - d. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive

9. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
  - a. Size: Approximately 4 by 7 inches.
  - b. Fasteners: Reinforced grommet and wire or string.
  - c. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
  - d. Color: Yellow background with black lettering.
10. Access Panel and Door Markers: 1/16-inch-thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment. Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

## 2.21 VALVE TAGS, CHARTS AND PIPE MARKINGS

- A. Furnish and install pipe identification markers on all exposed piping installed under this part of the Specification. Piping above removable suspended ceilings shall be considered exposed as well as piping located in mechanical equipment rooms or spaces. Pipe identification markers shall consist of labels of black letter imprinted on coded background and 1-1/2" color bands. Labels and bands shall indicate the pipe fill and the direction of flow. Pipe identification labels shall be the coiled, snap-on type, letters to be 2" high on all pipes 3" diameter and over, letters to be 3/4" high on all pipes under 3" diameter. Pipe identification markers shall be applied to the pipe or to the insulation in the case of insulated pipes, on 15' centers and at each valve, whichever is closer. Color coding for pipe identification markers shall be as follows:

LEGEND	BACKGROUND	LETTERING
Cold Water	Green	White
Dom. Hot Water Supply & Recirc.	Yellow	White
Natural Gas	Yellow	Black
Oxygen	Green	White
Medical Air	Yellow	Black
Medical Vacuum	White	Black
Nitrous Oxide	Blue	White
Carbon Dioxide	Gray	White
Nitrogen	Black	White
Anesthesia Evacuation (WAGD)	Purple	White
Instrument Air	Red	White

1. Pipe identification markers shall be W.H. Brady & Co., or approved equal.
- B. Furnish and install stamped or embossed 1/2" diameter brass tags or plastic identification plates for each valve, control entity or piece of equipment. These identification plates shall be permanently attached to their identifying equipment or valves with brass hooks or brass link chain. Each drain valve or plug shall be tagged "DRAIN".
- C. Each brass valve tag shall be lettered for its appropriate service and numbered in consecutive order: "CW" for cold water, "HW" for hot water, HWC for hot water circulation and "G" for gas, "O" for oxygen, "MA" for medical air, "MV" for medical vacuum and "NO" for nitrous oxide.
- D. Prepare in triplicate a complete listing of each valve, its number and describing its control function. These listings shall be presented to the Architect at the completion of the job.

## 2.22 PLUMBING FIXTURES

- A. The Plumbing Subcontractor shall furnish and install all fixtures shown on Plumbing Drawings and hereinafter specified, except as otherwise noted.
- B. The number and arrangement of the plumbing fixtures are as shown on the Drawings. The plate numbers and manufacturer's name given are American Standard.
- C. The Plumbing Subcontractor must obtain written approval of the list of fixtures before placing orders for same.
- D. All exposed fixture brass goods shall be heavy chromium-plated, and as manufactured by the manufacturer of the plumbing fixtures, unless specified otherwise. All exposed water and waste piping and fittings at any fixture, not required to be insulated shall be chromium-plated.
- E. All fixtures shall be fitted with a stop valve on each supply line.
- F. All fixtures shall be best quality, free from any defects.
- G. Supplies to individual fixtures shall be equipped with an air chamber at least 20 pipe diameters long and as large as the pipe it serves. Supplies to a group or battery of fixtures shall each be furnished with a water hammer arrestor similar to Smith 5010, Josam, Zurn.
- H. The Plumbing Subcontractor shall furnish all supports, brackets, brass bolt, etc., for proper installation of any fixtures requiring support. They shall be in accordance with the manufacturer's recommendations and, if necessary, shall be built into place as the building progresses. This Subcontractor shall be held responsible for the stability of and proper support of all plumbing fixtures.
- I. Unless otherwise specified, all fixtures shall be set flush and square to walls and floors and shall be taken up as close as possible without springing. Should there be a separation between fixture and wall and/or floor due to wall and/or floor variations, space shall be packed with oakum and sealed with a smooth bead of white silicone sealer.
  - 1. P-1 Water Closet, HC
    - a. Crane 31083 'Sanwalton', vitreous china, 1.6 gfp siphon jet, elongated bowl, floor mounted, 1-1/2" back spud, wall outlet, 17-1/4" bowl punched with seat post holes. Provided with psych safe bolts and escutcheons.
    - b. White seat with open front less cover as manufactured by Church or approved equal.
    - c. Sloan "Royal" model 952-1.6 hydraulic flushometer, quiet, concealed, diaphragm type, rough brass closet flushometer for either left or right hand supply. Unit shall be provided with psych safe front access panel and pushbutton set in panel Elmdor 5070 or approved equal.
  - 2. P-1A Water Closet, HC
    - a. Acorn siphon jet toilet – on floor 1684-ADA-W-2-EG-03-FV-SPS.
    - b. Provide unit less seat.
    - c. Provide unit with Air-Trol flush valve with operating time set by owner. Unit shall be provided with psych safe front access panel.
    - d. Provide mounting hardware for walls as recommended by manufacturer.
    - e. Provide color option for fixture to be selected by Architect.
  - 3. P-1B Water Closet, HC
    - a. Crane 31083 'Sanwalton', vitreous china, 1.6 gfp siphon jet, elongated bowl, floor mounted, 1-1/2" back spud, wall outlet, 17-1/4" bowl punched with seat post holes. Provided with psych safe bolts and escutcheon.
    - b. White seat with open front less cover as manufactured by Church or approved equal.

- c. Sloan "Royal" model 952-1.6 hydraulic flushometer, quiet, concealed, diaphragm type, rough brass closet flushometer for either left or right hand supply. Unit shall be provided with psych safe front access panel and pushbutton set in panel Elmdor 5070 or approved equal.
4. P-2 Lavatory, HC
  - a. Acorn 18" lavatory model 1652FA-ADA-1-BPH-4-EG-GT-TE.
  - b. Grid strainer, 1/2" hot and cold water supplies.
  - c. Provide support anchors for lavatory.
  - d. 1-1/4" x 1-1/2" C.P. P-trap with extension to wall and escutcheon with trap enclosure.
  - e. Provide color option for fixture to be selected by Architect.
5. P-2A Lavatory, HC
  - a. American Standard 0355.012 'Lucerne', 20-1/2" x 18-1/4" vitreous china, 4" centers.
  - b. Sloan model SL2711, single lever handle faucet complete with offset grid strainer and drain fittings.
  - c. Symmons 4-10B mixing valve, chrome plated.
  - d. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - e. 1-1/4" x 1-1/2" C.P. P-trap with extension to wall and escutcheon.
  - f. Smith floor support arm carrier to suit.
  - g. Provide security safe water and waste pipes enclosure (match lavatory color).
6. P-3 Lavatory, HC
  - a. Lavatory furnished by others.
  - b. Sloan model SL2711, single lever handle faucet complete with offset grid strainer and drain fittings.
  - c. Symmons 4-10B mixing valve, chrome plated.
  - d. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - e. 1-1/4" x 1-1/2" C.P. P-trap with extension to wall and escutcheon.
7. P-4 Hand Sink
  - a. Lavatory furnished by others.
  - b. Sloan model SL2711, single lever handle faucet complete with 337 offset grid strainer and drain fittings.
  - c. Symmons 4-10B mixing valve, chrome plated.
  - d. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - e. 1-1/4" x 1-1/2" C.P. P-trap with extension to wall and escutcheon.
8. P-5 Exam S.S. Sink
  - a. Elkay BLR15, 15" x 15" 18 gauge stainless steel, single bowl, counter insert, self-rim, 2-hole punch.
  - b. Chicago 895-317FCCP faucet complete with grid strainer and drain fittings.
  - c. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - d. 1-1/4" x 1-1/2" C.P. P-trap with extension to wall and escutcheon.
9. P-6 Counter S.S. Sink
  - a. Elkay BPSFR1215, 12-1/2" x 15", 20 gauge stainless steel, single bowl, counter insert, self-rim, 3-hole punch.
  - b. Speakman SEF-1800-TW combination faucet and eye wash and thermostatic mixing valve.
  - c. LK-35 drain with strainer and tailpiece.
  - d. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - e. 1-1/2" rough brass P-trap with cleanout and extension to wall with escutcheon.
10. P-7 Counter S.S. Sink
  - a. Elkay LR-1919, 19 1/2" x 19", 18 gauge stainless steel, single bowl, counter insert, self-rim, 2-hole punch.
  - b. Speakman SEF-1800-TW combination faucet and eye wash and thermostatic mixing valve.
  - c. LK-35 drain with strainer and tailpiece.

- d. (2) 1/2" C. P. brass supplies with stops and escutcheons.
- e. 1-1/2" rough brass P-trap with cleanout and extension to wall with escutcheon.
- 11. P-8 Shower, HC
  - a. Tile shower enclosure furnished by others.
  - b. (3) Acorn MO532-E505-1 with one conical shower head. Hand shower with hose assembly shall be provided with Woddford flush mounted wall box model 24/B24/Y24 and locking key. Coordinate shower head and valve box locations with architect prior to installation.
  - c. Provide tamper vandal proof drain with N.B. strainer, 2-inch P-trap to suit.
- 12. P-9 Flush Rim Service Sink
  - a. American Standard 9512.013 'Clinic Service Sink', vitreous china, wall hung, blow-out flushing action and (3) rim guards 7832.017.
  - b. Sloan 117 'Royal' flush valve.
  - c. Chicago No. 910-G-777-19K combination supply assembly with foot pedal operation, wall vacuum breaker and cleaning nozzle.
  - d. Chicago 815-VB combination flushing rim service sink faucet.
  - e. Smith carrier to suit.
- 13. P-10 Counter S.S. Sink
  - a. Elkay LR-1919, 19 1/2" x 19", 18 gauge stainless steel, single bowl, counter insert, self-rim, 3-hole punch.
  - b. Chicago 786-SWE29 faucet with gooseneck spout and 4" wrist blade handles.
  - c. LK-35 drain with strainer and tailpiece.
  - d. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - e. 1-1/2" rough brass P-trap with cleanout and extension to wall with escutcheon.
- 14. P-11 Counter S.S. Sink
  - a. Elkay LRAD-3319, 33" x 19 1/2", 18 gauge stainless steel, double bowl, counter insert, self-rim, 3-hole punch.
  - b. Elkay LKE4100F single lever top mount faucet with 8" tubular swing spout with restricted flow aerator, brass escutcheon, highly polished and chrome plated.
  - c. Elkay LK-35 drain with strainer and tailpiece.
  - d. Elkay K-53, 1 1/2" continuous waste.
  - e. (2) 1/2" C. P. brass supplies with stops and escutcheons.
  - f. 1-1/2" rough brass P-trap with cleanout and extension to wall with escutcheon.
- 15. P-12 Clothes Washer Fitting
  - a. Symmons W-602 recessed supply and waste fitting with cover.
  - b. (2) 1/2" supplies with Smith 5005 water hammer arrestors.
  - c. 2" P-trap to suit.
- 16. P-13 Drinking Fountain, HC
  - a. Acorn – model 1672-1-BP-1-FA Handicapped drinking fountain, 13"x18", off floor, wall outlet.
  - b. (1) 1/2" supplies with stop and escutcheon.
  - c. 1-1/2" rough brass P-trap with cleanout and extension to wall with escutcheon.
  - d. Provide color option for fixture to be selected by Architect.

## 2.23 ACCESS DOORS AND FRAMES

### A. ACCEPTABLE MANUFACTURERS

- 1. Milcor Div.; Inryco Inc.
- 2. Miami Carey
- 3. Way Loctor

### B. SUBMITTALS

- 1. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.

2. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
  3. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
  4. Coordination Drawings: Refer to Division 22 Article - COORDINATION DRAWINGS
- C. GENERAL: Furnish for installation by others access doors for access to all concealed valves or equipment requiring accessibility for maintenance or proper operation, when such elements are located behind building surfaces or enclosures. Access Door Fire rating shall match wall or ceiling assembly fire rating.
- D. Instruct appropriate panel installation contractor as to the proper location of all doors. Locate doors so that valve or element served can be easily reached. Size of doors shall be sufficient to serve intended purpose but in no case less than 9 inch by 9 inch. Doors located in corridors, lobbies or other habitable areas shall be reviewed by Architect as to location.
- E. Provide prime painted Flush Access Doors and Trimless Frames prime painted with flush screw driver operated cam locks and concealed hinges.
- F. Type of panels shall be based on:
- |                          |                 |
|--------------------------|-----------------|
| 1. GYPSUM Board Surfaces | "Milcor Type K" |
| 2. Masonry Construction  | "Milcor Type M" |

## 2.24 SEISMIC RESTRAINTS

- A. All isolation and seismic restraint devices shall be capable of accepting, without failure, the "G" forces as determined by seismic certification and calculations prepared by a registered professional engineer in the employ of the vibration isolation manufacturer.
- B. See Part 3 of these specifications under the installation of seismic restraints for a listing of where the seismic restraint types listed below are to be installed.
- C. Seismic Restraint Types
1. TYPE III: Restraints for suspended systems: Vibration isolated systems shall be braced with multiple 7 x 19 strand galvanized cable rope. Mason Industries Type SCB
  2. Pipe clevis cross braces are required at all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the clevis cross bolt. Clevis cross braces shall have Anchorage Preapproval AR Number from California OSHPD. Mason Ind. Model ACCB.
  3. TYPE V: Rigid attachment to structure utilizing wedge type expansion anchors for bolting and steel plates, either cast-in or anchored with wedge type expansion bolts, for welding. Powder shots are not acceptable. Concrete anchor bolt spacing shall be in accordance with manufacturer's published standards.

## 2.25 MEDICAL GAS AND MEDICAL VACUUM SYSTEMS

- A. PIPING
1. Copper Tubing: Type "K" or "L", ASTM B819, copper tube, hard drawn temper, with wrought copper fittings conforming to ANSI B16.22 or brazing fittings complying with MSS SP-73. Size designated reflecting nominal inside diameter. Nitrogen piping shall be

ASTM B819 Type K. Tubing and fittings shall be labeled "ACR/OXY", "OXY", "OXY/MED" or "MED".

2. Brazing Alloy: AWS A5.8, Classification BCuP, greater than 1000 degrees F melting temperature. Flux is strictly prohibited for copper to copper connections.
3. Screw Joints: Degreased polytetrafluoroethylene (Teflon) tape.
4. Underground Protective Pipe: Polyvinyl Chloride (PVC), ASTM D1785, Schedule 80.
5. Apply piping identification in accordance with NFPA 99. Supplementary color identification shall be in accordance with CGA Pamphlet C-9.
6. Galvanized Steel: Use only for discharge from vacuum producer.
  - a. Pipe: ASTM A53, standard weight.
  - b. Fittings:
    - 1) Flexible groove, malleable iron, ASTM A47, or ductile iron, ASTM A536.
    - 2) Malleable iron screwed, ANSI B16.3.
    - 3) Memory metal couplings having temperature and pressure ratings not less than that of a brazed joint shall be permitted.

#### B. VALVES

1. Ball: In line, other than zone valves in cabinets.
  - a. 2 inches and smaller: Fed. Spec. WW-V-35, Type II, Class 150, Style 1, with tubing extensions for brazed connections. Full ported, three-piece or double union end connections, Teflon seat seals, full flow, 400 psi WOG minimum working pressure, with locking type handle and cleaned for oxygen service.
  - b. 3-4 inches and larger: Fed. Spec. WW-V-35, Type II, Class F, Style 1, flanged end connections. Three piece, Teflon seals, full flow, 2750 kPa (400 psi) WOG minimum working pressure, with locking type handle, tubing extensions for brazed connections and cleaned for oxygen service.
2. Check:
  - a. 3 inches and smaller: Brass body, self-aligning, spring loaded ball type check mating with Teflon cone seat, vibration free, fast acting for silent operation, cleaned for oxygen service, 400 psi WOG minimum working pressure.
  - b. 4 inches and larger: Iron body, bronze trim, swing type, vertical or horizontal installation, flange connection, WSP (150 psi).
3. Zone Valve in Cabinet: Brass or bronze body, double seal union ball valve with replaceable Teflon seat seals, teflon stem seal; 2750 kPa (400 psi) WOG, cold non-shock gas working pressure, cleaned for oxygen service, blowout proof stem, one quarter turn to completely open or close. Provide tubing extensions factory brazed, pressure tested, cleaned for oxygen service. Provide 1/8 inch NPT gauge port for a 40 mm (1 1/2 inch) diameter monitoring gauge downstream of the shut-off valve. Zone valves shall be products of one manufacturer, and uniform throughout in pattern, overall size and appearance. Trim with color coded plastic inserts or color coded stick on labels. Install valves in cabinets such that cover window cannot be in place when any valve is in the closed position. Color coding for identification plates and labels is as follows:

#### C. VALVE CABINETS

1. A. Flush mounted commercially available item for use with medical gas services, not lighter than 1.3 mm (18 gage) steel or 1.9 mm (14 gage) extruded aluminum, rigidly assembled, of adequate size to accommodate valve(s) and fittings. Punch or drill sides to receive tubing. Provide anchors to secure cabinet to wall construction. Seal openings in cabinet shall be substantially dust tight. Locate bottom of cabinet approximately 1375 mm (4 foot 6 inches) above floor.
2. B. Mount engraved rigid plastic identification plate on wall above or adjacent to cabinet. Color code identification plate to match medical gas identification colors as indicated above. Identification plate must be clearly visible at all times. Provide inscriptions on plate to read in substance: "VALVE CONTROL SUPPLY TO ROOMS".



3. C. Cover plate: Fabricate from 1.3 mm (18 gage) sheet metal with satin chromed finish, extruded anodized aluminum, or .85 mm (22 gage) stainless steel. Provide stainless steel cover window, with lock and key. The key shall be available to maintain and access valve cabinet in emergencies. Permanently paint or stencil on window: "FOR EMERGENCY ONLY, SHUT OFF VALVES FOR PIPED GASES", or equivalent wording. Configuration such that it is not possible to install window with any valve in the closed position.
- D. Medical Gas Zone Valve and Boxes:
1. MGZVB-1. Medical Gas Zone Valve and Box– Beacon 6-150209-00 double recessed zone valve and box assembly, with (1) 3/4"x3/4" valve, labeled "OXYGEN" and 6-130108-00 gauge; (1) 1-1/4"x1-1/4" valve, labeled "VACUUM" and 6-130107-00 gauge as manufactured by BeaconMedaes or approved equal. Unit shall be provided with a psych safe locking cover with key.
- E. STATION OUTLETS AND INLETS
1. For all services except ceiling hose drops and nitrogen system: For designated service, consisting of a (DISS) (quick connect coupler) and inlet supply tube. Provide coupler that is non-interchangeable with other services, and leakproof under three times normal working pressure. Equip each station outlet with an automatic valve and a secondary check valve to conform with NFPA 99. Equip each station inlet with an automatic valve to conform with NFPA 99. Place valves in the assembly to provide easy access after installation for servicing and replacement, and to facilitate line blow-out, purging, and testing. Fasten each outlet and inlet securely to rough-in to prevent floating and provide each with a capped stub length of 6 mm (1/4-inch) (10 mm outside diameter) (3/8-inch outside diameter) tubing for connection to supply. Label stub tubing for appropriate service. Rough-in kits and test plugs for Prefabricated Bedside Patient Units (PBPU) are furnished under this specification but installed by manufacturer of PBPUs before initial test specified herein. Install completion kits (valve body and face plate) for the remainder of required tests.
- F. STATION OUTLET AND INLET ROUGH IN
1. Flush mounted, protected against corrosion. Anchor rough-in securely to unit or wall construction.
  2. Modular Cover Plate: Die cast plate, two piece 22 gage stainless steel or 16 gage chromium plated metal, secured to rough in with stainless steel or chromium plated countersunk screws.
  3. Cover Plate for Prefabricated Bedside Patient Units (PBPU): One piece with construction and material as indicated for modular cover plate.
  4. Provide permanent, metal or plastic, identification plates securely fastened at each outlet and inlet opening, with inscription for appropriate service using color coded letters and background. Metal plates shall have letters embossed on baked on enamel background. Color coding for identification plates is as follows:
  5. MGO-1: (1) MV- 6803-8138-802 rough-in and 6803-8110-802 finish assembly, complete, labeled "MED. VAC", with slide bracket assembly, (1) O – 6803-8138-800H rough-in and 6803-8110-800 finish assembly, complete, labeled "Oxygen". Outlets shall be installed in a "Security Patient Console" with slid bracket mounted to the inside of door. The security door shall be made of stainless steel and color as indicated by the Architect. Unit shall be manufactured by Hospital Systems, Incorporated or approved equal.
- G. GAGES
1. Pressure Gages: Includes gages temporarily supplied for testing purposes.
    - a. For line pressure use adjacent to source equipment: ANSI B40.1, pressure gage, single, size 4 1/2 inches, for compressed air, nitrogen and oxygen, accurate to within two percent, with metal case. Range shall be two times operating pressure. Dial graduations and figures shall be black on a white background, or white on a

black background. Gage shall be cleaned for oxygen use, labeled for appropriate service, and marked "USE NO OIL". Install with gagecock.

- b. For all services downstream of main shutoff valve: Manufactured expressly for oxygen use but labeled for appropriate service and marked "USE NO OIL", 1 1/2 inch diameter gage with dial range 1 - 100 psi for oxygen, nitrous oxide and air, and 1- 300 psi for nitrogen service.
2. Vacuum Gages:
    - a. For vacuum line use adjacent to source equipment: ANSI B40.1, vacuum gage, 4 1/2 inch, gage for air, accurate to within two percent, with metal case. Range shall be 0 - 30 inches Hg. Dial graduations and figures shall be black on a white background, or white on a black background. Label for vacuum service. Install with gagecock.
    - b. For vacuum service upstream of main shutoff valve: Provide 1 1/2 inch diameter gage with steel case, Bourdon tube and brass movement, dial range 0-30 inches Hg).

#### H. ALARMS

1. Provide all low voltage control wiring, except for wiring from alarm relay interface control cabinet to the Building Automation System (refer to HVAC Division 23), required for complete, proper functioning system. Low voltage control wiring shall conform to division 16. Run wiring in conduit, in conformance with Division 26.
2. Local Alarm Functions: Provide individual local air compressor and vacuum pump malfunction alarms at associated main control panels.
  - a. Compressor Malfunction Alarm: Compressor system receives the following individual signals and sends a single consolidated "compressor malfunction alarm" signal to master alarm panel.
    - 1) High Temperature Shutdown Alarm: Functions when discharge air temperature exceeds 350 degrees F, shutting down affected compressor.
    - 2) Lead Compressor Fails to Start Alarm: Functions when lead compressor fails to start when actuated causing lag compressor to start.
    - 3) Lag Compressor in Use Alarm: Functions when lag compressor starts.
    - 4) High Water Level in Receiver. (Liquid ring unit)
    - 5) High Water Level in Separator (if so required). (Liquid ring unit)
  - b. Desiccant Air Dryer Malfunction Alarm: Dryer receives the following individual signals and sends a single consolidated dryer malfunction alarm signal to master alarm panel.
    - 1) Dew Point Alarm: Functions when pressure dew point rises above 39 degrees F at 55 psi.
  - c. Vacuum Pump Malfunction Alarm: Pump system receives the following individual signals and sends a single consolidated pump malfunction alarm signal to master alarm.
    - 1) High Temperature Shut down Alarm: Functions when exhaust air temperature exceeds 220 degrees F, shutting down affected pump.
    - 2) Lead Pump Fails to Start Alarm: Functions when lead pump fails to start when actuated causing lag pump to start.
    - 3) Lag Pump in Use Alarm: Functions when lag pump starts.
3. Master Alarm Functions: Provide the following individual alarms at the master alarm panels.
  - a. Oxygen Alarms:
    - 1) Liquid oxygen low level alarm: Functions when stored liquid oxygen reaches a predetermined minimum level.
    - 2) Reserve switchover alarm: Functions when reserve oxygen supply goes in operation.

- 3) Reserve low supply alarm: Functions when contents of cylinder reserve oxygen supply are reduced to one day's average supply; switch and contacts at the bulk tank control panel.
  - 4) Reserve low pressure alarm: Functions when the gas pressure available in the liquid reserve oxygen supply is reduced below the pressure required to function properly.
  - 5) Low pressure alarm: Functions when system pressure downstream of the main shutoff valve drops below 40 psi, plus/minus two psi; operated by pressure switch or transmitters.
  - 6) High pressure alarm: functions when system pressure downstream of main shutoff valve increases above 60 psi, plus/minus two psi set points; operated by pressure switches or transmitters.
- b. Nitrous Oxide Alarms:
- 1) Reserve switchover alarm: Functions when secondary or reserve nitrous oxide supply goes in operation.
  - 2) Pressure alarms: Functions when system pressure downstream of main shutoff valve drops below 40 psi, plus/minus two psi or increases above 60 psi, plus/minus two psi set points; operated by pressure switches or transmitters.
- c. Nitrogen Alarms:
- 1) Reserve switchover alarm: Functions when secondary or reserve nitrogen supply goes in operation.
  - 2) Pressure alarms: Functions when system pressure downstream of main shutoff valve drops below 190 psi, plus/minus two psi or increases above 220 psi, plus/minus two psi set points; operated by pressure switches or transmitters.
- d. Carbon Dioxide Alarms:
- 1) Reserve Switchover Alarm: Functions when secondary or reserve carbon dioxide supply goes in operation.
  - 2) Pressure Alarms: Functions when system pressure downstream of main shutoff valve drops below 40 psi, plus/minus two psi or increases above 60 psi, plus/minus two psi set points; operated by pressure switches or transmitters.
- e. Compressed Air Alarms:
- 1) Dew point alarm: Functions when dew point rises above 39 degrees F at 55 psi. Receives signal from dew point monitor.
  - 2) Carbon Monoxide Alarm: Functions when carbon monoxide level rises above 10 parts per million, receives signal from carbon monoxide monitor.
  - 3) Main Bank Filter Sets Alarm: Functions when pressure drop across the filter set increases more than two psi over that when filters are clean and new; operates by differential pressure switch.
  - 4) Desiccant Pre-filter Alarm: Functions when pressure across the filter increases more than three psi over that when filters are clean and new; operates by pressure differential switch.
  - 5) Desiccant Post Filter Alarm: Functions when pressure drop across filter increases more than three psi over that when filters are clean and new; operates by pressure differential switch.
  - 6) Desiccant Dryer Malfunction Alarm: Functions on any combination of failure of tower cycling and/or pressure dew point rise above 39 degrees F at 100 psi.
  - 7) After-cooler High temperature Alarm: Functions when after-cooler discharge air temperature exceeds 100 degrees F.
  - 8) Pressure Alarms: Functions when system pressure downstream of main shutoff valve drops below 40 psi, plus/minus two psi or increases above 60

- psi, plus/minus two psi set points; operated by pressure switches or transmitters.
- 9) Compressor Malfunction Alarm: Functions when compressor system control panel signals compressor high temperature malfunction; lead compressor fails to start or lag compressor in use; high water in receiver and high water level in separator (if so required). Receives signal from compressor system control panel.
- f. Vacuum alarms:
- 1) Low vacuum alarm: Functions when system vacuum upstream of main shutoff valve drops below 12 inches Hg; operated by vacuum switch.
  - 2) SPEC WRITER NOTE: Delete the following paragraph if rotary vane type pumps are deleted from project.
  - 3) Filter differential pressure/backpressure alarm: Functions when discharge oil filter differential rises to set level, or when backpressure is sensed; receives signal from pump control panel.
  - 4) Medical vacuum pump malfunction.
- g. Area Alarm Functions:
- 1) Oxygen, nitrous oxide, carbon dioxide and compressed air alarms: Pressure alarms: Functions when pressure in branch drops below 40 psi, plus/minus two psi or increases above 60 psi, plus/minus two psi set points; operated by pressure switches or transmitters.
  - 2) Nitrogen alarms: Pressure alarms: Functions when pressure in branch drops below 190 psi, plus/minus two psi or increases above 220 psi, plus/minus two psi set points; operated by pressure switches or transmitters.
  - 3) Vacuum alarms: Low vacuum alarm: Functions when vacuum in branch drops below 12 inchesHg; operated by vacuum switch.
- h. Alarm Panels:
- 1) General: Modular design, easily serviced and maintained; alarms operate on direct current low voltage control circuit; provide required number of transformers for efficient functioning of complete system. Alarm panels shall be integral units, reporting oxygen, nitrous oxide, nitrogen, compressed air and vacuum services, as required. Provide pressure gage or readout for gas indicated for Area Alarm Panels.
  - 2) Box: Flush mounted, sectional or one piece, corrosion protected. Size to accommodate required number of service functions for each location, and for one audible signal in each box. Anchor box.
  - 3) Cover plate: Designed to accommodate required number of signals, visual and audible, for each location, and containing adequate operating instructions within the operator's view. Bezel shall be extruded aluminum, chromium plated metal, or plastic. Secure to the box with chromium plated or stainless steel countersunk screws.
  - 4) Service indicator lights: Red translucent plastic or LED with proper service identification inscribed thereon. Number of lights and service instruction shall be as required for each location. Provide each panel with a green test button of the same material, inscribed with "PUSH TO TEST" or similar message.
  - 5) Audible signal: Provide one in each alarm panel and connect electrically with all service indicator light functions.
  - 6) Controls:
    - a) Visual signal: When the condition occurs which any individual service indicator light is to report, button for particular service shall give a lighted visual signal which cannot be canceled until such condition is corrected.
    - b) Audible signal: Alarm shall give an audible signal upon circuit energization of any visual signal. Audible signal shall be continuous

until silenced by pushing a button. This shall cancel and reset audible only, and not affect the visual signal. After silencing, subsequent alarms shall reactivate the audible alarm.

- c) Signal tester: Test button or separate normal light shall be continuously lighted to indicate electrical circuit serving each individual alarm is energized. Pushing test button shall temporarily activate all visual signals and sound audible signal, thereby providing desired indications of status of system.
- 7) Alarm Relay Interface Control Cabinet: Design cabinet to transfer the closed circuit alarm signals through relays to a set of terminals for monitoring signals at the Building Management System (BMS) without interrupting the closed circuit system. Construct of 14 gage steel, conforming with NEMA ICS 6, Type 1 enclosures. Provide both normally open and normally closed contacts for output signals, with number of circuits required for full alarm capability at the BMS. Refer to Division 15, AUTOMATIC TEMPERAUTE CONTROLS, for compatibility.
- 8) AAP-1: Unit Sec'y Area Alarm Panel  
Furnish and install per plans and specs one (1) BeaconMedaes Model 6-M2R-OVBB comprised of one power supply module, one (1) Oxygen and (1) Vacuum, each with remote mounted gas specific sensors. Also included are two (2) blank modules for future expansion. Panel will require 120V supply power. Sensors with copper pigtails to be furnished mounted and prewired to area alarm panel requiring a brazed connection to the mains.

## PART 3 - EXECUTION

### 3.1 PIPING INSTALLATION

- A. All above ground piping shall be installed as closely as possible to walls, ceilings, beams, columns, etc., consistent with proper space allowance.
- B. The Plumbing Subcontractor shall note the invert elevations of existing sanitary drains and shall run his piping to these inverts as closely as possible. Branches on sanitary lines shall pitch a minimum of 1/8 inch to one foot wherever possible.
- C. All piping shall be run approximately as indicated on the Drawings and to avoid conflicts, rigidly supported and evenly spaced, aligned and/or graded and arranged without sags, pockets or low spots. Low ends of water lines shall be fitted with drain leg tees fitted with screwed plugs.
- D. Valves, special traps and accessories shall be installed so as to allow for proper operation and maintenance. Provide access panels.
- E. Except where otherwise noted, all piping shall be concealed in walls, ceiling construction, access spaces and chases provided.
- F. In general, the sizes of drainage lines shall be indicated on the Plans, but in no case shall fixture drains and wastes be less than those required by the Plumbing Code.

### 3.2 EQUIPMENT FURNISHED BY OTHERS

- A. Furnish and install water, waste, vent, gas and any special plumbing piping or connections to each piece of equipment all as indicated on the drawings. This equipment will be FURNISHED AND SET IN PLACE BY OTHERS, as designated by (F.B.O.C.) on the plumbing drawings.
- B. NO FINAL ROUGHING SHALL BE INSTALLED UNTIL THE ARCHITECT HAS FURNISHED APPROVED LAYOUTS FOR EQUIPMENT AND TRIM SHOWING LOCATION AND ROUGHING-IN DIMENSIONS.
- C. All loose set or packaged plumbing parts, faucets and trim furnished with equipment shall be properly assembled and fastened to the equipment at required locations and piped as part of the plumbing installation.
- D. Sink traps, supplies and stops required for the complete installation of equipment SHALL BE FURNISHED AND INSTALLED AS PART OF THE PLUMBING INSTALLATION.
- E. Special trim, shock absorbers, etc., shall be furnished and installed as specified and/or indicated. Ratings and sizes of special trim shall be as listed by the equipment manufacturer.
- F. Each service to equipment shall have valve stops at supply stubs. Traps shall be furnished by the Plumbing Subcontractor required by equipment. Locations are approximate and shall be checked with final equipment drawings. Single supply stubs may be arranged to serve a maximum of two (2) units of equipment. All floor and wall waste and supply stubs shall be fitted with chrome plated brass locking flanges.
- G. Waste Piping: All traps and continuous waste piping exposed under sinks shall be chrome plated, traps being cast brass, solder type. Traps serving all kitchen equipment shall be chrome plated brass with chrome waste piping. Traps serving all other equipment shall be rough cast brass with DWV copper waste piping, unless otherwise directed.
- H. Supply Piping: Supply piping to sinks and equipment shall be copper tube with brass valves, all chrome plated where exposed and all chrome plated serving all kitchen equipment.
- I. The Plumbing Subcontractor shall refer to the Contract Plans and Specifications for the location, type and quantity of equipment or sinks to be installed which shall include, but not be limited to the following:
  - 1. Kitchen equipment.
  - 2. Therapy Equipment
  - 3. Laundry Equipment

### 3.3 INSTALLATION OF MEDICAL GAS AND MEDICAL VACUUM SYSTEMS

- A. INSTALLATION
  - 1. In accordance with NFPA 50 and 99. Run buried oxygen piping in PVC protective pipe for entire length including enclosure of fittings and changes of direction.
  - 2. Comply with Section 15400, PLUMBING, for exposed piping and sleeves.
  - 3. Keep open ends of tube capped or plugged at all times or otherwise sealed until final assembly.
  - 4. Cut piping square and accurately with a tube cutter (sawing not permitted) to measurements determined at place of installation. Ream tube to remove burrs, being careful not to expand tube, and so no chips of copper remain in the tube. Work into place without springing or forcing. Bottom tube in socket so there are no gaps between tube and fitting. Exercise care in handling equipment and tools used in cutting or reaming of tube to prevent oil or grease being introduced into tubing. Where contamination has occurred, material is no longer suitable for oxygen service.

5. Spacing of Hangers: NFPA 99.
6. Rigidly support valves and other equipment to prevent strain on tube or joints.
7. While being brazed joints shall be continuously purged with oil free nitrogen. The flow of purge gas shall be maintained until joint is cool to touch.
8. Do not bend tubing. Use fittings.
9. Support ceiling column assembly from heavy submounting castings furnished with the unit as part of roughing in. Anchor with 1/2 inch diameter bolts attached to angle iron frame supported from structural ceiling, unless otherwise indicated.
10. Provide two 1 inch minimum conduits from ceiling column assembly to adjacent corridor, one for mass spectrometer tubing and wiring and one for monitor wiring, for connection to signal cabling network.
11. Pressure, vacuum switches, sensors, transmitters and gages to be assessable, and provide access panel where installed above plaster ceiling. Install pressure switches and sensors with orifice nipple between pipe line and switch/sensor.
12. Zone Valve. All station outlets/inlets shall be supplied through a zone valve as follows: (1) the zone valve shall be placed such that a wall intervenes between the valve and outlets/inlets that it controls. (2) the zone valve shall serve only outlets/inlets located on the same story.
13. Apply pipe labeling during installation process and not after installation is completed. Size of legend letters shall be in accordance with ANSI A13.1.
14. Pipe compressor intake to a source of clean ambient air as indicated in NFPA 99.
15. After initial leakage testing is completed, allow piping to remain pressurized with testing gas until testing agency performs final tests.
16. Penetrations:
  - a. Fire Stopping: Where pipes pass through fire partitions, fire walls, smoke partitions, or floors, install a fire stop that provides an effective barrier against the spread of fire, smoke and gases as specified in Section 07270, FIRESTOPPING. Completely fill and seal clearances between raceways and openings with the fire stopping materials.
  - b. Waterproofing: At floor penetrations, completely seal clearances around the pipe and make watertight with sealant as specified in Section 07920, SEALANTS AND CAULKING.
  - c. Provide 1-1/2 inch diameter line pressure or vacuum gage downstream of zone valve in valve cabinets.

#### B. TESTS

1. Initial Tests: Blowdown, and high and low pressure leakage tests as required by NFPA 99, with documentation.
2. Medical gas testing agency shall perform the following:
  - a. Perform and document all cross connection tests, labeling verification, supply system operation, and valve and alarm operation tests as required by, and in accordance with, NFPA 99 and the procedures set forth in pre-qualification documentation.
  - b. Verify that the systems, as installed, meet or exceed the requirements of NFPA 99 and this specification, and that the systems operate as required.
  - c. Piping Purge Test: For each positive pressure gas system, verify cleanliness of piping system. Filter a minimum of 35 cubic feet of gas through a clean white 0.45 micron filter at a minimum velocity of 3.5 scfm. Filter shall show no discoloration, and shall accrue no more than 0.1 mg of matter. Test each zone at the outlet most remote from the source. Perform test with the use of an inert gas as described in CGA P-9.
  - d. Piping Purity Test: For each positive pressure system, verify purity of piping system. Test each zone at the most remote outlet for dew point, carbon monoxide, total hydrocarbons (as methane), and halogenated hydrocarbons, and compare with source gas. The two tests must in no case exceed variation as specified

below in Paragraph, MAXIMUM ALLOWABLE VARIATION. Perform test with the use of an inert gas as described in CGA P-9.

- e. Outlet and Inlet Flow Test:
  - 1) Test all outlets for flow. Perform test with the use of an inert gas as described in CGA P 9.
  - 2) Oxygen, nitrous oxide and air outlets must deliver 3.5 scfm with a pressure drop of no more than 5 psi, and static pressure of 50 psi.
  - 3) Nitrogen outlets must deliver 20 scfm with a pressure drop of no more than 5 psi, and static pressure of 210 psi.
  - 4) Vacuum inlets must draw no less than 3.0 scfm with adjacent inlet flowing, at a dynamic inlet pressure of 12 inches Hg, and a static vacuum of 15-inches Hg.
  - 5) Anesthesia evacuation inlets must draw no less than 1.0 scfm at a dynamic inlet pressure of 12-inches Hg, and a static vacuum of 15 inches Hg.
- f. Source Contamination Test: Analyze each pressure gas source for concentration of contaminants, by volume. Allowable concentrations are below in paragraph, ANALYSIS TEST.
  - 1) Dew point -
    - a) Compressed air 39 degrees F pressure dew point at 50 psi
    - b) All others- Minus 26 degrees F pressure dew point at 50 psi
  - 2) Carbon monoxide 10 ppm)
  - 3) Carbon dioxide –
    - a) Compressed air ppm
    - b) All other gases 300 ppm
  - 4) Gaseous hydrocarbons -
    - a) Compressed air 5 ppm as methane
  - 5) Halogenated hydrocarbons - Compressed air 2 ppm
    - a) Take samples for air system test at the intake and at a point immediately downstream of the final filter outlet. The compared tests must in no case exceed variation as specified below in Paragraph, MAXIMUM ALLOWABLE VARIATION.
- g. ANALYSIS TEST:
  - 1) Analyze each pressure gas source and outlet for concentration of gas, by volume.
  - 2) Make analysis with instruments designed to measure the specific gas dispensed.
  - 3) Allowable concentrations are within the following:
    - a) Oxygen. 99 plus percent oxygen
    - b) Nitrous oxide 99 plus percent nitrous oxide
    - c) Nitrogen 99 plus percent nitrogen
    - d) Medical air 19.5 percent to 23.5 percent oxygen
    - e) Carbon Dioxide 99 plus percent carbon dioxide
- h. MAXIMUM ALLOWABLE VARIATION: Variation between the source gas and all outlets shall not exceed the following:
  - 1) Dew point 2 degrees C (4 degrees F)
  - 2) Carbon monoxide 2 mg/L (ppm)
  - 3) Total hydrocarbons as methane 1 mg/L (ppm)
  - 4) Halogenated hydrocarbons 2 mg/L (ppm)

C. CONNECTION TO EXISTING MEDICAL GAS SYSTEM:

- 1. Install shut-off valve at the connection of new line to existing line.
- 2. Coordinate time for shut-down of the existing medical gas system with the VA medical center.
- 3. Shut off all oxygen zone valves and gas riser valves if the section to be connected to cannot be totally isolated from the remainder of the system.



4. Prior to any work being done, check the new pipeline for particulate or other forms of contamination.
5. Insure that the correct type of pipe tubing and fittings are being used.
6. Make a spot check of the existing pipelines in the facility to determine the level of cleanness present.
7. Reduce the pressure to zero and make the tie-in as quickly as possible. A nitrogen purge is not required since this would require another opening in the pipe.
8. After the tie-in is made and allowed to cool, slowly bleed the source gas (oxygen) back into the pipeline. Test the work area for leaks with soapy water and repair any leaks.
9. After all leaks, if any, are repaired and the line is fully recharged, perform blowdown and testing. Open the zone that is closest to the main to the system, access the closest outlet to the work, and blow the main through the outlet. After the outlet blows clear into a white cloth, make an additional check at a zone most distant from the work.

### 3.4 INSTALLATION OF SEISMIC RESTRAINTS

#### A. GENERAL

1. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's written instructions and all submittal data.
2. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

#### B. SEISMIC RESTRAINTS

1. All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted or welded to the structure to comply with the required acceleration. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively attached to the structure.
2. All horizontally suspended pipe shall use RESTRAINT TYPE III. Spacing of seismic bracing shall be as per TABLE C at the end of this section.
3. For all trapeze supported piping, the individual pipes must be transversely and vertically restrained to the trapeze support at the designated restraint locations.
4. For overhead supported equipment, over stress of the building structure must not occur. Bracing may occur from:
  - a. Flanges of structural beams.
  - b. Upper truss chords in bar joists.
  - c. Cast in place inserts or drilled and shielded inserts in concrete structures.
5. Pipe Risers
  - a. Where pipe passes through cored holes, core diameters to be a maximum of 2" larger than pipe O.D., including insulation. Cored holes must be packed with resilient material or fire stop as specified in other sections of this specification and/or state and local codes. No additional horizontal seismic bracing is required at these location.
  - b. Non-isolated, constant temperature pipe risers through cored holes require a riser clamp at each floor level on top of the slab attached in a seismically approved manner for vertical restraint.
  - c. Non-isolated, constant temperature pipe risers in pipe shafts require structural steel attached in a seismically approved manner at each floor level and a riser clamp at each floor level on top of, and fastened to the structural steel. The riser clamp and structural steel must be capable of withstanding all thermal, static and seismic loads.
  - d. Isolated and/or variable temperature risers through cored holes require riser resilient Guides and Anchors installed to meet both thermal expansion and seismic acceleration criteria.

- e. Isolated and/or variable temperature risers in pipe shafts require resilient riser guides and anchors installed on structural steel to meet both thermal expansion and seismic acceleration criteria. Each floor level must have a riser clamp that does not interfere with the thermal expansion/contraction of the pipe.
- 6. Stacks passing through floors are to be bolted at each floor level or secured above and low each floor with riser clamps.
- 7. All non-isolated floor or wall mounted equipment and tanks shall use RESTRAINT TYPE III or V.
- 8. Where base anchoring of equipment is insufficient to resist seismic forces, restraint TYPE III shall be located above the unit's center of gravity to suitably resist "G" forces specified.
- 9. Vertically mounted tanks or similar equipment may require this additional restraint. A rigid piping system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and roof; solid concrete wall and a metal deck with lightweight concrete fill, pipes, duct, conduit, etc. crossing a building expansion joint.
- 10. Exclusions for seismic restraints on Non-Life Safety and non-combustable piping systems:
  - a. Piping
    - 1) All piping less than 2-1/2" diameter, except in mechanical rooms where piping less than 1-1/4" is exempted.
    - 2) All clevis or trapeze supported piping suspended by hangers with positive attachment to the structure that are less than 12 inches in length as measured from the top of the pipe to the point of attachment to the structure. If the 12" limit is exceeded by any hanger in the run, seismic bracing is required for the run.

C. INSPECTION

- 1. Upon completion of installation of all vibration isolation and seismic restraint devices, the owner may elect to contract and outside consultant at the owners expense to review the installation. Any deficiencies in the installation will be corrected immediately at the contractor's expense.

<b>TABLE C SEISMIC BRACING TABLE</b>			
<b>EQUIPMENT</b>	<b>ON CENTER SPACING (Max)</b>		<b>WITHIN EACH CHANGE OF DIRECTION (LARGER OF . . .)</b>
	<b>TRANSVERSE</b>	<b>LONGITUDINAL</b>	
<b>PIPE (Threaded, Welded, Soldered or Grooved)</b>			
To 16"	40 Feet	80 Feet	10 Feet or 15 Diameters

3.5 PLUMBING SYSTEM TESTS

- A. All plumbing systems shall be tested by the Plumbing Subcontractor in the presence of the Architect or his representative and the Plumbing Inspector after completion of "ROUGHING IN" and before concealing a section from view.
- B. Furnish labor, tools and all materials and do all testing as described herein.

- C. No piping shall be insulated until it has been pressure tested and proven tight. All new systems that can be isolated with valves shall be pressure tested and proven tight as described herein.
- D. Each new system shall be pressure tested at pressures described herein and in a manner as described herein. Test pressures for each system shall be maintained as long as required by the Architect to determine the tightness of the system and/or as long as required to inspect the joints visually or with painted soap solutions. Wherever testing indicates leaks, the leaks shall be repaired in a manner prescribed by the Architect and the test shall be reprocessed until the system is proven tight.
- E. New storm, sanitary and vent piping shall have openings plugged and the system above filled with water to the top of vent pipes. Water shall be allowed to stand a minimum of 60 minutes, or as long thereafter as is required for the complete inspection. Each vertical stack with its branches may be tested separately. If the lines prove tight the water shall be drawn off and the fixtures connected.
- F. All interior water piping shall be tested to a hydrostatic pressure of one hundred fifty (150) pounds per square inch and proven tight at this pressure. Test pressures shall be held for at least 8 hours minimum, or as long thereafter as is required to make the complete test. Water piping to be concealed by structural work or put in grade shall be tested to the above pressure and proven tight before pipes are concealed.
- G. Natural Gas System: After assembly and before piping is concealed the system shall be tested to a pressure of 5 psig, for a period of 30 minutes or as long as required to prove the system tight without drop in pressure. If the system is found to be leaking, each joint shall be checked with a solution of soap suds and all leaks shall be properly repaired and the system re-tested and proved tight.
- H. Furnish and make temporary installations of all pumps, compressors and instruments for the testing. Test pressure shall be held for at least the minimum time periods noted above, or long enough thereafter to prove the system tight that is being tested. Any defects in any system shall be repaired or replaced as directed and the expense shall be borne by the Plumbing Subcontractor. All soap tested joints shall be washed clean after testing, and tests water properly drawn off.

### 3.6 CLEANING AND ADJUSTING

- A. At the completion of the work, all fixtures, equipment apparatus and exposed trim for same included in this Section shall be cleaned and where required polished ready for use. Faucet washers which have been damaged during construction shall be replaced. Drains and traps shall be thoroughly cleaned. At the completion of the work, all valves, faucets and automatic control devices shall be adjusted for proper and quiet operation.
- B. At the completion of the work, all valves, faucets and automatic control devices shall be adjusted for proper and quiet operation.

### 3.7 PAINTING

- A. Wherever factory finishes of paint, lacquer, baked enamel, etc., have been damaged or deteriorated during construction, use factory finish painting materials and refinish or touch up the damage or deterioration to the satisfaction of the Architect.

### 3.8 STERILIZATION

- A. The entire new potable hot water, recirculating hot water and cold water distribution system for the building shall be thoroughly sterilized with a solution containing not less than 50 parts per million of available chlorine. The chlorinating materials shall be either liquid chlorine, calcium hypochlorite, or chlorinated lime. The sterilizing solution shall be allowed to remain in the system for a period of eight (8) hours, during which time all valves and faucets shall be opened and closed several times. After sterilization, the solution shall be flushed from the system with clean water until the residual chlorine content is not greater than 0.2 part per million, unless otherwise directed.

### 3.9 INSTRUCTIONS

- A. After completion of assembly and installation of all systems and equipment and piping required under this Section of the Specifications, the Owner's supervisory and operating personnel shall be instructed regarding the operation and maintenance of the systems. The instructions shall be given by the Plumbing Subcontractor and other qualified personnel who are thoroughly familiar with all systems and shall be furnished for a time period as directed by the Architect.

END OF SECTION 22 00 00

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## SECTION 23 00 00 – HEATING, VENTILATION AND AIR-CONDITIONING

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. Conditions of the Contract and Division 1, General Requirements, shall be made part of this Section.
- B. Refer to the drawings for further definition of location, extend, and details of the work described herein.
- C. Cooperate and coordinate with all trades in execution of the work described in this Section and so as to provide clearance for equipment maintenance operation.
- D. Where referred to, standard specifications of technical Societies, Manufacturer's Associations, and Federal Agencies shall include all amendments current as the date of issue of these Specifications.
- E. It is intended, for the guidance of the bidders, that the Manufacturer's name used first throughout this Section of the Specification, is that used in the design of the HVAC system. All material submitted shall be equal in all respects to that used in the design.
- F. The Subcontractor for work of this Section shall become familiar with other Sections of the Specifications to determine the type and extent of work there under which affects the work of this trade, whether or not such work is specifically mentioned in this Section.

#### 1.2 WORK INCLUDED

- A. Provide all labor, equipment, and materials, required to furnish and install all HVAC work, complete as shown on the drawings and specified herein. The following are major items of work included:
  - 1. Selective Demolition
  - 2. Hoisting and rigging for equipment and materials specified herein.
  - 3. Core drilling, cutting and channeling for holes five (5) inches and less in diameter.
  - 4. Furnish and maintain in safe and adequate condition, all staging and scaffolding that is required for work of this section.
  - 5. Multiple Phase Project: The project is intended for multiple phases. The contractor shall treat each phase as a separate project requiring equipment start-up; testing, adjusting and balancing, reports; system flushing and testing; submittals; coordination drawings; punch lists; etc.
  - 6. Premium Time: The project requires work to be completed on premium time (outside normal business hours).
  - 7. Maintain Proper Indoor Air Quality of building during construction.
  - 8. Properly protect all stored and partially installed equipment, piping and ductwork.
  - 9. Submittals and Coordination Drawings.
  - 10. Equipment and Systems:
    - a. Fire and Smoke Stopping. Coordinate materials and methods with Division 7.
    - b. Factory fabricated air handling units
    - c. Chilled water hydronic piping systems.
    - d. Hot water hydronic piping systems.

- e. Chillers.
  - f. Low Pressure steam and condensate piping systems
  - g. High/Medium Pressure Steam and condensate systems
  - h. Pressure Reducing Station
  - i. Pumps
  - j. Humidifiers
  - k. Air Terminals
  - l. Terminal Units
  - m. Condensate drain, piping systems and appurtenances.
  - n. Chemical treatment systems.
  - o. Supply, return and exhaust air systems
  - p. Ductwork
  - q. Registers, Grilles and Diffusers.
  - r. Ductwork insulation
  - s. Piping Insulation
  - t. Equipment Insulation
  - u. Mechanical Identification
  - v. Variable Volume Air Control terminal units
  - w. HVAC Motor starters and interlocking devices
  - x. HVAC Variable frequency drives
  - y. Thermal insulation
  - z. Sound attenuators
  - aa. Vibration isolation and Seismic Restraint
  - bb. Hydronic duct heating coils
  - cc. Radiant panels
  - dd. Exhaust, return and supply fans
  - ee. Automatic Temperature Controls and all interlock wiring and monitoring
- 11. Hydronic System cleaning, flushing, chemical treatment and Water Quality report.
  - 12. Testing, Adjusting and Balancing of all air and water systems.
  - 13. System Demonstration/Start-up/Manufacturer Representation.
  - 14. Operations and Maintenance Manuals
  - 15. Record Drawings
  - 16. Test and Clean all ductwork, air moving equipment, and coils.

### 1.3 INTENT

- A. Description in the Specifications, or the indication on the Drawings of equipment, materials, operation and methods, required that such items shall be of the quantity required, and the systems complete in every respect.
- B. The Specifications shall be considered an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified. In the case of a conflict, the more demanding item shall apply.
- C. The HVAC Contractor shall be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. The HVAC Contractor shall provide fully qualified personnel to fulfill this requirement. The HVAC Contractor shall be responsible for prompt replacement of defective materials, equipment and parts of equipment and related damages.

### 1.4 RELATED WORK

1. Examine all other sections of the Specifications and all drawings for the relationship of the work under this Section and the work of other trades. Cooperate with all trades and coordinate all work under this section therewith. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. The following related items are included under sections listed below:
1. Concrete bases, housekeeping pads and filling inertia pads for HVAC equipment. DIVISION 3 - CAST IN PLACE CONCRETE.
  2. Except as specified herein, cutting shall be the responsibility of the General Contractor and patching shall be performed by the respective trades. Refer to the respective sections.
  3. The HVAC Subcontractor shall provide all hoisting and rigging for equipment and materials specified herein.
  4. Core drilling, cutting and channeling for HVAC equipment for holes five (5) inches and less in diameter.
  5. Furnish and maintain in safe and adequate condition, all staging and scaffolding that is required for work of this section.
  6. Fuel, water and electricity for all tests and temporary operation of HVAC equipment. – DIVISION 1 - TEMPORARY FACILITIES AND CONTROLS.
  7. Temporary heat. DIVISION 1 - TEMPORARY FACILITIES AND CONTROLS.
  8. Openings for Air Devices: In APPLICABLE SECTIONS, in which they occur.
  9. Undercut doors and door louvers. DIVISION 8 – DOORS and.
  10. Woodgrounds (Blocking) for fastening air devices and radiation. Refer to Architectural drawings and DIVISION 6 -, ROUGH CARPENTRY to determine if these items are provided. Secure to woodgrounds if provided or directly to wall or ceiling surface if not provided. Provide expansion bolts for masonry - concrete - block wall mounting.
  11. Flashing of ductwork, Equipment Supports and Roof Curbs roof curbs for HVAC equipment. DIVISION 7 - THERMAL AND MOISTURE PROTECTION.
  12. Painting of all exposed ductwork and other mechanical equipment not having enameled surfaces, stainless steel or chromed finishes. DIVISION 9 - PAINTING
  13. City water piping and fittings including insulation and backflow prevention on plumbing piping systems connecting to HVAC equipment. DIVISION 22 - PLUMBING.
  14. In general, all wiring required for equipment provided by the HVAC Contractor that requires Automatic Controls and all interlock wiring and accessories for this HVAC equipment that is not shown or indicated on the Electrical Drawings of DIVISION 26 - ELECTRICAL, shall be provided under DIVISION 23 – HEATING, VENTILATION, AND AIR CONDITIONING.
  15. HVAC Motor Starters, Disconnects and Variable Frequency Drives installed under DIVISION 26 – ELECTRICAL.
  16. Fire and Smoke stopping at penetrations through fire-rated assemblies. Fire-stop materials and methods are specified in DIVISION 7.
- C. Furnish the following materials to be installed under other specification sections.
1. Prefabricated roof curbs and prefabricated equipment supports installed and flashing installed under DIVISION 7 - THERMAL AND MOISTURE PROTECTION.
  2. Access Doors and Panels to be installed under applicable sections.
- D. Install the following materials to be furnished under other SECTIONS.
1. Duct installed smoke detectors furnished and wired under DIVISION 26 - ELECTRICAL. Refer to electrical drawings for exact number and general locations.

#### 1.5 STANDARD OF MATERIALS AND WORKMANSHIP

- A. Refer to Part A and Division 1 of Part B for general instructions and, in addition, adhere to the following:
  - 1. Workmanship and installation methods shall conform to the highest standard practice. Work shall be performed by skilled tradesmen under the direct supervision of fully qualified personnel.
  - 2. Install equipment in strict accordance with manufacturer's published recommendations.
  - 3. When requested, submit samples of materials proposed for review before proceeding with the work.
  - 4. Install equipment and materials to present a neat appearance. Install piping, ducts and conduit parallel with or perpendicular to building planes.
  - 5. Conceal piping, ducts and conduit in finished areas. Install work so as to require a minimum amount of furring.
  - 6. Make provisions for neat insulation finish around equipment and materials. Do not mount piping or equipment within insulation depth.
  - 7. Equipment, materials and work shall comply with the requirements of generally recognized agencies, including, but not limited to, agencies listed under DIVISION 15 – HEATING VENTILATION AND AIR-CONDITIONING Article STANDARDS- REFERENCES and shall conform to and be installed in strict accordance with Federal, State and Town requirements and shall meet all of the requirements of all authorities having jurisdiction.

#### 1.6 ABBREVIATIONS AND DEFINITIONS

- A. "HVAC" or "HV" or "AC" as mentioned herein means specifically "Heating, Ventilating and Air Conditioning" or "Heating and Ventilating" or "Air Conditioning" respectively, when used in conjunction with contractor, equipment, work or articles within this specification.
- B. A.T.C. as mentioned herein means specifically Automatic Temperature Control as it refers to the manufacturer or description of work and equipment
- C. "Provide" may be used in place of "furnish and install" and where used shall mean to deliver, furnish, erect, and connect up complete in readiness for regular operation, the particular work or equipment referred to, unless otherwise specified.
- D. "Concealed" shall be defined as areas where piping or ducts are located in chases, shafts, and above ceilings whether furred or lay-in type.
  - 1. All other ductwork and piping shall be considered "exposed".
- E. The term "Applicable Section Contractor" or "A.S.C." shall be understood to refer to a contractor or contractors other than the HVAC Contractor or any HVAC Subcontractor or HVAC Sub-subcontractor.

#### 1.7 EXAMINATION

- A. Before submitting bid, visit and examine the site where work is to be carried out and become familiar with all features and characteristics which affect the work of this SECTION.
- B. Examine the Specifications and Drawings, including the Specifications and Drawings of other DIVISIONS before bid.
- C. Report in writing, any discrepancies or deficiencies which may adversely affect the work, at least six days prior to close of bid.

- D. No allowance will be made for any difficulties encountered due to any features of the building, site or surrounding public and private property which existed up to the time of bid.

## 1.8 REFERENCES

- A. All material and workmanship shall comply with all applicable codes, local and state ordinances, industry standards, and utility company regulations.
- B. All materials, equipment and apparatus shall be Underwriters Listed or Labeled for all components where such listing or label are available. Items which are not UL Listed or Labeled are not acceptable if labeled or listed equipment can be obtained from another acceptable manufacturer. Assemblies or components not labeled or listed shall be furnished with certification by the manufacturer that the wiring complies with UL safety requirements.
- C. STANDARDS: Except as modified by governing codes or this specification, the following applicable standards (latest editions regardless of years listed below) shall apply to materials, equipment and installation of components and systems furnished and/or installed as part of this Section:
1. ASHRAE – American Society of Heating, Refrigeration and Air-conditioning Engineers
    - a. Special Attention is required for:
      - 1) ASHRAE Standard 15-92: Safety Code for Mechanical Refrigeration.
      - 2) ASHRAE Standard 62-89: Ventilation for Acceptable Indoor Air Quality.
      - 3) ASHRAE Standard 111-1988: Practices for Measurement, Testing, Adjusting and balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
  2. NFPA – National Fire Protection Association
    - a. Special Attention is required for:
      - 1) NFPA 90A: Air Conditioning and Ventilation Systems.
      - 2) NFPA 91: Blower and Exhaust Systems.
  3. SMACNA – Sheet Metal and Air Condition Contractors Nation Association, Inc.
    - a. Special Attention is required for:
      - 1) SMACNA Duct Construction Standards Metal and Flexible.
      - 2) SMACNA Fire, Smoke, Radiation, Damper Installation Guide for HVAC Systems.
      - 3) SMACNA Air Duct Leakage Test Manual.
      - 4) SMACNA IAQ Guidelines for Occupied Buildings Under Design and Construction
  4. NEC – NATIONAL ELECTRIC CODE
  5. OSHA – Occupational Safety & Health Administration
  6. UL – Underwriter's Laboratory
  7. EPA – Environmental Protection agency
  8. AIA – American Institute of Architects
  9. AGA - American Gas Association
  10. ANSI – American Nation Standards Institute
  11. ASME – American Society of Mechanical Engineers
    - a. Special Attention is required for:
      - 1) ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear appropriate ASME label.
  12. ARI – American Air Conditioning and Refrigeration Institute
  13. IEEE- Institute of Electrical and Electronics Engineers
  14. IPCEA – Insulated Power Cable Engineers Association
  15. ADA –American Standards Association

16. FM – Factory Mutual Engineering Division
17. CS – Commercial Standard of NBS (US Department of Commerce)
18. NEMA – National Electrical Manufacturers Association
19. ASTM – American Society of Testing and Materials
20. AMCA – Air Moving and Conditioning Association
21. ADC – American Diffuser Council
22. American Institute of Architects Academy for Health “Guidelines for Design and Construction of Hospital and Healthcare Facilities” – 2006 Edition

D. CODES and ORDINANCES: Conform with the provisions of the latest editions of the following:

1. The Maine State Building Code
2. 2006 International Building Code.
3. City/Town of Portland, ME fire protection codes and/or ordinances.
4. 2006 International Mechanical Code.
5. 2006 International Plumbing Code
6. The 2008 National Electric Code.

### 1.9 DRAWINGS

- A. The Drawings are schematic in nature and are intended to show approximate locations of apparatus, fixtures, piping and duct runs in diagrammatic form. The Drawings are not intended to show Architectural and Structural details.
- B. Do not scale drawings. Obtain any information requiring accurate dimensions from Architectural and Structural Drawings or from site measurements. Check locations and elevations before proceeding with work.
- C. At no additional cost to the Owner, make all changes or additions to materials and/or equipment necessary to accommodate structural and architectural conditions.
- D. Leave areas clear and unobstructed where space is indicated as reserved for future equipment.
- E. Whether shown on the Drawings or not, provide adequate space and provision for servicing of equipment and removal and reinstallation of replaceable items such as motors, coils, filters and tubes.
- F. Provide all ceiling mounted components, including air terminals, access doors and panels, in strict accordance with reflected ceiling plans.

### 1.10 FABRICATION OF MATERIALS

- A. Before prefabricating ductwork or piping for installation, make certain that such items can be installed as shown on the coordination drawings without interfering with the structure or the work of other trades. Any problems that cannot be solved in agreement with other trades affected, shall be submitted for decision.
- B. If ductwork or piping is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at not extra cost to the Owner.
- C. In case of any discrepancies between the Specifications and Drawings, or where the Specifications or Drawings are not clear or definite, the subject shall be referred to or decided

by the Architect whose decision shall be final. Otherwise, make adjustments at no expense to the Owner.

#### 1.11 PERMITS, FEES, INSPECTION CERTIFICATES

- A. Apply for, obtain and pay for all permits, inspections and fees required.
- B. Be fully acquainted with and obey all Federal, State, and Municipal laws, by-laws, codes and regulations, and all authorities having jurisdiction. Provide fire dampers and smoke dampers in air handling systems as described herein.
- C. Before starting any work, submit the required specifications and Drawings to the Governing Authorities for their approval. Comply with any requested changes as part of the Contract, and give any notification immediately of such changes.
- D. Where the Specifications, Instructions, or the Governing Authorities require any work to be tested, inspected or approved, give sufficient notice of its readiness for inspection, and, if the inspection is by a Governing Authority, of the date and time set for such inspection.
- E. Inspection will be made promptly. If any work is covered up without consent, it shall, if required, be uncovered for examination and the required corrections made at not extra cost to the Owner.
- F. Furnish any certificates necessary as evidence that the work conforms to the requirements of all authorities having jurisdiction.
- G. Make changes, if required, to make the work conform to all laws, bylaws, codes, and regulations, as part of this SECTION work.

#### 1.12 RECORD DRAWINGS

- A. Refer to DIVISION 1 – GENERAL REQUIREMENTS and DIVISION 1 - PROJECT CLOSEOUT.
- B. All costs for Record Drawings shall be borne by the HVAC Subcontractor.
- C. Purchase and maintain at the job site at all times, a complete set of blackline prints of the HVAC drawings. As the work progresses, mark all changes made, whether resulting from addenda, formal change orders or other instructions issued by the Architect. Color in the various ductwork, piping, equipment, apparatus and associated appurtenances exactly as they are erected.
- D. The accurate location, depth, size and type of all concealed items shall be recorded before concealment to ensure accurate and direct future access doors and panels. Show inverts of all services at key points within the building, or buried items, and entering and leaving the building. Show dimensions from building grid lines.
- E. The record drawings will be reviewed at regular intervals by the Architect and will be taken into consideration when reviewing the monthly applications for payment submitted by the HVAC Subcontractor.
- F. When this procedure has been accomplished to the satisfaction of the Architect, the Record Drawing information shall be transferred to reproducible drawings by this Subcontractor and submitted to the Architect, as directed in DIVISION 1, PROJECT CLOSEOUT.

### 1.13 OPERATION AND MAINTENANCE DATA

- A. Refer to DIVISION 1 - PROJECT CLOSEOUT
- B. Assemble three copies of indexed hard cover manuals entitled "Operating and Maintenance Instructions for Mechanical System".
- C. Submit one copy for review at least two months before instructions to Owner are commenced. Instruct the Owner for one week (40 hours) as to the Operation-Maintenance of the System. This, and all instructional sessions, shall be videoed and three (3) copies made and submitted to the Architect. Refer to DIVISION 1, PROJECT CLOSEOUT.
- D. Ensure that the terminology used in various sections of the manual is consistent.
- E. Each manual shall contain the following information:
  - 1. Description of each system, with description of each major component of the system.
  - 2. Complete sets of approved page-size equipment shop drawings including temperature control drawings.
  - 3. A lubrication schedule of all specified equipment.
  - 4. Spare parts list.
  - 5. Equipment identification list with serial numbers.
  - 6. Page-size valve tag schedule and flow diagrams.
  - 7. Final balancing reports.
  - 8. Water treatment procedure and tests.
  - 9. Names and telephone numbers of all equipment parts suppliers.
  - 10. Control commissioning report
  - 11. Equipment start-up reports
  - 12. Two (2) "snap-shots" of the DDC points of the Automatic Temperature Control system. This data shall be compiled and recorded with the system in the "occupied" and "unoccupied" modes of each zone. Also include the schedule for these modes as established by the Owner.

### 1.14 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fan Belts: One set for each belt-drive fan.
  - 2. Filters: One set of filters for each unit including final filters.

### 1.15 SUBMITTALS

- A. Refer to DIVISION 1 - SUBMITTAL PROCEDURES and specifications for submittal requirements. Without limiting the generality thereof, the HVAC Subcontractor shall also submit the additional information noted herein.
- B. Present, not later than three (3) weeks after award of the Contract, a list of submittals to be submitted with the name of each manufacturer and supplier. Failure to submit this list will result in the necessity for the Contractor to use that equipment which is scheduled.
- C. Submittals for equipment furnished under this Section shall include, but not be limited to all items listed in DIVISION 23 – HEATING VENTILATION AND AIR-CONDITIONING Article -



WORK INCLUDED and listed within this specification. Refer to each article of this section for additional specific submittal requirements.

- D. Do not manufacture, deliver or install equipment and materials until final review of Shop Drawings has been completed.
- E. Submit a minimum of seven (7) copies of certified submittals of all equipment, materials, equipment wiring, diagrams, motors, starters, controls and schedules. Ensure that submittals have adequate clear space for all stamps. When requested, resubmit promptly.
- F. Identification: In addition to the information required by DIVISION 1 - SUBMITTAL PROCEDURES indicate:
  - a. Name and address of supplier.
  - b. Name of manufacturer.
  - c. Reference specification section number, article number, article name and page number (e.g. 23 00 00 - 2.10 - VIBRATION ISOLATION AND SIESMIC RESTRAINT – Page 23 00 00 -14)
  - d. Identify if submittal is a resubmission of previous reviewed equipment.
  - e. Distribution list of all Trade subcontractors and manufacturers who will receive the Engineer's reviewed comments.
- G. Do not manufacture, deliver or install equipment and materials until final review of Submittals has been completed.
- H. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  - 1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
  - 2. Mark each copy of each submittal to show which products and options are applicable.
  - 3. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Dimensions and Required clearances
    - e. Equipment Shipping and Operating weights and Structural Loads.
    - f. Components required for field installation.
    - g. Method of field assembly, components, and location and size of each field connection.
    - h. Field electrical and mechanical connection requirements.
    - i. Notation of coordination requirements.
    - j. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring
    - k. Material gages and finishes.
    - l. Standard color charts.
    - m. Manufacturer's catalog cuts.
    - n. Wiring diagrams showing factory-installed wiring.
    - o. Certified performance curves for each fan, air handling unit and pump, showing duty and horsepower with design operating points over the components entire range indicated clearly.
    - p. Certified performance ratings with system operating conditions indicated.
    - q. Certified compliance with specified referenced standards. Testing by recognized testing agency.
    - r. Motor ratings, electrical characteristics, and motor accessories.

- s. Filters with performance characteristics.
- t. Equipment Manufacturer supplied Dampers, housings, linkages, and operators.
- u. Equipment Manufacturer supplied valves and operators.
- v. All available specialties, options and accessories. Clearly indicated furnished specialties, options and accessories.
- w. Standard product operation and maintenance manuals.
- x. Notation of coordination requirements.
- y. Submit certified discharge and radiated sound power levels for:
  - 1) Air terminal units
  - 2) Air moving equipment – fans, air handlers, roof top units, etc.
  - 3) Equipment with compressors
  - 4) Water moving equipment – pumps
  - 5) Steam pressure reducing stations.
- I. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data. Prepare shop drawings for all custom equipment such as air handlers, roof top units, custom roof curbs, cooling towers, pressure reducing stations, and any equipment that standard manufacturers printed data is not suitable for use.
  - 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Dimensions.
    - b. Equipment Shipping and Operating weights.
    - c. Identification of products.
    - d. Fabrication and installation drawings.
    - e. Roughing-in and setting diagrams.
    - f. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
    - g. Design calculations.
- J. Compliance with specified standards. Be responsible for presenting the processing of submittals to suit manufacturing schedule of equipment and construction schedule of building.
- K. Be responsible for the accuracy of equipment dimensions relative to available space, the performance and the electrical characteristics. When required, submit a complete comparison between accepted alternative equipment and materials, and that which is specified.
- L. Each submittal shall indicate clearly the correct name and address of the project, the intended use and location of the equipment, and the specified and/or scheduled designation tag/number.
- M. Upon receipt of approved Submittals, distribute copies to all trades and manufacturers affected. Submit approved Submittals to authorities having jurisdiction when requested.
- N. Keep one set of reviewed Submittals on the site at all times.
- O. Bind one set of the corrected, reviewed and approved Submittals in each Operation and Maintenance Instructions Manual. Refer to DIVISION 1 - SUBMITTALS, DIVISION 1 - PROJECT CLOSEOUT and DIVISION 23 HEATING VENTILATION AND AIR CONDITIONING article – OPERATION AND MAINTENANCE DATA.
- P. Prior to submission of Submittals, the HVAC Subcontractor shall thoroughly check each shop drawing to ascertain that it complies with the Contract requirements; that the electrical characteristics are correct; and that the dimensions of work submitted fit the available space. Any deviations from the Contract requirements shall be clearly noted on the submittals. The HVAC Subcontractor shall stamp each submittal with his firm's name, date and approval,

thereby representing that the above has been complied with. Shop Drawings not so checked and stamped, shall be returned without being examined. Review of the Shop Drawings shall not relieve the HVAC Subcontractor from the responsibility for departures from the Contract Documents. Errors in shop drawings shall be the sole responsibility of the HVAC Subcontractor whether the drawings are reviewed or not.

- Q. The HVAC Subcontractor shall submit to the General Contractor, for transmittal to the Owner, any samples requested by the Owner. Submittal, review, and approval of samples shall be in accordance with the Conditions of the Contract.
- R. Drawings not stamped by the General Contractor shall be returned without being examined.

#### 1.16 COORDINATION DRAWINGS

- A. Prepare Coordination Drawings in accordance to the requirements of DIVISION 1 - SUBMITTAL PROCEDURES. Before work progresses, in addition to the shop drawings listed herein, coordination drawings shall be created and prepared by the HVAC and Sheetmetal Subcontractors in AutoCAD DWG electronic format. The Coordination Drawings once completed by the HVAC and Sheetmetal contractors shall be delivered to the Plumbing Contractor, Fire Protection Contractor and lastly the Electrical Contractor for inclusion of their respective equipment and systems. Provide drawings in electronic format, one 3/8 inch scale reproducible and one 3/8 inch scale blue print of coordination drawings.
- B. Prepare Coordination Drawings in accordance to Division 1 and, in addition, adhere to the following:
  - 1. Indicate temporary relocation, phasing, sequencing and moving of large equipment in the building during construction.
  - 2. Floor plans and details, including the following:
    - a. HVAC Coordination Drawings shall include, as a minimum, all supply and return ductwork, VAV Boxes, air-handlers, fans, piping lay-outs and all other equipment installed under this Section showing the adjoining work of the other trades at all floors, Mechanical Rooms and duct shafts. Refer to articles throughout this SECTION for additional coordination requirements.
    - b. HVAC Sub-contractor shall note apparent conflicts and suggest alternate solutions.
    - c. Composite systems coordination drawings showing how HVAC systems are to be installed where conflicts with the work of other trades may occur.
    - d. Access Door and Panel Coordination: Show sizes and locations of all access panels and doors on coordination drawings.
- C. The Contractor, before transmittal of the Coordination Drawings to the Owner for approval, may require the HVAC and Sheetmetal Subcontractors to revise the composite coordination drawings and shop drawings and to make reasonable modifications in the layout of the HVAC work, so that the HVAC work may be properly accommodated without the interference with work of other trades. The HVAC and Sheetmetal Subcontractors shall make such revisions to composite systems coordination drawings, when requested, without extra charge.
- D. The HVAC Contractor shall be responsible for the cost for changes in the HVAC and adjoining work where an approved substitution of the HVAC equipment requires such changes in the HVAC work or in the adjoining work of any other trade. Provide coordination drawings showing all changes.
- E. Sheetmetal ductwork installed in floor areas which may be in conflict with ceiling system. The Ceiling Contractor and the Sheetmetal Contractor shall coordinate the method of support and access for the ceiling. In no case shall the ductwork be used to support the ceiling construction

nor shall it fall on the grid or its cross points unless the specific areas of conflict are allowed by the Architect/Engineer.

- F. The Contractor, before transmittal of the Coordination Drawings to the Owner for approval, shall review with and obtain sign-off from the following contractors indicating that the work of their trade is fully coordinated:
1. General Contractor
  2. HVAC contractor
  3. Sheetmetal Contractor
  4. ATC Contractor
  5. Testing and Balancing Contractor
  6. Duct Cleaning Contractor
  7. Plumbing Contractor
  8. Electrical Contractor
  9. Low voltage wiring contractor
  10. Fire Protection Contractor

#### 1.17 REQUESTS FOR INTERPRETATION (RFIs)

- A. Prepare Requests for Interpretation (RFIs) in accordance to Division 1 and, in addition, adhere to the following:
- B. RFIs shall originate with the Contractor. RFIs submitted directly by sub-contractors will be returned with no response. RFIs sent directly to engineer will be returned with no response. Incomplete RFIs will not be reviewed and will be returned for additional information.
- C. If email RFI submissions are allowed by Division 1 then the RFI and Attachment(s) shall be in Adobe Acrobat PDF format.
- D. Submit RFIs in format specified and in addition include:
1. Specification Section number and title and related paragraphs, as appropriate.
  2. Drawing number, room name, structural grid coordinates and detail references, as appropriate.
  3. Field dimensions and conditions, as appropriate.
  4. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  5. Attachments: Include 8 ½" x 11" copies of construction documents highlighting areas requiring interpretation. Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation and suggested solution(s).
    - a. Supplementary drawings prepared by Contractor shall be to scale and shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

#### 1.18 TEMPORARY SERVICES

- A. Refer to DIVISION 1 - TEMPORARY FACILITIES AND CONTROLS.
- B. Operations necessary for checking, testing and balancing shall be done after written approval is given to start up systems. Before then, ensure that care is taken to protect equipment from damage, and to prevent distribution of dust through duct systems. Cap and seal ducts and cap pipes as required to prevent construction debris from entering.

- C. Permanent heating or air conditioning systems shall not be used for temporary heating, except with written permission of the Architect. It is intended that the HVAC Subcontractor shall schedule his work so as to be able to utilize the permanent heating system for temporary heat when the building is totally enclosed. When the permanent heating system is utilized for temporary heat, the boiler plant shall be operated as designed with all accessory equipment and systems operative. Upon completion of the temporary heating phase, the equipment shall be inspected and cleaned as required to bring it to as new condition. Under no circumstances shall the boilers, air handlers, or any permanent equipment be operated without feed water, chemical treatment or air filters.
- D. Where air systems are used the associated Ductwork System shall be protected with return air filters at all duct openings or air inlets. Prior to balancing the system for permanent use replace air filters, and clean and test the air system including but not limited to ductwork, air handler, air terminals. Refer to AIR DUCT AND SYSTEM CLEANING for cleaning and testing requirements.

#### 1.19 IDENTIFICATION OF MECHANICAL SERVICES

- A. After finish painting complete, identify all mechanical services. Use terminology consistent with the Drawings and Specifications. Refer to Division 1. A line item on the schedule of values for equipment identification shall be included.
- B. Prepare flow diagrams (same size as record documents) of piping systems to identify equipment and valves. Include these diagrams in record drawings.
  - 1. Insert page-size copies of diagrams into each Operating and Maintenance Manual.
  - 2. Install schematic piping flow diagrams, framed under glass, on equipment room walls. Final location shall be as directed on site by Owner. All valves shall be identified in these diagrams.
  - 3. A line item in the schedule of values shall be dedicated to flow diagrams of mechanical services.
- C. Provide typewritten master lists in Operating and Maintenance Instruction Manuals; and shop equipment numbers on Record Prints and sepias.
- D. Identification shall be consistent with Owner's standard methods of identification.

#### 1.20 PROTECTION

- A. Protect all mechanical work from damage. Keep all equipment dry and clean at all times.
- B. Cover openings in equipment, and pipes, with caps or heavy gauge plastic sheeting until final connections are made.
- C. Correct at no cost to the Owner, any damage caused by improper storage, handling, or installation of equipment and materials.
- D. Protect equipment, piping and temporary services installed within this SECTION from weather damage.
- E. Provide temporary sheetmetal caps on all ductwork, air terminals and sound attenuators delivered, stored and partially installed at the site.

## 1.21 COORDINATION

- A. Fully coordinate with other trades to ensure that work is carried out in the best interests of all concerned. Install work in proper sequence to conserve headroom and space.
- B. Coordinate work with other trades to provide maximum accessibility for maintenance and operation of all equipment installed by all trades.
- C. Give notices of requirements for holes, recessed openings, pits and chases before structure is to be erected.
- D. Set all necessary sleeves and inserts before concrete is scheduled to be poured.
- E. Furnish all items to be built-in, in ample time to allow schedules progress of work.
- F. Refer to the Coordination Drawing Section of Specification for Coordination drawing process.
- G. Provide the Electrical contractor and Plumbing Contractor with all requirements within Two (2) weeks from date of Contract to allow proper coordination of trades by the Contractor.
- H. Verify with the Electrical contractor available electrical characteristics before ordering any equipment.
- I. Verify with the Plumbing contractor available natural gas pressure before ordering any equipment.
- J. Verify Smoke and Smoke/Damper actuator requirements with Fire Alarm and/or electrical contractor before ordering any equipment.
- K. Verify Smoke detector and Fire Alarm interlock requirements before ordering any equipment.
- L. Furnish to the Electrical Contractor all starters, control devices, relays, pilot lights, accessories, contactors, wiring diagrams, and the like required for proper operation, connection and control of motorized equipment, as specified and/or shown on the drawings.
- M. Electrical Contractor shall be responsible for the following:
  - 1. Mount and connect starters, controllers and disconnects, except where specified to be factory wired and mounted on the equipment.
  - 2. Provide all required power connections for all motor driven equipment.
  - 3. Provide power wiring to control transformers and control panels.
- N. HVAC contractor provides low and line voltage control wiring to all equipment requiring control unless specifically called for on the Electrical Drawings or Specifications.
- O. General contractor shall provide all roof openings. Roof openings shall be the minimum size required for duct and/or pipe penetrations. Roof openings for roof curbs shall be the minimum allowable for duct and pipe passage. Under no circumstances shall the roof opening be as large as the roof curb. Openings shall be sealed tight to duct or piping penetrating the roof or roof structure. Roof openings shall not be cut until show drawings are approved.

## 1.22 GUARANTEE

- A. Conform to the requirements of DIVISION 1 - Project Close-out.

- B. All equipment, material and workmanship shall be unconditionally guaranteed, as set forth in the Contract, or for longer periods when stated in the Specifications. Extensions to the standard equipment warranty periods shall be arranged by the HVAC Subcontractor to enable the period to commence upon beneficial usage by the Owner.
- C. If any equipment or material does not match the manufacturer's published data or specifically supplied rating schedules during performance tests, replace without delay the defective equipment or materials. Bear all associated costs and adjust all components at no charge to the Owner and adjust all components to achieve the proper rating.
- D. Correct defects and deficiencies, and pay for resulting damage to Mechanical or other work, and to property and person, which appear or originate during the guaranteed period
- E. The Owner shall give notice of observed defects promptly in writing.

#### 1.23 DRAIN PANS OVER ELECTRIC EQUIPMENT AND MOTORS

- A. Wherever piping runs above motor control centers, panels or other electrical equipment due to field conditions or coordination process, a stainless steel drip pan with drain outlet shall be provided.
- B. Indicate on coordination drawings the locations where piping passes over motors and electric panels.
- C. Drip pans shall have lips 2 inch high, stiffened and braced, supported to prevent sagging, and shall be pitched to a  $\frac{1}{4}$ " per foot toward the drain outlet. Drain outlet shall be piped, with approved piping, to nearest floor drain or other indirect waste connection. Width of pan shall extend 6 inches beyond piping, but shall not be less than 18 inches wide. All seams shall be watertight.

#### 1.24 CONNECTIONS TO EQUIPMENT

- A. The HVAC Subcontractor shall provide all duct and/or pipe connections to equipment provided under other sections of the specifications as shown on the contract documents and herein specified including final connections to equipment to result in a complete system, fully operational. Coordinate the locations of all equipment with Architect. Obtain installation diagrams and methods of installation of all equipment from manufacturers. Follow instructions strictly.

#### 1.25 SEISMIC DESIGN

- A. This project is located within a seismic zone requiring special provisions for the support and restraint of equipment and piping. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to the Office of Statewide Health Planning & Development for the State of California (OSHPD) and shall bear anchorage preapproval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

- B. Submittals: Submit Shop Drawings and Product Data signed and sealed by a qualified professional engineer. Include the following:
1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.
- C. Where applicable and for high rise buildings, the seismic restraint design and construction requirements for equipment and piping incorporated as part of Life Safety Systems shall be such that these systems will remain in place and be functional following a major earthquake, and that the design shall consider lateral drifts between stories as specified by code.

#### 1.26 HVAC BASIS OF DESIGN

- A. For major pieces of HVAC equipment, including but not limited to chillers, rooftop units and air handlers the engineers basis of design is the unit shown on the plans and listed in the schedules. The contractor may submit an alternate unit from the list of approved manufacturers in this specification IF he ensures that such unit has thermal and acoustical performance equal or better than the scheduled unit and IF he ensures that the unit fits within the allotted mechanical space.
- B. For roof mounted equipment, the contractor must ensure that his submitted unit either weighs less than the scheduled unit or can be supported by the roof structure.
- C. For all outdoor mounted equipment, which differs from that shown on the schedules, the contractor must ensure that his submitted equipment does not violate any local noise ordinances.
- D. Electrical characteristics of submitted equipment must match those of scheduled equipment. This means that voltages, phases and hertz of submitted equipment must be the same as scheduled equipment and that current draws (amperage) must be equal or less than scheduled equipment.

#### 1.27 IAQ PROCEDURES FOR OCCUPIED BUILDINGS UNDER CONSTRUCTION

- A. For renovation work taking place in occupied buildings the mechanical contractor shall designate an individual to be indoor air quality coordinator. This individual shall be available at the job site during working hours and he or she shall be thoroughly familiar with the procedures for maintaining indoor air quality detailed in the SMACNA publication "IAQ Guidelines for Occupied Buildings Under Construction." On commencement of the project the contractor shall provide the name of this individual to the Architect and Engineer.



- B. Before commencing any work in an occupied building, including demolition work the mechanical contractor shall submit to the Architect and Engineer for review, a plan for maintaining indoor air quality in the occupied space. The plan shall be based on the procedures in Chapter 3 of the SMACNA IAQ manual referenced above. At a minimum the plan shall address the specifics of how the following procedures are to be carried out (or if they are not to be implemented - why not):
1. Keeping the construction area under negative pressure. State specific balancing procedures to be followed.
  2. Keeping the occupied area under positive pressure. State specific balancing procedures to be followed.
  3. Erecting barriers between the construction area and the occupied area. State type of barrier and sealing method.
  4. Exhausting the construction area. State where exhaust is directed to and whether filtration on exhaust is to be provided
  5. Sealing of ductwork openings.
  6. Protection of sheetmetal sections not yet installed from dust and water.
  7. Protection of equipment not yet installed from dust and water.
  8. Cleaning of ductwork and terminal boxes after construction is complete.
  9. Provision of temporary filters on return air systems. State efficiency of filters.
  10. Provision of fan powered air cleaners.
  11. Any other procedure not listed above which the contractor is implementing to maintain adequate levels of indoor air quantity.

#### 1.28 MANUFACTURERS REPRESENTATIVE

- A. Provide, at the appropriate time or as directed by Architect, the services of a competent factory-trained Engineer of each piece of equipment. Manufacture representative shall inspect, adjust, troubleshoot and place in proper operating condition any and all items of the manufacturer.
- B. No additional compensation will be allowed Contractor for such services.
- C. Refer to the individual specification paragraphs for additional Manufacturer representative requirements.

#### 1.29 HVAC SYSTEM DEMONSTRATION

- A. At completion of the HVAC system installation, testing and balancing and start up, the mechanical contractor shall demonstrate to the owner and to the engineer the proper operation of all major HVAC systems. This shall include but not be limited to temperature controls, chillers, air handlers, rooftop units, fan systems, pumps, and terminal units. Allow minimum of one full day (8 hours) for this demonstration.
- B. Provide owner and engineer at least one week notice before demonstration is to begin. Mechanical contractor shall ensure the presence of personnel from local manufacturer's representative for the specific pieces of equipment involved as well as for the automatic temperature controls contractor who shall be present throughout the entire procedure.
- C. If a piece of equipment has an occupied/unoccupied cycle or otherwise has two speed operations all control cycles and speeds are to be demonstrated.
- D. If any piece of equipment or control cycle does not operate as specified then this contractor shall remedy the deficiency and repeat the demonstration in the owner's and engineers presence.

### 1.30 ALTERNATES

- A. Examine DIVISION 1 - ALTERNATES for scope of work which may affect the work of this section and include any deletions or additions in the form for sub bid under the appropriate alternate.

### 1.31 RELATED DOCUMENTS

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

## PART 2 - PRODUCTS

### 2.1 PIPE AND FITTINGS

#### A. PIPE AND TUBE

1. Black Steel Pipe: ASTM A 53, A 106 or A 120; except comply with ASTM A 53 or A 106 where close coiling or bending is required
2. Copper Tube: ASTM B 88, Type L, seamless.
3. ACR Copper Tube: ASTM B 280.
- 4.

#### B. FITTINGS

1. Cast Iron Flanged Fittings: ANSI B 16.1, including bolting.
2. Cast Iron Threaded Fittings: ANSI B 16.4.
3. Malleable Iron Threaded Fittings: ANSI B 16.3; plain or galvanized as indicated.
4. Malleable Iron Threaded Unions: ANSI B 16.39; selected by installer for proper piping fabrication and service requirements, including style, end connections, and metal to metal seats (iron, bronze or brass); plain or galvanized as indicated.
5. Wrought-Steel Butt welding Fittings: ANSI B 16.9; except B 16.28 for short radius elbows and returns; rated to match connected pipe.
6. Wrought Copper Solder Joint Fittings: ANSI B 16.22.

#### C. UNIONS AND COUPLINGS

1. Pipe Size 2 inch and under: 150 psi malleable iron for threaded ferrous piping; bronze for copper or brass pipe soldered joints.
2. Pipe Size over 2 inch: 150 psi steel butt weld flanges for ferrous piping; bronze flanges for copper or brass piping.

#### D. MISCELLANEOUS PIPING MATERIALS/PRODUCTS

1. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials.
2. Tin-Antimony Solder (95/5): ASTM B 32, Grade 95TA.
3. Silver-Lead Solder: ASTM B 32, Grade 96TS.
4. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials.
5. Gaskets for Flanged Joints: ANSI B 16.21; full faced for cast iron flanges; raised faced for steel flanges, unless other wise indicated.
6. Joint Compound and Tape: Suitable for pipe, system, fluid within system and associated chemical treatment.

## 2.2 PIPING SPECIALTIES

### A. PIPE ESCUTCHEONS

1. General: Provide pipe escutcheons as specified herein with inside diameter closely fitting pipe or pipe insulation outside diameter. Select outside diameter of escutcheon to completely cover pipe penetration hole in floors, walls, or ceilings; and pipe sleeve extension, if any. Furnish pipe escutcheons with nickel or chrome finish for occupied areas, prime paint finish for unoccupied areas.
2. Pipe Escutcheons for Moist Areas: For waterproof floors, and areas where water and condensation can be expected to accumulate, provide cast brass or sheet brass escutcheons, solid or split hinged.
3. Pipe Escutcheons for Dry Areas: Provide sheet steel escutcheons, solid or split hinged.

### B. Y-TYPE PIPELINE STRAINERS

1. General: Provide strainers full line size of connecting piping, with ends matching piping systems materials. Select strainers for 125 psi working pressure, with Type 304 stainless steel screens, with 3/64" perforations @ 233 per sq. in.
2. Threaded Ends - 2" and Smaller: Cast-iron body, screwed screen retainer with centered blowdown fitted with pipe plug.
3. Flanged Ends - 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off center blowdown fitted with pipe plug.
4. Grooved Ends: Ductile iron body, ASTM A-536, type 304 stainless steel, removable basket with 1/16" diameter perforation.
5. ACCEPTABLE MANUFACTURERS
  - a. Armstrong Machine Works.
  - b. Hoffman Specialty ITT; Fluid Handling Div.
  - c. Spirax Sarco.

### C. DIELECTRIC UNIONS

1. General: Provide standard products for use in service indicated, which effectively isolate ferrous from non-ferrous piping (electrical conductance), prevent galvanic action, and stop corrosion.

### D. MECHANICAL SLEEVE SEALS

1. General: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
2. ACCEPTABLE MANUFACTURERS
  - a. Thunderline Corp.

### E. FIRE BARRIER PENETRATION SEALS

1. Provide seals for any opening through fire rated walls, floors, or ceilings used as passage for mechanical components and piping.
2. Cracks, Voids, or Holes UP to 4" Diameter: Use putty or caulking, one piece intumescent elastomer, non-corrosive to metal, compatible with synthetic cable jackets, and capable of expanding 10 times when exposed to flame or heat, UL listed.
3. Openings 4" or Greater: Use sealing system capable of passing 3-hour fire test in accordance with ASTM E-814, consisting of wall wrap or liner, partitions, and end caps capable of expanding when exposed to temperatures of 250 to 350 deg. F., UL listed.
4. ACCEPTABLE MANUFACTURERS
  - a. Electro Products Div./3M.
  - b. Nelson; Unit of General Signal.

### F. FABRICATED PIPING SPECIALTIES

1. Pipe Sleeves: Provide pipe sleeves of one of the following:
2. Sheet-Metal: Galvanized sheet steel. Fabricate of following gages: 3" and smaller, 20 gage, 4" to 6", 16 gage, over 6", 14 gage.
3. Steel-Pipe: Fabricate from schedule 40 galvanized steel pipe; remove burrs.
4. Sleeve Seals: Provide sleeve seals for sleeves located in foundation walls below grade, or in exterior walls.

## 2.3 VALVES

### A. ACCEPTABLE MANUFACTURERS

- a. Jenkins
- b. Bray
- c. Crane Co.
- d. Powell (Wm.) Co.
- e. Conbraco Ind. Inc., (Apollo)
- f. Jamesbury Corp.
- g. Mission Mfg. Co.
- h. Rockwell Mfg. Co.

### B. SUBMITTALS

1. Product Data: For each type of valve indicated. Include body, seating, and trim materials; valve design; pressure and temperature classifications; end connections; arrangement; dimensions; and required clearances. Include list indicating valve and its application. Include rated capacities; shipping, installed, and operating weights; furnished specialties; and accessories.
2. Shop Drawing: Show valves on Coordination drawings. Refer to 'COORDINATION DRAWINGS" this SECTION.

### C. GENERAL

1. Provide valves of same manufacturer throughout where possible.
2. Where a single acceptable manufacturer does not produce all valve types required, multiple manufacturers may be used, but in no case shall the same type valve be provided by different manufacturers.
3. Valve manufacturers and their valve numbers indicated herein are meant to describe type and quality only.
4. ASME Compliance: ASME B31.9 for building services piping valves.
5. ASME Compliance for Ferrous Valves: ASME B16.10 and ASME B16.34 for dimension and design criteria.

### D. GATE VALVES

1. Type GV2: Bronze, non-rising stem, inside screw, solid wedge, screwed ends, Class 150, (Jenkins Fig. 370).
2. Type GV4: Iron body, bronze trim, OS&Y, solid wedge, rising stem, flanged ends, Class 125, (Jenkins Fig. 651-A).
3. Type GV5: Iron body, bronze trim, OS&Y, solid wedge, rising stem, flanged ends, Class 250, (Jenkins Fig. 204).
4. Type GV6: Bronze, non-rising stem, inside screw, solid wedge, screwed ends, screw-in bonnet, Class 300, (Jenkins Fig. 270).

### E. GLOBE VALVES

1. Type GLV2: Bronze, rising stem, renewable composition disc, screw-over bonnet, screwed ends, Class 150, (Jenkins Fig. 106-A).

2. Type GLV3: Iron body, bronze trim, OS&Y, renewable composition disc, rising stem, flanged ends, Class 125, (Jenkins Fig. 142).
3. Type GLV4: Iron body, bronze trim, OS&Y, renewable bronze disc and seat ring, rising stem, flanged ends, Class 250, (Jenkins Fig. 923).
4. Type GLV5: Bronze, rising stem, renewable composition disc, screw-over bonnet, screwed ends, 250 psi, (Jenkins Fig. 801).

F. BALL VALVES

1. Type BLV1: Bronze body and retainer, reinforced Teflon seats and packing, chromium plated ball, soldered ends, full port (Apollo 77-200).
2. Type BLV2: Bronze body and retainer, reinforced Teflon seats and packing, chromium plated ball, screwed ends, full port (Apollo 77-100).
3. Provide extended stems for all valves in insulated piping systems. Stems shall extend to length necessary for full handle exposure outside of insulation system.

G. BUTTERFLY VALVES

1. Type BFV1: Iron lug body, bronze disc, EPDM liner, stainless steel stem, 200 psi WP, -20 to 200 deg. F.
2. Unless otherwise indicated provide lever operators for valves 6" and less and gear operators for valves 8" and larger.

H. CHECK VALVES

1. Type SCV1: Swing check valve, bronze body, regrinding bronze disc, soldered ends, 300 psi, (Jenkins Fig. 122).
2. Type SCV2: Swing check valve, bronze body, regrinding bronze disc, screwed ends, Class 150, (Jenkins Fig. 92-A).
3. Type SCV3: Swing check valve, iron body, regrind-renew bronze disc and seat ring, flanged ends, Class 125, (Jenkins Fig. 624).
4. Type SCV4: Swing check valve, iron body, regrind-renew bronze disc and seat ring, flanged ends, 250 psi, (Jenkins Fig. 339-R).
5. Type LCV1: Lift check valve, bronze body, renewable composition disc, spring loaded, screw over cap, screwed ends, Class 150 (Jenkins Fig. 655-A).
6. Type WCV1: Wafer check valve, iron body, bronze trim, bronze disc, stainless steel spring, (Jenkins Fig. 777).

I. DRAIN VALVES

1. Type DV1: Ball or gate valve with hose end, bronze cap and chain.

J. PLUG VALVES

1. Type PV1: Semi-steel, bolt gland type, (Rockwell Fig. 142 or 143).

K. VALVES FOR HYDRONIC SYSTEMS

1. Valves for hydronic systems shall be as follows:
  - a. BALL VALVES:
    - 1) 2" and Less (Soldered Ends); Type BLV1.
    - 2) 2" and Less (Screwed Ends); Type BLV2.
  - b. BUTTERFLY VALVES
    - 1) 2-1/2" and Larger; BFV1.
  - c. SWING CHECK VALVES
    - 1) 2" and Less (Soldered Ends); Type SCV1.
    - 2) 2" and Less (Screwed Ends); Type SCV2.
    - 3) 2-1/2" and Larger (Flanged Ends Pressure under 125 PSI); SCV3.
    - 4) 2-1/2" and Larger (Flanged Ends Pressure over 125 PSI); SCV4.
  - d. LIFT CHECK VALVES:
    - 1) 2" and Less; Type LCV1.

- e. WAFER CHECK VALVES (For Use on Pump Discharge Services):
  - 1) All Sizes; WCV1.
- f. DRAIN VALVES:
  - 1) Type DV1.
- g. PLUG VALVES:
  - 1) Type PV1

L. VALVES FOR STEAM SERVICE

- 1. Valves for steam service shall be as follows:
  - a. LOW PRESSURE (0 - 15 PSIG) SERVICE VALVES
    - 1) Gate Valves (2" & Less): Type GV3.
    - 2) Gate Valves (2-1/2" and Greater): Type GV4.
    - 3) Globe Valves (2" & Less): Type GLV2.
    - 4) Globe Valves (2-1/2" and Larger): Type GLV3.
    - 5) Ball Valves (2" & Less): Type BLV2.
    - 6) Check Valves (2" & Less): Type SCV2.
    - 7) Check Valves (2-1/2" & Larger): Type SCV3.
    - 8) Drain Valves: Type DV1.
  - b. MEDIUM PRESSURE (15 - 100 PSIG) SERVICE VALVES
    - 1) Gate Valves (2" & Less): Type GV3.
    - 2) Gate Valves (2-1/2" and Greater): Type GV5.
    - 3) Globe Valves (2" & Less): Type GLV2.
    - 4) Globe Valves (2-1/2" and Larger): Type GLV3.
    - 5) Check Valves (2" & Less): Type SCV2.
    - 6) Check Valves (2-1/2" & Larger): Type SCV4.
    - 7) Drain Valves: Type DV1.

2.4 HANGERS AND SUPPORTS

A. ACCEPTABLE MANUFACTURERS

- a. Carpenter and Patterson, Inc.
- b. B-line Company.
- c. ITT Grinnell Corp.

B. GENERAL:

- 1. MSS: Manufacturers Standardization Society for The Valve and Fittings Industry Inc.
- 2. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."
- 3. Coordinate provision of all Hangers and Supports with the seismic restraints portion of this specification. Hangers and Supports provided shall not compromise the ability of the piping system to resist seismic loads.

C. PIPE HANGERS AND SUPPORTS

- 1. Hangers for Pipe Sizes 2 Inch to 1-1/2 Inch: Adjustable steel band hanger; MSS Type 7.
- 2. Hangers for Pipe Sizes 2 Inch to 3 Inch : Carbon steel, adjustable, clevis; MSS Type 1.
- 3. Hangers for Pipe Sizes 4 Inch to 5 Inch: Steel adjustable, cast iron roll, single hanger; MSS Type 43.
- 4. Hangers for Pipe Sizes 6 Inch and Over: Single cast iron pipe roll, double hangers; MSS Type 41.
- 5. Shields for insulated all cold piping and insulated hot piping size 3 inch and less: Galvanized steel shield over insulation in 180 deg. segments, minimum 12 inch long at pipe supports.
- 6. Shield for all hot piping 4 inch and larger: Steel pipe covering protection saddle; MSS Type 39. Fill void with insulating cement.

7. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6" and over.
8. Wall Support for Pipe Sizes 4 Inch and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inch and over.
9. Vertical Support: Steel riser clamp.
10. Floor Support for Pipe Sizes to 4 Inch and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.
11. Floor Support for Pipe Sizes to 6 Inch and Over: Adjustable cast iron roll and stand, steel screws, and concrete pier or steel support.
12. Provide copper plated hangers and supports for copper piping systems.
13. Shields for Vertical Copper Pipe Risers: Sheet lead.

D. HANGER RODS

1. Steel Hanger rods: Continuous threaded.

E. INSERTS AND BUILDING ATTACHMENTS

1. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
2. Provide: Provide steel beam clamps, C-clamps, and steel brackets as required to accept threaded rods.

## 2.5 PIPING INSULATION

A. GLASS FIBER

1. Acceptable Manufacturers:
  - a. Knauf.
  - b. Manville.
  - c. Certaineed.
2. Insulation: ASTM C795; rigid, noncombustible, end grain adhered to jacket.
  - a. 'K' value: ASTM C177, 0.24 at 75 degrees F.
  - b. Maximum service temperature: 650 degrees F.
  - c. Maximum moisture absorption: 0.2 percent by volume.
  - d. All fittings shall also be rigid, conformed pieces with integral vapor barrier; basis of design shall be Hamfab insert product.
3. Vapor Barrier Jacket:
  - a. ASTM C921, White kraft paper with glass fiber yarn, bonded to aluminized film.
  - b. Moisture vapor transmission: ASTM E96; 0.02 perm-inches.
4. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
5. Vapor Barrier Lap Adhesive:
  - a. Compatible with insulation.
6. Insulating Cement/Mastic:
  - a. ASTM C195; hydraulic setting on mineral wool.
7. Fibrous Glass Fabric:
  - a. Cloth: Untreated; 9 oz/sq yd weight.
  - b. Blanket: 1.0 lb/cu ft density.
  - c. Weave: 5x5 10x10 10x20.
8. Indoor Vapor Barrier Finish:
  - a. Cloth: Untreated; 9 oz/sq yd weight.
  - b. Vinyl emulsion type acrylic, compatible with insulation.
9. Outdoor Vapor Barrier Mastic:
  - a. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.
10. Outdoor Breather Mastic:
  - a. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

11. Insulating Cement:
  - a. ASTM C449/C449M.

**B. JACKETS**

1. General: ASTM C 921, Type 1, unless otherwise indicated
2. PVC Plastic.
  - a. PVC Jacket: High-impact, ultraviolet-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; PVC; 20 milsthick; roll stock ready for shop or field cutting and forming.
  - b. Adhesive: As recommended by insulation jacket material manufacturer.
  - c. PVC Jacket Color: Off-White and Color-code jackets based on system. Color as selected by Architect.
  - d. Standard PVC Fitting Covers
    - 1) Factory-fabricated fitting covers manufactured from 20-mil-thick, high-impact, ultraviolet-resistant PVC to match jacket if available; otherwise, field fabricate.
    - 2) Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, traps, mechanical joints, and P-traps.
3. Aluminum Jacket (Use on all exterior applications): ASTM B209
  - a. Thickness: 0.016 inch sheet.
  - b. Finish: Smooth
  - c. Joining: Longitudinal slip joints and 2 inch (50 mm) laps.
  - d. Fittings: 0.016inch thick die shaped fitting covers with factory attached protective liner.
  - e. Metal Jacket Bands: 3/8 inch wide;

**C. ACCESSORIES**

1. Insulating Cement: ASTM C195; hydraulic setting mineral wool.
2. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.
3. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

**2.6 MECHANICAL IDENTIFICATION**

**A. ACCEPTABLE MANUFACTURERS**

1. Allen Systems, Inc.
2. Brady (W.H.) Co.; Signmark Div.
3. Seton Name Plate Corp.

**B. SUBMITTALS**

1. Product Data: For each type of product indicated.
2. Valve numbering scheme.
3. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

**C. MATERIALS**

1. Unless specified otherwise, comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.
2. Plastic Nameplates: Laminated three-layer plastic with engraved black letters on light contrasting background.
3. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.



4. Plastic Pipe Markers: Factory fabricated, flexible, semi rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and fluid being conveyed. On piping three (3) inches diameter (including insulation) and larger, lettering shall be two (2) inches high capitals. On smaller diameter piping, use ¾ inch high capital letters.
5. Plastic Tape Duct Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings. On ductwork (including insulation) lettering shall be two (2) inches high capitals.
6. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inch wide by 4 mil thick, manufactured for direct burial service.
7. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
  - a. Data:
    - 1) Manufacturer, product name, model number, and serial number.
    - 2) Capacity, operating and power characteristics, and essential data.
    - 3) Labels of tested compliances.
  - b. Location: Accessible and visible.
  - c. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
  - d. Fasteners: As required to mount on equipment.
8. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
  - a. Terminology: Match schedules as closely as possible.
  - b. Data:
    - 1) Name and plan number.
    - 2) Equipment service.
    - 3) Design capacity.
    - 4) Other design parameters such as pressure drop, entering and leaving conditions, and speed.
  - c. Location: Accessible and visible.
  - d. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.
9. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine subcore, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
  - a. Data: Instructions for operation of equipment and for safety procedures.
  - b. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
  - c. Thickness: [1/8 inch], unless otherwise indicated.
  - d. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
  - e. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive
10. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.
  - a. Size: Approximately 4 by 7 inches.
  - b. Fasteners: Reinforced grommet and wire or string.
  - c. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
  - d. Color: Yellow background with black lettering.
11. Access Panel and Door Markers: 1/16-inch- thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment. Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

- D. Flow arrows shall be solid black. Arrows shall be six (6) inches long by two (2) inches wide.
- E. Do color coding of pipes with two (2) inch wide bands according to color schedule to be issued by the Owner during the progress of the work.
- F. Labeling of new systems added to existing systems shall be consistent with the existing numbering system and terminology. Do not use valve numbers that have already been used.
- G. Provide typewritten master lists in Operating and Maintenance Instruction Manuals; and shop equipment numbers on Record Prints and sepias.
- H. Identification shall be consistent with Owner's standard methods of identification.
- I. Provide 1-1/2 inch diameter, 1/16 inch thick brass tags with 3/8 inch die stamped black letters. Attach to valves with four (4) inch brass chains. Brass tags may be omitted on small valves which isolate a single piece of equipment such as unit heater, fan coil unit, and section of radiation.

## 2.7 ACCESS DOORS AND FRAMES

### A. ACCEPTABLE MANUFACTURERS

- 1. Milcor Div.; Inryco Inc.
- 2. Miami Carey
- 3. Way Loctor

### B. SUBMITTALS

- 1. Product Data: For each type of access door and frame indicated. Include construction details, fire ratings, materials, individual components and profiles, and finishes.
- 2. Shop Drawings: Show fabrication and installation details of access doors and frames for each type of substrate. Include plans, elevations, sections, details, and attachments to other work.
- 3. Access Door and Frame Schedule: Provide complete access door and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
- 4. Coordination Drawings: Refer to "COORDINATION DRAWINGS" this SECTION.

### C. GENERAL:

- 1. Furnish for installation by others access doors for access to all concealed valves or equipment requiring accessibility for maintenance or proper operation, when such elements are located behind building surfaces or enclosures. Access Door Fire rating shall match wall or ceiling assembly fire rating.
- 2. Instruct appropriate panel installation contractor as to the proper location of all doors. Locate doors so that valve or element served can be easily reached. Size of doors shall be sufficient to serve intended purpose but in no case less than 9 inch by 9 inch. Doors located in corridors, lobbies or other habitable areas shall be reviewed by Architect as to location.
- 3. Provide prime painted Flush Access Doors and Trimless Frames prime painted with flush screw driver operated cam locks and concealed hinges.
- 4. Type of panels shall be based on:
  - a. GYPSUM Board Surfaces "Milcor Type K"
  - b. Masonry Construction "Milcor Type M"

## 2.8 DUCTWORK INSULATION

- A. ACCEPTABLE MANUFACTURERS
  - 1. CertainTeed Corp.
  - 2. Knauf Fiber Glass
  - 3. Owens Corning Fiberglas Corp.
  
- B. GLASS FIBER FLEXIBLE
  - 1. Insulation: ASTM C553; flexible, noncombustible blanket.
    - a. 'K' value: ASTM C518, 0.25 at 75 degrees F.
    - b. Maximum service temperature: 350 degrees F.
    - c. Maximum moisture absorption: 0.50 percent by volume.
  - 2. Vapor Barrier Jacket:
    - a. Kraft paper with glass fiber yarn and bonded to aluminized film.
    - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
    - c. Secure with pressure sensitive tape.
  - 3. Vapor Barrier Tape:
    - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
  - 4. Tie Wire: Annealed steel, 16 gauge.
  
- C. GLASS FIBER, RIGID
  - 1. Insulation: ASTM C612; rigid, noncombustible blanket.
    - a. 'K' value: ASTM C518, 0.24 at 75 degrees F.
    - b. Maximum service temperature: 350 degrees F.
    - c. Maximum moisture absorption: 0.20 percent by volume.
    - d. Density: 3.0 lb/cu ft.
  - 2. Vapor Barrier Jacket:
    - a. Kraft paper with glass fiber yarn and bonded to aluminized film.
    - b. Moisture vapor transmission: ASTM E96; 0.04 1.3 perm.
    - c. Secure with pressure sensitive tape two coats of vapor barrier mastic and glass tape.
  - 3. Vapor Barrier Tape:
    - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.
  - 4. Indoor Vapor Barrier Finish:
    - a. Cloth: Untreated; 9 oz/sq. yd. weight, glass fabric.
    - b. Vinyl emulsion type acrylic, compatible with insulation, white color.
  
- D. JACKETS
  - 1. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils thick; roll stock ready for shop or field cutting and forming.
    - a. Adhesive: As recommended by insulation material manufacturer.
    - b. PVC jackets are available in several colors. Colored jackets may be used to replace field painting. Ultraviolet rays fade colors. Some colors (black, gray, and white) do not fade as quickly as other colors (red, orange, and green).
    - c. PVC Jacket Color: Off-white.
  - 2. Canvas Jacket: UL listed.
    - a. Fabric: ASTM C921, 6 oz/sq yd , plain weave cotton treated with dilute fire retardant lagging adhesive.
    - b. Lagging Adhesive: Compatible with insulation.
  - 3. Exterior Rubber Jacket System.
    - a. Vapor, UV and weather protection
    - b. Based on Polyguard Alumaguard 60
    - c. Rubberized Bitumen Membrane
    - d. Laminated "Peel and Stick" to insulation face
    - e. Self healing if punctured

f. Cold weather activator

E. ACCESSORIES

1. Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
2. Provide cements, adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by insulation manufacturer for applications indicated.

2.9 EQUIPMENT INSULATION

A. ACCEPTABLE MANUFACTURERS

1. CertainTeed Corp.
2. Knauf Fiber Glass
3. Owens Corning Fiberglas Corp.

B. GLASS FIBER, FLEXIBLE

1. Insulation: ASTM C553; flexible, noncombustible.
  - a. 'K' Value: ASTM C177 or ASTM C518, 0.24 at 75 degrees F.
  - b. Maximum Service Temperature: 450 degrees F.
  - c. Maximum Moisture Absorption: 0.2 percent by volume.
  - d. Density: 3.0 lb/cu ft.
2. Vapor Barrier Jacket:
  - a. ASTM C921, Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.
  - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
  - c. Secure with self-sealing longitudinal laps and butt strips.
  - d. Secure with outward clinch expanding staples and vapor barrier mastic.
3. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
4. Vapor Barrier Lap Adhesive:
  - a. Compatible with insulation.
5. insulating Cement/Mastic:
  - a. ASTM C195; hydraulic setting on mineral wool.

C. GLASS FIBER, RIGID

1. Insulation: ASTM C612 or ASTM C592; rigid, noncombustible.
  - a. 'K' Value: ASTM C177 or ASTM C518, 0.24 at 75 degrees F.
  - b. Maximum Service Temperature: 850 degrees F.
  - c. Maximum Moisture Absorption: 0.1 percent by volume.
  - d. Density: 3.0 lb/cu ft.
2. Vapor Barrier Jacket:
  - a. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film..
  - b. Moisture vapor transmission: ASTM E96; 0.02 perm.
  - c. Secure with self-sealing longitudinal laps and butt strips.
  - d. Secure with outward clinch expanding staples and vapor barrier mastic.
3. Facing: 1 inch galvanized or stainless steel hexagonal wire mesh stitched onto both faces of insulation.
4. Vapor Barrier Lap Adhesive:
  - a. Compatible with insulation.
5. Insulating Cement/Mastic:
  - a. ASTM C195; hydraulic setting on mineral wool.

D. CELLULAR FOAM

1. Insulation: ASTM C534; flexible, cellular elastomeric, molded or sheet.
  - a. 'K' Value: ASTM C177; 0.25 at 75 degrees.

- b. Minimum Service Temperature: -40 degrees F.
  - c. Maximum Service Temperature: 220 degrees F.
  - d. Maximum Moisture Absorption: ASTM D1056; 1.0 percent by volume.
  - e. Moisture Vapor Transmission: ASTM E96; 0.05 perm-inches.
  - f. Connection: Waterproof vapor barrier adhesive.
2. Elastomeric Foam Adhesive:
- a. Air dried, contact adhesive, compatible with insulation.

E. JACKETS

1. PVC Plastic:
- a. Jacket: ASTM C921, Sheet material, off-white color.
    - 1) Minimum Service Temperature: -40 degrees F.
    - 2) Maximum Service Temperature: 150 degrees F.
    - 3) Moisture Vapor Transmission: ASTM E96; 0.002 perm-inches.
    - 4) Thickness: 30 mil.
    - 5) Connections: Pressure sensitive color matching vinyl tape.
  - b. Covering Adhesive Mastic:
    - 1) Compatible with insulation.
2. Canvas Jacket: UL listed.
- a. Fabric: ASTM C921, 6 oz/sq. yd., plain weave cotton treated with dilute fire retardant lagging adhesive.
  - b. Lagging Adhesive:
    - 1) Compatible with insulation.
3. Aluminum Jacket: ASTM B209.
- a. Thickness: 0.016 inch sheet.
  - b. Finish: Smooth.
  - c. Joining: Longitudinal slip joints and 2 inch laps.
  - d. Metal Jacket Bands: 3/8 inch wide; stainless steel.

F. ACCESSORIES

- 1. Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.
- 2. Provide cements, adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by insulation manufacturer for applications indicated.
- 3. Jacketing Material (Fiberglass & Calcium Silicate): Presized glass cloth jacketing material, not less than 7.8 ounces per square yard.

2.10 VIBRATION ISOLATION AND SEISMIC RESTRAINT

A. ACCEPTABLE MANUFACTURERS

- 1. Novia Associates, Inc.
- 2. Mason Industries Inc.
- 3. Vibration Mountings and Controls, Inc.

B. GENERAL

- 1. All vibration isolation and seismic devices described in this section shall be the product of a single supplier. NAI (Novia Associates, Inc.) is the Base Supplier of these specifications; products of other suppliers may be acceptable provided their systems strictly comply with intent, structural design, performance and deflections of the Base Supplier.
- 2. It is the intent of the seismic restraint portion of this specification to provide restraint of non-structural building components. Restraint systems are intended to withstand the stipulated seismic accelerations applied through the component's center of gravity.

3. Each and every support attachment to the structure of equipment that meets the requirements of this specification must be positive, including equipment that may be excluded from auxiliary seismic bracing as noted in Part 3.
- C. The work in this section includes the following:
1. Vibration isolation elements for equipment.
  2. Equipment isolation bases.
  3. Piping flexible connectors.
  4. Seismic restraints for isolated equipment.
  5. Seismic restraints for non-isolated equipment.
  6. Certification of seismic restraint designs and installation supervision.
  7. Equipment support stands, bases or rails.
- D. SUBMITTALS
1. Product Data sheets on
    - a. For each specific vibration isolators and restraints to be utilized detailing compliance with the specification. Reference "TYPE" as per "PRODUCTS" section of this specification.
    - b. An itemized list of all isolated and non-isolated equipment including detailed schedules showing isolator and seismic restraints proposed for each piece of equipment, referencing material and seismic calculation drawing numbers.
  2. Shop Drawings
    - a. Show base construction for equipment; include dimensions, structural member sizes and support point locations.
    - b. When walls and slabs are used as seismic restraint locations, details of acceptable methods for ducts and pipe must be included.
    - c. Indicate isolation devices selected with complete dimensional and deflection data before condition is accepted for installation.
    - d. Provide specific details of seismic restraints and anchors; include number, size and locations for each piece of equipment.
    - e. Coordinated or contract drawings shall be marked-up with the specific locations and types of restraints shown for all pipe and duct. Rod bracing requirements and assigned load at each restraint location shall be clearly delineated. Any and all tributary loads shall be considered for proper restraint sizing.
    - f. For ceiling suspended equipment design restraints for a minimum installation angle of  $30^{\circ}$  from vertical. Indicate maximum installation angle allowed for restraint system as well as braced and unbraced rod lengths at each allowable installation condition.
    - g. Calculate thrust for fan heads, axial and centrifugal fans to determine whether thrust restraints are required. (See EQUIPMENT INSTALLATION)
  3. Seismic Certification and Analysis
    - a. Seismic restraint calculations must be provided for all connections of equipment to the structure. All performance of products (such as; strut, cable, anchors, clips, etc.) associated with restraints must be supported with manufacturer's data sheets or certified calculations.
    - b. For roof mounted equipment both the seismic acceleration and wind loads (30 psf) shall be calculated, the highest load shall be utilized for the design of the restraints and isolators.
    - c. Certifications of calculations to support seismic restraint designs must be stamped by a professional engineer registered in the State were the project is located.
      - 1) Analysis must indicate calculated dead loads, derived loads and materials utilized for connections to equipment and structure. Analysis must detail anchoring methods, bolt diameter, embedment and weld length.
  4. An in force, Errors and Omissions insurance certificate must accompany submittals. Manufacturer's product liability insurance certificates are not acceptable.

E. MANUFACTURER'S RESPONSIBILITY

1. Manufacturer of vibration and seismic control equipment shall have the following responsibilities:
  - a. Determine vibration isolation and seismic restraint sizes and locations.
  - b. Provide equipment vibration isolation and seismic restraints as specified.
  - c. Guarantee specified isolation system deflections.
  - d. Provide installation instructions, drawings and field supervision to insure proper installation and performance of systems.

F. RELATED WORK

1. Housekeeping Pads
  - a. Housekeeping pad attachment to structure design shall be by the project structural engineer. Material and labor required for attachment and construction shall be by the concrete section contractor.
  - b. Housekeeping pads shall be coordinated with the Seismic Restraint Supplier and sized to provide a minimum edge distance of 13 bolt diameters of clearance all around the outermost anchor bolt to allow for the use of full anchor ratings.
2. Supplementary Support Steel
  - a. Contractor shall supply supplementary support steel and connections for all equipment, piping, ductwork, etc. Including roof mounted equipment, as required or specified.
  - b. Where support for equipment requires stands, bases, rails, etc. these devices shall be designed and fabricated by Seismic Restraint Supplier to ensure the seismic capability of the entire installation.
3. Attachments
  - a. Contractor shall provide restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. as directed by the Seismic Restraint Supplier.

G. SEISMIC RESTRAINTS AND VIBRATION ISOLATION TYPES

1. General
  - a. All isolation and seismic restraint devices shall be capable of accepting, without failure, the "G" forces as determined by the seismic certification and calculations as described in the "SUBMITTAL DATA REQUIREMENTS" section of these specifications.
  - b. Corrosion protection for outdoor applications shall be as follows:
    - 1) Springs shall be cadmium plated, zinc electroplated or powder coated.
    - 2) Hardware shall be cadmium or zinc plated.
    - 3) All other metal parts shall be hot spray or hot dipped galvanized or zinc electroplated.
  - c. All seismic restraint devices
    - 1) Shall maintain the equipment in a captive position and not short circuit isolation device during normal operating conditions.
    - 2) Shall have provisions for bolting and/or welding to the structure.
  - d. Welding of springs to isolator housing, base plates, etc. is strictly prohibited.
2. Seismic Restraint Types
  - a. TYPE I: Same as Type B isolator.
  - b. TYPE II: Where required, each corner or side of equipment base shall incorporate a seismic restraint snubber having an all directional resilient neoprene pad limit stops. Restraints shall be fabricated of plate, structural members or square metal tubing. Model "SS" as manufactured by NAI.
  - c. TYPE III: Restraints for suspended systems.
    - 1) Vibration isolated systems shall be braced with multiple 7 x 19 galvanized steel cables with approved attachment devices (such as thimbles and wire rope clips) to equipment and structure.

- 2) Non-isolated systems shall be braced with structural steel strut or cable with approved attachment devices to equipment and structure.
  - 3) Steel angles (by contractor) shall be provided to prevent rod bending of hung equipment where indicated by the Seismic Restraint Supplier's submittals. Steel angles shall be attached to the rods with a minimum of three clamps model "SRC" at each restraint location. Welding of support rods to angles is not acceptable.
  - d. TYPE IV: Double deflection neoprene.
    - 1) Mountings shall be fabricated to resist the wind or seismic forces. Model "RNM" as manufactured by NAI.
  - e. TYPE V: Rigid attachment to structure utilizing wedge type expansion anchors for bolting and steel plates, either cast-in or anchored with wedge type expansion bolts, for welding. Powder shots are not acceptable. Concrete anchor bolt spacing shall be in accordance with anchor manufacturer's published standards.
3. Vibration Isolator Types
- a. TYPE A: Spring Isolator - Free Standing
    - 1) Spring shall have a minimum outer diameter to overall height ratio of 0.8: 1 at rated deflection.
    - 2) Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.
    - 3) Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
    - 4) Model "SM" as manufactured by NAI.
  - b. TYPE B: Spring Isolator - Restrained
    - 1) Shall be the same as TYPE A with the following additional features.
      - a) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.
      - b) Internal spring adjusting nut or bolt.
      - c) Built-in all-directional limit stops with minimum 1/8" clearance under normal operation.
      - d) Model "RSM" as manufactured by NAI.
  - c. TYPE C: Spring Hanger Isolator
    - 1) a. Spring element (same as TYPE A) within a steel box with an Elastomer bushing to insulate lower support rod from the hanger box.
    - 2) b. Steel hanger box shall be capable of 30-degree misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.
    - 3) Model "SH" as manufactured by NAI.
  - d. TYPE D: Double deflection neoprene
    - 1) Mountings shall be fabricated to resist the wind or seismic forces.
    - 2) Model "RNM" as manufactured by NAI.
  - e. TYPE E: Elastomer Hanger Isolator
    - 1) Molded neoprene element with a bushing to insulate lower support rod from the hanger box.
    - 2) Steel hanger box shall withstand three times the rated load without failure.
    - 3) Model "NH" as manufactured by NAI.
  - f. TYPE F: Combination Spring/Elastomer Hanger Isolator
    - 1) Spring and neoprene elements in a steel hanger box with the features as described for TYPE C and E isolators.
    - 2) Model "SNH" as manufactured by NAI.
  - g. TYPE G: Pad type elastomer isolator
    - 1) Neoprene pad shall have 0.50" minimum thickness, deflection rating of 0.1 inch under rated load.
    - 2) 1/16" galvanized steel plate between multiple pad layers.



- 3) Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
- 4) When bolting is required for seismic compliance, neoprene and duck washers and bushings shall be provided to prevent short-circuiting of bolt.
- 5) Model "NP" as manufactured by NAI.
- h. TYPE H: Pad type elastomer isolator
  - 1) Laminated canvas duck & neoprene, maximum loading 1000 psi, minimum ½" thick.
  - 2) Load distribution plate where attachment to equipment bearing surface is less than 75% of the pad area.
  - 3) When bolting is required for seismic compliance, neoprene and duck washers and bushings shall be provided to prevent short-circuiting.
  - 4) Model "LNP" as manufactured by NAI.
- i. TYPE I: Thrust Restraints
  - 1) A spring element same as TYPE A shall be combined with steel angles, backup plates, threaded rod, washers and nuts to produce a pair of devices capable of limiting thrust movement of air moving equipment to 1/4".
  - 2) Restraints shall be easily converted in the field from a compression type to tension type.
  - 3) Unit shall be factory precompressed.
  - 4) Model "TR" as manufactured by NAI.
- j. TYPE J: Telescoping Riser Guide
  - 1) Telescoping arrangement of two sizes of steel tubing separated by a minimum ½" thickness of TYPE H pad.
  - 2) Model "TRG" as manufactured by NAI.
- k. TYPE K: Resilient Pipe Anchors and Guides
  - 1) All directional acoustical pipe anchor, consisting of a telescopic arrangement of two sizes of steel tubing separated by a minimum ½" thickness of TYPE H pad.
  - 2) Vertical restraint shall be provided by a similar material arranged to prevent vertical travel in either direction.
  - 3) Allowable loads on neoprene pad shall not exceed 500 PSI and the design shall be balanced for equal resistance in any direction.
  - 4) Model "RAG" as manufactured by NAI.
- l. TYPE M: Flashable restrained isolator
  - 1) Shall have all features of TYPE B isolator.
  - 2) Shall have galvanized steel spring pocket covers for adjustment and/or removal and replacement of springs.
  - 3) The combination floating top rail and top flashing shall be fabricated of two formed and nested layers of 12 gauge galvanized steel.
  - 4) Isolator shall be flashed directly into the waterproofing membrane.
  - 5) To be complete with wood nailers, plywood sides, counter flashing and resilient weather seal.
  - 6) Model "FRSM" as manufactured by NAI.
- m. TYPE P: Elastomer Isolator
  - 1) Double deflection neoprene compression mountings.
  - 2) Non-skid top and bottom surfaces.
  - 3) Threaded bolting sleeves shall be embedded in the isolator.
  - 4) Drilled tie-down bolt holes shall be provided in the base plate.
  - 5) Model "FMD" by NAI.

## H. EQUIPMENT BASES, CURBS & SUPPORTS

### 1. GENERAL

- a. All curbs, roof rails and isolators are to be bolted or welded to the structure to attain the higher of; the specified acceleration criteria or a minimum 30 PSF wind load applied to the largest face area.
  - b. All non galvanized materials shall be prime paint finished.
  - c. Review roof top mounted equipment sections of these specifications and contract drawings for supplementary conditions and/or requirements.
  - d. Operating height for roof mounted supports & curbs shall be as shown on the drawings.
  - e. Provide pre-drilled holes for all roof mounted curbs and rails for attachment to the building structure.
2. BASE TYPES
- a. TYPE B-1: Integral Structural Steel Base
    - 1) Constructed of structural members as required to prevent base flexure at equipment startup and misalignment of driver and driven units. Perimeter members shall be a minimum of 1/10th the longest unsupported span. Centrifugal fan bases shall be complete with motor slide rails and drilled for driver and driven units.
    - 2) Height saving brackets shall be used to maintain 1" operating clearance under base.
    - 3) Model "SB" as manufactured by NAI.
  - b. TYPE B-2: Concrete Inertia Base
    - 1) Steel concrete forms for floating foundations. Bases for pumps shall be large enough to support elbows and/or suction diffusers. The base depth shall be a minimum of 1/12 the longest unsupported span, but not less than 6 inches or greater than 12 inches. Forms shall be manufactured from structural steel channel sections and include concrete reinforcement consisting of steel bars welded in place on 8 inch centers both ways in a layer 1-1/2 inches above the bottom.
    - 2) Height saving brackets shall be used to maintain 1" clearance below the base.
    - 3) Base shall be furnished with steel templates and anchor bolt sleeves to hold anchors while concrete is being poured.
    - 4) Model "CIB" as manufactured by NAI.
  - c. TYPE B-3: Spring Roof Curb
    - 1) Spring isolation curbs that bear directly on the roof structure and are flashed and waterproofed into the roof's membrane waterproofing system. Equipment manufacturers' or field fabricated curbs shall not be used.
    - 2) Curbs shall include the following features:
      - a) Curbs shall be manufactured from 12 gauge G60 galvanized sheetmetal, reinforced and cross braced as required. All side & end seams between sheets shall be continuously welded, corner joints to be bolted.
      - b) Springs pockets shall have all of the features of TYPE B isolator.
      - c) The combination floating top rail and top flashing shall be fabricated of two formed and nested layers of 12 gauge G60 galvanized steel and shall be factory insulated with 1-1/2" thick 3# density fiberglass board. Note Well: Curb perimeter shall have no more than 3/4" high un-insulated area on sides and ends from bottom of the curb to the top of the top rail.
      - d) All spring locations shall have removable waterproof galvanized steel covers to allow for spring adjustment and/or replacement.
      - e) Curbs shall be externally factory insulated with 2" thick R-14.3 foam insulation, FM Class 1 and UL Class A Ratings, with bonded fiber reinforced facer.

- f) Waterproofing and air tightness shall be achieved by use of a continuous flexible air and water seal attached to the bottom counter flashing. The seal shall be protected from exposure to the elements by the top flashing. NOTE WELL: Neoprene weather seals exposed to sunlight are not acceptable. Metal flashing that must be rigidly attached to the floating and non-floating portions of the curb which would short circuit the isolation effectiveness of the curb are not acceptable.
  - g) Wood nailers around the full perimeter of the curb and around each spring pocket.
  - h) Overhung condensing units shall be supported by TYPE B isolators. These isolators shall in turn be supported on cross braced structural steel pedestals that are attached to the building structure and provide a consistent mounting height relative to the RTU. Field built pedestals for condensing units are not acceptable.
  - i) Galvanized steel duct supports shall be provided as required. Supports shall be capable of supporting the ductwork with a maximum deflection over the width of the curb of L/360.
  - j) All duct supports shall be provided with attached flexible connectors. Connectors shall be constructed of 3" wide coated woven nylon with double lock gripping finger attachment to metal.
  - k) Provide 22 gauge galvanized pans for roof top units that require pans under condensing sections.
  - l) Removable lifting lugs.
  - m) The curb shall maintain the same installed and operating height with or without the equipment load and shall be capable of being utilized as a blocking device.
  - n) Curbs shall be fully assembled at the factory and shipped as one piece.
  - o) Curbs shall be capped with 7 mil shrink wrap for weather protection.
  - p) Provide flexible connections for all piping connected to RTU. See paragraph 3.03 A. 6. & 7. for requirements.
  - q) Model "VibCurb" as manufactured by NAI.
- d. TYPE B-4: Flashable Roof Rail System - Isolated
- 1) Spring isolation rails that bear directly on the roof structure and are flashed and waterproofed into the roof's membrane waterproofing system. Field fabricated rails with external isolators shall not be used.
  - 2) Rails shall include the following features:
    - a) Springs pockets shall have all of the features of TYPE B isolator.
    - b) The combination floating top rail and top flashing shall be fabricated of two formed and nested layers of 12 gauge G60 galvanized steel. 12 gauge galvanized end rails shall tie the side rails together providing full perimeter support.
    - c) All spring locations shall have removable waterproof galvanized steel covers to allow for spring adjustment and/or replacement.
    - d) Waterproofing and air tightness shall be achieved by use of a continuous flexible air and water seal attached to the bottom counter flashing. The seal shall be protected from exposure to the elements by the top flashing. NOTE WELL: Neoprene weather seals exposed to sunlight are not acceptable. Metal flashing that must be rigidly attached to the floating and non-floating portions of the rail which would short circuit the isolation effectiveness are not acceptable.
    - e) Plywood sides and ends.
    - f) Removable lifting lugs.

- g) The rails shall maintain the same installed and operating height with or without the equipment load and shall be capable of being utilized as a blocking device.
        - h) Provide galvanized steel bridging members as required or as shown on the drawings to support equipment mounted between the rails. Bridging steel shall be designed for a maximum deflection at mid-span of L/360.
        - i) Model "FRR" as manufactured by NAI.
  - e. TYPE B-5: Non-isolated roof curb
    - 1) Curbs shall be manufactured from 12 gauge G60 galvanized sheetmetal, reinforced and cross braced as required. All side & end seams between sheets shall be continuously welded, corner joints to be bolted.
    - 2) Curbs shall have provision for up to 2" external insulation. All exterior insulation is to be furnished and installed by the roofing contractor.
    - 3) Galvanized steel duct supports shall be provided as required. Supports shall be capable of supporting the ductwork with a maximum deflection over the width of the curb of L/360.
    - 4) Provide 22 gauge galvanized pans for roof top units that require pans under condensing sections.
    - 5) Curbs shall be fully assembled at the factory and shipped as one piece.
    - 6) Model "SeisCurb" as manufactured by NAI.
  - f. TYPE B-6: Flashable non-isolated roof rails
    - 1) Rails shall be manufactured from 12 gauge G60 galvanized sheetmetal, reinforced and cross braced on ends.
    - 2) Provide galvanized steel bridging members as required or as shown on the drawings to support equipment mounted between the rails. Bridging steel shall be designed for a maximum deflection at mid-span of L/360.
    - 3) Model "FRR-0" as manufactured by NAI
  - g. TYPE B-7: Steel Rails
    - 1) Steel members of sufficient strength to prevent equipment flexure during operation.
    - 2) Height saving brackets as required to reduce operating height.
    - 3) Model "SR" as manufactured by NAI.
  - h. TYPE B-8 Spring Roof Curb for Condensing Units.
    - 1) Same as B-3 with the following additional features.
      - a) The curbs shall have a custom fabricated zinc plated clips that are attached to the top rail of the curb and the condensing unit.
      - b) Provide a sound barrier package consisting of galvanized angles supported from the top isolated rail and spaced 24" O.C. maximum. These angles shall provide a grid for installation of two layers of 1/2" Durock Cement board and 2" - 3 lbs./sq. ft. fiberglass insulation furnished and installed by the General Contractor.
      - c) A 60 mil EPDM roofing membrane shall be furnished and installed by others as shown on the contract drawings.
      - d) 4). Curbs shall be fully assembled at the factory and shipped as one piece.
      - e) Model "VibCurb" as manufactured by NAI.

#### I. FLEXIBLE CONNECTORS

- 1. All connectors shall be installed on the equipment side of shutoff valves; horizontal and parallel to equipment shafts whenever possible. Piping shall be supported and/or anchored to resist pipe movement beyond the allowable movement of the flexible connector. Installations must include check valves and/or other design and installation precautions to reduce the threat to life safety when subjected to the specified seismic accelerations.

2. TYPE FC-1: Spherical Elastomer connector
  - a. Manufactured of EPDM.
  - b. Sizes 2" and larger shall have two spheres reinforced with an external ring between spheres. Bolted-on strap type reinforcing is not acceptable. Sizes 16" to 24" may be single sphere.
  - c. Threaded one piece bolted flange assemblies with female threaded ends for sizes 3/4" to 1-1/2".
  - d. Rated at 250 psi up to 1700 F, with a uniform drop in allowable pressure to 170 psi at 2500 F for sizes through 14". 16" through 24" single sphere minimum ratings are 180 psi at 1700 F and 130 psi at 2500 F.
  - e. Connectors shall be installed in piping gaps equal to the length of the connector under pressure.
  - f. Control rods are required in unanchored installations where the installation exceeds the pressure limitation without control rods.
    - 1) Control rods shall have 1/2" thick Neoprene washer bushings large enough in diameter to take the thrust at 1,000 psi maximum on the washer area.
  - g. Connectors bolted to Victaulic type coupling or gate, butterfly or check valves to have a minimum 5/8" flange spacer (by others) installed between the connector and the coupling flange. Connectors must mate to a flat-faced flange in all instances.
3. TYPE FC-2: Flexible Stainless Steel Hose
  - a. Stainless steel hose and braid rated with 3:1 safety factor.
  - b. 2" diameter and smaller with male nipples, 2-1/2" and larger with fixed flat faced steel flanges.
    - 1) Lengths shall be: 9" for 2-1/2" to 4", 11" for 5" and 6", 12" for 8", 13" for 10", 14" for 12" to 16".
4. TYPE FC-3: Unbraided Exhaust Hose
  - a. Low pressure Stainless steel annularly corrugated with flanged ends.
  - b. Maximum temperature of 1500 degrees F.
5. TYPE FC-4: Wire Braid Reinforced Flexible Metal Hose
  - a. Metal hose and braid rated with a minimum 3:1 safety factor. (Minimum 150 PSI)
  - b. Copper tube ends.

## 2.11 PIPE EXPANSION FITTINGS AND LOOPS

### A. GENERAL

1. Coordinate provision of all expansion compensation devices with the seismic restraints portion of this specification. Expansion compensation devices provided shall not compromise the ability of the piping system to resist seismic loads.

### B. SUBMITTALS

1. Product Data: For each type of pipe expansion joint and alignment guide indicated.
2. Shop Drawings
  - a. Anchor Details: Detail fabrication of each anchor indicated. Show dimensions and methods of assembly and attachment to building structure.
  - b. Alignment Guide Details: Detail field assembly and attachment to building structure.
  - c. Schedule: Indicate type, manufacturer's number, size, material, pressure rating, end connections, and location for each expansion joint.

- C. Show pipe expansion fittings loops, anchors, and alignment guides on Coordination drawings. Refer to "COORDINATION DRAWINGS" this SECTION. Refer to detail sheet for valves, vents and other hydronic components not called for by this section of the specification but required for proper installation.

D. EXPANSION JOINTS

1. Acceptable Manufacturers:
  - a. Metraflex, Inc.
  - b. Adscio
  - c. Flexonics
2. Basis of Design: Metraflex, Inc. model HP.
3. Stainless Steel Bellows Type:
  - a. Pressure Rating: 200 psig and 250 degrees F.
  - b. Maximum Compression: 3 inch.
  - c. Maximum Extension: 1/4 inch.
  - d. Joint: As specified for pipe joints.
  - e. Size: Use pipe sized units
  - f. Application: Steel piping 3 inch and under.
4. External Ring Controlled Stainless Steel Bellows Type:
  - a. Pressure Rating: 200 psig and 250 degrees F.
  - b. Maximum Compression: 1-1/4 inch.
  - c. Maximum Extension: 3/8 inch.
  - d. Maximum Offset: 5/16 inch.
  - e. Joint: Flanged
  - f. Size: Use pipe sized units
  - g. Accessories: Internal flow liner.
  - h. Application: Steel piping over 3 inch.

E. PIPE ALIGNMENT GUIDES

1. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

F. SWIVEL JOINTS

1. Double ball bearing race, field lubricated, with rubber (Buna-N) O-ring seals.

G. MATERIALS FOR ANCHORS

1. Steel Shapes and Plates: ASTM A 36/A 36M.
2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel, hex head.
3. Washers: ASTM F 844, steel, plain, flat washers.
4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, and tension and shear capacities appropriate for application.
  - a. Stainless-steel studs are available.
  - b. Stud: Threaded, zinc-coated carbon steel.
  - c. Expansion Plug: Zinc-coated steel.
  - d. Washer and Nut: Zinc-coated steel.
5. Chemical Fasteners: Insert-type-stud bonding system anchor for use with hardened portland cement concrete, and tension and shear capacities appropriate for application.
  - a. Bonding Material: ASTM C 881, Type IV, Grade 3, 2-component epoxy resin suitable for surface temperature of hardened concrete where fastener is to be installed.
  - b. Stainless-steel studs are available.
  - c. Stud: ASTM A 307, zinc-coated carbon steel with continuous thread on stud, unless otherwise indicated.
  - d. Washer and Nut: Zinc-coated steel.
6. Concrete: Portland cement mix, 3000 psi minimum. Refer to DIVISION 3 - "Cast-in-Place Concrete" for formwork, reinforcement, and concrete.
7. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink, nonmetallic grout; suitable for interior and exterior applications.

- a. Properties: Nonstaining, noncorrosive, and nongaseous.
- b. Design Mix: 5000-psi, 28-day compressive strength.

## 2.12 METERS AND GAUGES

### A. PRESSURE GAGES

- 1. Gage: ASME B40.1, with bourdon tube, rotary brass movement, brass socket, front recalibration adjustment, black scale on white background.
  - a. Case: Steel
  - b. Bourdon Tube: Brass.
  - c. Dial Size: 2 inch.
  - d. Mid-Scale Accuracy: One percent.
  - e. Scale: Psi.

### B. STEM TYPE THERMOMETERS

- 1. Thermometer: ASTM E1, red appearing mercury, lens front tube, cast aluminum case with enamel finish.
  - a. Size: 7 inch scale.
  - b. Window: Clear glass.
  - c. Stem: Brass, 3/4 inch NPT, 3-1/2 inch long.
  - d. Accuracy: ASTM E77 2 percent.
  - e. Calibration: Degrees F.
  - f. Scale shall be 30 – 240 deg. with 2 deg. F. divisions for hot water and 30-180 deg. with 2 deg F divisions for chilled water.

### C. TEST PLUGS

- 1. Test Plug:
  - a. 1/4 inch NPT or 1/2 inch NPT brass stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with:
  - b. Neoprene core for temperatures up to 200 degrees F.
  - c. Test Kit:
    - 1) Carrying case, internally padded and fitted containing:
    - 2) One 2 inch diameter pressure gages.
    - 3) Two gage adapters with 1/8 inch probes.
    - 4) Two one inch 1-1/2 inch dial thermometers.

### D. STATIC PRESSURE GAGES

- 1. Dial Gages:
  - a. 3-1/2 inch diameter dial in metal case, diaphragm actuated black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.
  - b. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

## 2.13 DUCTWORK

### A. SUBMITTALS

- 1. Ductwork construction standards.
- 2. Refer to “COORDINATION DRAWINGS” this SECTION.

### B. PRESSURE CLASSIFICATION

<u>CLASS</u>	<u>S.P. ("WG)</u>	<u>TYPE</u>	<u>SEAL CLASS</u>	<u>MAX. VEL.(FPM)</u>
6	4 to 6	POS	A	2500 UP
4	3 to 4	POS	B	2500 UP

3	2 to 3	POS/NEG	B	2500 DN
2	up to 2	POS/NEG	C	1500 DN

C. MATERIALS

1. STEEL DUCTS: ASTM A525 galvanized steel sheet, lock forming quality, having zinc coating of 1.25 oz per sq ft for each side in conformance with ASTM A90.
2. INSULATED FLEXIBLE SUPPLY DUCT:
  - a. Interlocking spiral of galvanized steel, stainless steel or aluminum as applicable to installation rated to 2 WG inch positive and 1.5 inch WG negative for class 2 ducts and 15 inch WG positive or negative for Class 3,4,6 and 10 ducts.
  - b. Wrap flexible duct with flexible glass fiber insulation, enclosed by seamless aluminum pigmented plastic vapor barrier jacket; maximum 0.23 K value at 75 Deg. F.
3. DOUBLE WALL INSULATED FLEXIBLE SUPPLY DUCTS: Double wall insulated interlocking spiral of galvanized steel. vapor barrier jacket; maximum 0.23 K value at 75 Deg. F.
4. DUCT SEALANT: Non-hardening, non-migrating mastic or liquid elastic sealant as compounded and recommended by duct manufacturer specifically for sealing joints in ductwork.
5. DUCTWORK SUPPORT MATERIALS: Hot dipped galvanized steel fasteners, anchors, rods, straps, trim and angle support for ductwork.
  - a. For exposed stainless steel ductwork, provide matching stainless steel support materials.
  - b. For aluminum ductwork, provide matching aluminum support materials.

D. Class 2 DUCTWORK

1. Fabricate in accordance with SMACNA Duct Construction Standards. Provide duct gages, reinforcing, and sealing for applicable operating pressures.
2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
3. Increase duct sizes gradually, not exceeding 15 deg. divergences wherever possible. Divergence upstream of equipment shall not exceed 30 deg.; convergence downstream shall not exceed 45 deg.
4. Connect fabric flexible duct to metal duct with 22 gauge draw bands.

E. Class 3, 4, and 6 DUCTWORK

1. Fabricate in accordance with SMACNA Duct Construction Standards. Provide duct gages, reinforcing, and sealing for applicable operating pressures.
2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where rectangular elbows are used, provide turning vanes. Where acoustical lining is indicated, provide turning vanes of perforated metal with glass fiber insulation.
3. Transform duct sizes gradually, not exceeding 15 degrees divergence and 30 degrees convergence. Connect double wall insulated flexible duct to metal duct with adhesives plus sheetmetal screws.

2.14 DUCTWORK ACCESSORIES

A. SUBMITTALS

1. Product Data Sheets: For each type of Ductwork Accessories indicated.
2. Shop Drawings: Show all ductwork accessories on Coordination drawings. Refer to "COORDINATION DRAWINGS" this SECTION.

B. VOLUME DAMPERS



1. Fabricate in accordance with SMACNA Duct Construction Standards.
  2. Fabricate splitter dampers of double thickness sheetmetal to streamlined shape. Secure blades with continuous hinge or rod. Operate with min. 1/4 inch diameter rod in self aligning, universal joint action flanged bushing with set screw.
  3. Fabricate single blade dampers for duct sizes to 12" x 30".
  4. Fabricate opposed blade dampers with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized frame with suitable hardware.
  5. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.
  6. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
  7. On insulated ducts mount quadrant regulators on stand off mounting bracket, bases or adapters.
- C. TURNING VANES
1. Fabricated Type: Construct in accordance with SMACNA Duct Construction Standards.
  2. Manufactured Type: 1-1/2" wide curved blades set at 3/4" O.C., supported with bars perpendicular to blades set at 2" O.C.
  3. Acoustical Type: Airfoil shaped aluminum extrusions with perforated faces and fiberglass fill.
- D. FIRE DAMPERS
1. Fabricate in accordance with NFPA 90A and UL 555; provide UL label for 1-1/2 hour rating unless architectural plans call for 3 hour or other rating.
  2. Curtain type fire dampers; galvanized steel with interlocking blades; stainless steel closure spring and latches for horizontal installations. Blades out of air stream for all duct pressure classes.
  3. Fusible links, UL 33, shall separate at 165 deg. F.
  4. Curtain Type Dynamic Fire Dampers shall have UL 555 differential pressure rating for 4 in. W.G. and minimum UL 555 velocity rating of 2000 fpm.
  5. Multi-blade Type Dynamic fire dampers shall have UL 555 differential pressure rating for 6 in. W.G. and minimum UL 555 velocity rating of 3000 fpm.
  6. Provide means to determine damper position from visual inspection of exterior of duct.
- E. SMOKE DAMPERS
1. Fabricate in accordance with NFPA 90A and UL 555S; provide UL label for 1-1/2 hour rating unless architectural plans call for 3 hour or other rating.
  2. Multi-blade type dampers; galvanized steel frame and blades; stainless steel sleeve bearings; plated steel blade linkage; stainless steel closure spring, blade stops, lock; 2 inch actuator shaft.
  3. Dampers shall be shall have UL 555S differential pressure rating for 6 in. W.G. and minimum UL 555 velocity rating of 3000 fpm.
  4. Leakage shall not exceed 30 CFM/SF at 1 in. W.G.
  5. Coordinate damper operator power and control requirements with Automatic Temperature Control contractor.
  6. Damper shall open with power on; damper closes on interruption of power and resets to open position when power is restored. Provide means to determine damper position from visual inspection of exterior of duct.
- F. FLEXIBLE DUCT CONNECTORS
1. Fabricate in accordance with SMACNA Duct Construction Standards.
  2. UL listed fire retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 20 oz per sq yd, approximately 6 inches wide, crimped into metal edging strip.
  3. Leaded vinyl sheet, minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

G. DUCT ACCESS DOORS

1. Fabricate in accordance with SMACNA Duct Construction Standards.
2. Provide flush frames for un-insulated ductwork, extended frames for insulated ductwork.
3. Provide one side hinged, other side with one latch type handle for doors 12" high and smaller, 2 handle type latches for larger doors.

2.15 HYDRONIC PIPING SYSTEMS

A. ASME COMPLIANCE:

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

B. PIPE AND FITTINGS

1. Pipe Size 2" and Smaller: Black steel pipe; Schedule 40; Class 125 cast iron fittings; threaded joints.
2. Pipe Size 3" and Smaller: Copper tube, Type L, hard drawn temper; wrought copper fittings; tin-antimony solder (95/5) joints.
3. Pipe Size 2-1/2" and Larger: Black steel pipe; Schedule 40; wrought steel butt weld fittings; welded joints.
4. Pipe Run Within Concrete Construction: Copper tube; Type K, soft annealed temper; no joints or fittings allowed; sleeve tube with continuous length of 3/8" minimum thickness of rubber pipe insulation.

C. VALVES: Unless otherwise indicated provide valves as listed in the "VALVES" and "HYDRONIC SPECIALTIES" paragraphs of this specification.

2.16 HYDRONIC SPECIALTIES

A. SUBMITTALS

1. Product Data Sheets: For each type of Hydronic Specialty indicated.
2. Shop Drawings: Show all Hydronic Specialties on Coordination drawings. Refer to "COORDINATION DRAWINGS" this SECTION.

B. ASME COMPLIANCE:

1. Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear appropriate ASME label.

C. COMBINATION BALANCING AND SHUT-OFF VALVES – 1" AND UNDER

1. Valves shall be of bronze body/brass ball construction with glass and carbon filled TFE seat rings.
2. Valves are to have differential pressure read-out ports across valve seat area. Read-out ports to be fitted with internal EPT inserts and check valves.
3. Valve bodies to have 1/4" NPT tapped drain/purge port.
4. Valves to have memory stop feature to allow valve to be closed for service and then reopened to set point without disturbing balance position. All valves to have calibrated nameplates to assure specific valve settings.
5. Valves shall be designed for positive shut off.
6. Valves to be provided with preformed insulation to permit access for balance and read-out.
7. Provide extended stems for all valves in insulated piping systems. Stems shall extend to length necessary for full handle exposure outside of insulation system.
8. Valves to be Bell & Gossett Circuit Setter Plus or equivalent by Taco.

D. COMBINATION BALANCING AND SHUT-OFF VALVES – OVER 1”

1. Balancing valves shall be of the “Y” pattern globe style design. Valves shall offer a minimum of four full rotations of the handwheel for accurate adjustments and acceptable flow control ranges.
2. All balancing valves must exhibit an accuracy of  $\pm 5\%$  in the normal operating range of the valve.
3. All balancing valves shall have integral self-sealing metering ports for measuring differential pressure, flow rates and temperature.
4. All balancing valves must be capable of 100% shutoff at pressures up to 250 psi.
5. Valves shall have a hidden preset and tamperproof locking device to prevent unauthorized adjustment and to allow for a return to the original setting after shut off.
6. All balancing valves in sizes up to 2” shall have a digital handwheel for positioning and presetting accuracy. Sizes 2.5” and over shall have a vernier sleeve for readout.
7. Valves up to 2” shall have a drain fill connection with an integral stop valve.
8. Valves up to 2” shall be manufactured from die cast dezincification resistant copper alloy which does not require dielectric fittings. Valves over 2” shall be manufactured from cast iron with all wetted moving parts of dezincification resistant copper alloy.
9. Valves up to 2” to be provided with preformed insulation to permit access for balance and read-out.
10. Provide extended stems for all valves in insulated piping systems. Stems shall extend to length necessary for full handle exposure outside of insulation system.
11. Valves shall be by Tour & Anderson or equivalent by Nibco or Armstrong.

E. BALANCE COCKS

1. Threaded or Soldered Ends (as required) 2” and Smaller: Class 125, bronze body, bronze plug; screwdriver operated, straight or angle pattern.
2. ACCEPTABLE MANUFACTURERS
  - a. American Air Filter Co.
  - b. B&G ITT; Fluid Handling Div.
  - c. Spirax Sarco Co.
  - d. Taco, Inc.

F. AIR VENTS

1. Manual: Screwdriver or thumbscrew operated 1/8 inch NPS connection.
2. Automatic: Float principle; stainless steel float and mechanism; cast iron body; 125 psi; 2 inch NPS inlet and outlet connections.
3. ACCEPTABLE MANUFACTURERS
  - a. Armstrong Machine Works.
  - b. B&G ITT; Fluid Handling Div.
  - c. Spirax Sarco Co.

G. AIR SEPARATORS

1. Centrifugal Type: 125 psi; steel construction; Fabricate and Stamp to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1. Tangential inlet and outlet connections; perforated stainless steel air connector; blowdown connection.
2. ACCEPTABLE MANUFACTURERS
  - a. B&G ITT; Fluid Handling Div.
  - b. Armstrong Pump Inc.
  - c. Spirax Sarco Co.

H. DIAPHRAGM-TYPE COMPRESSION TANKS

1. Steel construction; 125 psi; Fabricate and Stamp to comply with ASME Boiler and Pressure Vessel Code, Section VIII, Division 1; flexible diaphragm sealed into tank to permanently separate air from water; pressure gage and air charging fitting; drain fitting.
2. ACCEPTABLE MANUFACTURERS

- a. B&G ITT; Fluid Handling Div.
- b. Armstrong Pump, Inc.
- c. Amtrol, Inc.

I. WATER RELIEF VALVES

1. ASME rated, direct spring loaded type, lever operated, nonadjustable factory set discharge pressure.
2. Select relief setting not to exceed 6 psig above maximum allowable working pressure for pressures up to and including 60 psig.
3. ACCEPTABLE MANUFACTURERS
  - a. B&G ITT; Fluid Handling Div.
  - b. Spirax Sarco Co.
  - c. Taco, Inc.

J. PUMP DISCHARGE VALVES

1. Non-slam check valve with spring loaded disc and calibrated flow adjustment feature; positive shut off; 175 psi; flanged cast iron body; straight or angle pattern as indicated. Valve shall be system line size.
2. ACCEPTABLE MANUFACTURERS
  - a. Armstrong Pump, Inc.
  - b. B&G ITT; Fluid Handling Div.
  - c. Taco, Inc.

K. PUMP SUCTION DIFFUSER

1. Angle type suction guide fitting with flanged or threaded cast iron body; 175 psi; steel or cast iron guide vanes; removable stainless steel strainer; blow down and gage tappings; 16 mesh bronze start-up strainer.
2. Suction diffuser shall be non-reducing with both the system side and pump side equivalent to the system line size.
3. ACCEPTABLE MANUFACTURERS
  - a. Armstrong Pump, Inc.
  - b. B&G ITT; Fluid Handling Div.
  - c. Taco, Inc.

L. SHOT FEEDERS

1. 5 Gallon capacity or as otherwise indicated; cast iron or steel construction; 125 psi; funnel valve on top for loading; drain valve in bottom; recirculating valves on side.

2.17 STEAM AND CONDENSATE PIPING SYSTEMS

A. DEFINITIONS

1. LOW PRESSURE: 0 to 15 psig.
2. MEDIUM PRESSURE: Greater than 15; less than 100 psig.

B. LP STEAM PIPE AND FITTINGS

1. Size 2" and Less: SCH. 40 black steel pipe; 125 psi cast iron threaded fittings.
2. Size 2-1/2" and Larger: SCH. 40 black steel pipe; Class 150 wrought steel butt weld fittings.

C. LP CONDENSATE PIPE AND FITTINGS

1. Size 2" and Less: SCH. 80 black steel pipe; 125 psi cast iron threaded fittings.
2. Size 2-1/2" and Larger: SCH. 80 black steel pipe; Class 150 wrought steel butt weld fittings.

- D. MP STEAM PIPE AND FITTINGS
  - 1. Size 2" and Less: SCH. 40 black steel pipe; 125 psi cast iron threaded fittings.
  - 2. Size 2-1/2" and Larger: SCH. 80 black steel pipe; 150 wrought steel butt weld fittings
- E. MP CONDENSATE PIPE AND FITTINGS
  - 1. Size 2" and Less: SCH. 80 black steel pipe; 125 psi cast iron threaded fittings.
  - 2. Size 2-1/2" and Larger: SCH. 80 black steel pipe; Class 300 wrought steel butt weld fittings.
- F. VALVES
  - 1. Unless otherwise indicated provide valves as listed in the "VALVES" paragraph of these specifications.

## 2.18 STEAM AND CONDENSATE SPECIALTIES

- A. SUBMITTALS
  - 1. Product Data Sheets: For each type of steam and condensate Specialty indicated.
  - 2. Shop Drawings: Show all Hydronic Specialties on Coordination drawings. Refer to "COORDINATION DRAWINGS" this SECTION.
- B. GENERAL
  - 1. Provide steam and condensate specialties of design pressures equal or greater than that of the piping system to which they are connected.
- C. FLOAT AND THERMOSTATIC TRAPS
  - 1. Cast iron or semi-steel body; diaphragm or bellows type thermostatic element with stainless steel valve cone and valve seat; stainless steel or copper float, with positive snap-action valve mechanism, stainless steel valve and renewable seat.
  - 2. ACCEPTABLE MANUFACTURERS
    - a. Armstrong Machine Works.
    - b. Barnes & Jones, Inc.
    - c. Spirax Sarco.
- D. INVERTED BUCKET TRAPS
  - 1. Cast iron body; stainless steel head and seat; stainless steel valve retainer, lever, and guide pin assembly: Stainless steel bucket and inlet strainer. Stainless steel automatic air vent.
  - 2. Minimum pressure rating: 250 psig.
  - 3. ACCEPTABLE MANUFACTURERS
    - a. Armstrong Machine Works.
    - b. Barnes & Jones, Inc.
    - c. Spirax Sarco.
- E. STEAM VENTS
  - 1. Automatic; thermostatic balanced pressure type; brass or semi-steel bodies; renewable stainless steel head and seat; phosphor bronze thermostatic bellows, liquid filled.
- F. PRESSURE REDUCING VALVES
  - 1. Pilot actuated, diaphragm type; cast semi-steel bodies with stainless steel trim; replaceable valve head and seat; main head stem guide fitted with flushing and pressure arresting device.
  - 2. ACCEPTABLE MANUFACTURERS
    - a. Leslie Co.
    - b. Spirax Sarco.

c. Spence Engineering co., Inc.

G. PRESSURE REDUCING VALVES

1. Pilot actuated, diaphragm type; cast semi-steel bodies with stainless steel trim; replaceable valve head and seat; main head stem guide fitted with flushing and pressure arresting device.
2. Provide following options on all valves:
  - a. Discharge noise suppressor
  - b. Manufacturer's removable insulation jacket
3. ACCEPTABLE MANUFACTURERS
  - a. Spirax Sarco.
  - b. Spence Engineering co., Inc.
  - c. Leslie Co.

2.19 STEAM TO HOT WATER CONVERTER

A. ACCEPTABLE MANUFACTURERS:

1. ITT Bell & Gossett
2. Taco
3. Amtrol.

B. GENERAL

1. Furnish and install approximately where shown on plans and with manufacturer's recommendations, Steam to Liquid Heat Exchanger(s), according to the following specifications:

C. TYPE:

1. Shell and Tube, U-bend removable tube bundle.
2. Equipped with mounting legs.

D. MATERIALS:

1. Front Head: Cast Iron (Bonnet)
2. Baffles: Steel
3. Tie Rods/Spacers: Steel
4. Shell: Steel
5. Gasket Material: Compressed Fiber
6. Tubesheet: Steel
7. Tubes: Copper

E. CONSTRUCTION:

1. A manufacturers' data report for pressure vessels, form No. U-1 as required by the provisions of the ASME Code Rules, is to be furnished to the engineer for the owner upon request. This form must be signed by an authorized inspector, holding National Board Commission, certifying that construction conforms to the latest ASME Code for pressure vessels for:
  - a. Tube side: 150.0 PSIG design pressure at 375.0 deg. F
  - b. Shell side: 150.0 PSIG design pressure at 375.0 deg. F
2. As detailed in form No. U-1. The ASME "U" symbol should also be stamped on the Heat Exchanger(s). In addition, each unit is registered with the National Board of Boiler and Pressure Vessel Inspectors.

2.20 REFRIGERANT PIPING SYSTEMS

- A. ACCEPTABLE MANUFACTURERS
  - 1. Alco Controls Div.; Emerson Electric Co.
  - 2. Henry Valve Co.
  - 3. Parker-Hannifin Corp.; R&AC Div.
  - 4. Sporlan Valve Co.
  
- B. SUBMITTALS
  - 1. Piping Valve numbering scheme.
  - 2. Shop Drawings:
    - a. Design Calculations: Calculate requirements for refrigerant piping systems.
    - b. Schematic diagrams of piping layout and sizing. Include valves and refrigerant specialties.
    - c. Refrigerant equipment manufacturers piping, valve and refrigerant specialties requirements.
  
- C. REFRIGERANT PIPE AND FITTINGS
  - 1. Tube size 4-1/8" and Smaller: Copper tube; Type ACR, hard drawn temper; wrought copper solder joint fittings; soldered joints.
  - 2. Solder joints using lead-silver solder, ASTM B 32, Grade 96 TS.
  
- D. SPECIAL REFRIGERANT VALVES
  - 1. Globe Shutoff Valves: Forged brass, packed, back seating, winged seal cap, 300 deg. F. temperature rating, 500 psi working pressure.
  - 2. Check Valves: Forged brass, accessible internal parts, soft synthetic seat, fully guided piston and stainless steel spring, 250 deg. F. temperature rating, 500 psi working pressure.
  
- E. REFRIGERANT SPECIALTIES
  - 1. Strainers: Brass shell and end connections, brazed joints, monel screen, 100 mesh, UL listed, 350 psi working pressure.
  - 2. Moisture Indicator: Forged brass, single port, removable cap, polished optical glass, solder connections, UL listed, 200 deg. F. temperature rating, 500 psi working pressure.
  - 3. Filter-Drier: Corrosion resistant steel shell, steel flange ring and spring, wrought copper fittings, ductile iron cover plate with steel cap screws, replaceable filter-drier core, 500 psi working pressure.
  - 4. Solenoid Valves: Forged brass, conform to ARI 760, normally closed, Teflon valve seat, NEMA 1 solenoid enclosure, 24 volt, 60 Hz., UL listed, 2" conduit adapter, 250 deg. F. temperature rating, 400 psi working pressure; manual operator to open valve.
  - 5. Expansion Valves: Brass body, internal or external equalizer, adjustable superheat setting capillary tube and remote sensing bulb.
    - a. Size to avoid being undersized at full load and excessively oversized at partial load.
    - b. Select for maximum load at design operating pressure and minimum 43 deg. F. of superheat.
  - 6. Flexible Connectors: Minimum 9" long with bronze fittings; Close pitch corrugated bronze hose with single layer of exterior braiding.

## 2.21 AC AND HUMIDIFIER CONDENSATE PIPING

- A. PIPE AND FITTINGS
  - 1. All Sizes: Copper tube, Type L, hard drawn temper; wrought copper fitting; tin-lead solder (50/50) joints.

## 2.22 REGISTERS, GRILLES AND DIFFUSERS

### A. ACCEPTABLE MANUFACTURERS

1. Anemostat
2. Titus Products Div.; Philips Industries, Inc.
3. Nailor
4. Metal Industries
5. Krueger Mfg. Co.
6. Tuttle & Bailey; Div. of Interpace Corp.

### B. SUBMITTALS

1. Product Data: For each product indicated, include the following:
  - a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - b. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
2. Shop Drawings: Show all register, grilles and diffusers on Coordination drawings. Refer to "COORDINATION DRAWINGS" this SECTION.

### C. GENERAL

1. Provide manufacturers standard air outlets and inlets of type, size, materials, and with accessories and options indicated.

### D. FINISH

1. Finish of all registers, grilles and diffusers shall be standard color selected by Architect. Provide color samples to Architect for his approval during the submittal process.

### E. PERFORATED FACE CEILING REGISTERS AND DIFFUSERS (use for all psychiatric patient access areas).

1. Type: Removable, perforated face. Maximum security, suicide deterrent. 3/16" thick steel plate with 5/32" diameter holes on 7/32" staggered centers. Border with roll-over edge to fit flush to ceiling. Face shall be removable via tamper-proof, face-mounted, screws.
2. Frame: All welded steel construction with angle frame backing. 1-1/2"x1-1/2"x3/16" thick. Support frame from ceiling deck with bracing or rods.
3. Fabrication: Steel, all welded construction. 3/16" steel sleeve. Provide aluminum version for all shower rooms.
4. Paint: Must pass 100 hour ASTM B117 corrosive environment salt spray test without creepage or blistering/deterioration of film. Must pass ASTM D2794 reverse impact cracking test with a 50 inch-pound force applied.
5. Performance data must be tested in accordance with ANSI/ASHRAE Standard 700-2006.
6. Provide integral volume dampers accessible from grille face (after removal).
7. Basis of design is Anemostat model RRMX-1.

### F. PERFORATED FACE CEILING REGISTERS AND DIFFUSERS

1. Type: Perforated face.
2. Frame: coordinate with architectural ceiling plans.
3. Fabrication: Steel with steel or aluminum frame and finish to be coordinated with the Architect.
4. Provide adjustable throw pattern attachment for diffusers and opposed blade damper for both diffusers and registers.
5. Note carefully which diffusers located at the bottom of shafts are to be fire rated and are to be provided with integral fire dampers and be of suitable construction to maintain the fire rating of the ceiling.



- G. CEILING SUPPLY REGISTERS/GRILLES
1. Type: Streamlined and individually adjustable curved blades to discharge air along face of grille, one-way or two-way deflection.
  2. Frame: coordinate with architectural ceiling plans..
  3. Fabrication: Aluminum extrusions with factory finish coordinated with Architect.
  4. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.
- H. CEILING EXHAUST AND RETURN REGISTERS/GRILLES
1. Type: Streamlined blades, 3/4 inch maximum spacing, with blades set at 45 degrees, vertical or horizontal face as indicated on schedules.
  2. Frame: coordinate with architectural ceiling plans..
  3. Fabrication: Steel with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory finish to be coordinated with the Architect.
  4. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.
- I. WALL SUPPLY REGISTERS/GRILLES
1. Type: Streamlined and individually adjustable blades, with deflection type as indicated on schedules.
  2. Frame: coordinate with architectural plans.
  3. Fabrication: Steel (unless otherwise scheduled) with 20 gage minimum frames and 22 gage minimum blades, steel and aluminum with 20 gage minimum frame, or aluminum extrusions, with factory finish to be coordinated with Architect.
  4. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.
- J. WALL EXHAUST AND RETURN REGISTERS/GRILLES
1. Type: Streamlined blades, with spring or other device to set blades.
  2. Refer to schedules for fabrication materials.
  3. Frame: coordinate with architectural plans.
  4. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.
- K. ACCESSORIES:
1. Equalizing grid.
  2. Safety chain.

## 2.23 ROOF FANS

- A. ACCEPTABLE MANUFACTURERS
1. Greenheck
  2. Loren Cook Co.
  3. Penn Ventilator Co., Inc.
- B. GENERAL: Except as otherwise indicated, provide standard prefabricated centrifugal roof fans, curb mounted of the type, size, material, characteristics, performance and with the accessories indicated on the Drawings or specified herein.
- C. CODES AND STANDARDS
1. Bear the AMCA certified rating seal.
  2. Test in accordance with U.L. 705 "Power Ventilators".

3. Motors and electrical accessories shall comply with NEMA standards. All motors 1 HP or over shall meet the full load nominal efficiency requirements of EPA Act 1992. These standards are the same as those listed in NEMA MG1-1993, Table 12-10. Testing of efficiency shall be performed in accordance with IEEE Standard 112, Test Method B.
4. Fans used for kitchen grease removal service shall have U.L. classification YZHW and shall meet the requirements of NFPA Standard 96.

#### D. FEATURES

1. Sheaves shall be dynamically balanced, bored to fit shafts and keyed. Sheaves shall be of the variable or adjustable pitch type.
2. Provide fan shaft with self-aligning pre-lubricated ball bearings.
3. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
  - a. Configuration: Built-in raised cant and mounting flange.
  - b. Overall Height: 18 inches.
  - c. Sound Curb: Roof curbs shall incorporate sound attenuating baffles to further reduce noise generated from the fan. Sound attenuating baffles to be constructed of a die formed perforated aluminum outer housing and filled with sound absorbing fiberglass wool. Sound attenuating baffles shall have solid, rounded noses to increase noise reduction. Aluminum baffles are to be attached to curb using spring steel wire holding clips that allow for easy removal of each baffle for cleaning or maintenance. Baffles without perforated aluminum outer housing such as fiberglass duct board are unacceptable.
  - d. Pitch Mounting: Manufacture curb for roof slope.
  - e. Metal Liner: Galvanized steel.
  - f. Mounting Pedestal: Galvanized steel with removable access panel.

#### E. ACCESSORIES

1. Removable bird screen, 1/2 - inch mesh, 16 gauge, aluminum, brass or galv. steel wire.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted outside fan housing, factory wired through an internal aluminum conduit.
3. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

### 2.24 CHEMICAL WATER TREATMENT

#### A. MATERIALS

1. All chemicals shall be approved by the Federal Environmental Protection Agency.
2. System Cleaner:
  - a. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products ; sodium tripoly phosphate and sodium molybdate.
3. Biocide
  - a. Chlorine release agents such as sodium hypochlorite or calcium hypochlorite, or microbiocides such as quarternary ammonia compounds, tributyl tin oxide, methylene bis (thiocyanate), or isothiazolones.
4. Closed System Treatment (Water):
  - a. Sequestering agent to reduce deposits and adjust pH ; polyphosphate.
  - b. Corrosion inhibitors ; liquid boron-nitrite, sodium nitrite and borax, sodium tolyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.
  - c. Conductivity enhancers ; phosphates or phosphonates.

#### B. BY-PASS (POT) FEEDER

1. 6.0 gal quick opening cap for working pressure of 175 psig.

## 2.25 PACKAGED CHILLER / HYDRONIC SKID

### A. ACCEPTABLE MANUFACTURERS

1. York
2. Trane
3. Carrier

### B. GENERAL

1. Provide factory assembled and tested chiller and hydronic pump skid package consisting of an air-cooled scroll liquid chiller, chilled water pumps, air separator, expansion tank, shot feeder, 200-gallon buffer tank, and all associated piping to provide single chilled water supply and chilled water return connections.
2. Provide proper vibration isolation for associated piping & wiring according to manufacturer's representatives.
3. All skid components shall be suitable for exterior mounting and shall be factory insulated and jacketed. See applicable specification sections for insulation and jacketing systems.
4. Refer to individual component product and installation specification sections herein for further information regarding requirements for hydronic pumps, air separator, expansion tank, shot feeder, and piping.

### C. PACKAGED CHILLER / COMPONENTS

#### 1. GENERAL

- a. Chiller shall be provided with scroll compressors, evaporator, thermal expansion valve, refrigeration accessories, and control panel. Construction and rating shall be in accordance with ANSI/ARI 590.
- b. Refer to chiller installation specification section.

#### 2. HOUSING

- a. The frame shall be heavy duty galvanized structural steel construction. The housing shall be fabricated from heavy gauge aluminum removable panels finished with corrosion and weather-resistant finish.

#### 3. COMPRESSOR(S): Hermetic, 1750 RPM, scroll type designed for indicated refrigerant.

- a. Tip seals to provide efficient axial sealing while preventing scroll tip to base contact.
- b. Controlled Orbit Design for radial sealing to incorporate minimum flank to flank contact for long service life.
- c. Refrigerant flow through the compressor with 100% suction cooled motor.
- d. Large suction side free volume and oil sump to provide liquid handling capability.
- e. Annular discharge check valve and reverse vent assembly to provide low pressure drop, silent shutdown and reverse rotation protection.
- f. Initial Oil charge.
- g. Oil Level sightglass.
- h. Vibration isolator mounts for compressors.
- i. Brazed-type connections for fully hermetic refrigerant circuits.

#### 4. EVAPORATOR

- a. Provide remote or integral evaporator (as indicated on drawings) of shell and tube type, seamless or welded steel construction with cast iron or fabricated steel heads, seamless copper tubes or red brass tubes with integral aluminum fins, rolled or silver brazed into tube sheets. Provide multiple refrigerant circuits.
- b. Design, test, and stamp refrigerant side for 225 PSIG working pressure and water side for 150 PSIG working pressure in accordance with ANSI/ASME SEC 8.
- c. Insulate with 0.75 inch minimum thick flexible expanded polyvinyl chloride insulation with maximum K value of 0.26.

- d. Provide water drain connection and thermometer wells for temperature controller and low temperature cutout.
  5. CONDENSER
    - a. Provide condenser of copper tubes with aluminum plate fins. Fins shall be formed with tube collars and mechanically expanded with fin collars for full contact. Condenser coils shall be tested to 225 psig air pressured.
    - b. Casings shall be heavy gauge aluminum. Tube sheets shall be die formed and full collared for tube support. Headers to be constructed of heavy wall seamless copper tubing.
  6. CONDENSER FANS
    - a. Provide direct drive propeller type with zinc plated chromate dipped blades. Air shall discharge vertically to minimize noise generation and air recirculation.
    - b. Fans shall be located within a formed venturi and be provided with a polyvinyl covered fan guard.
    - c. Fan motors shall be 3 phase, 1140 RPM, vertical, direct drive motors with permanently lubricated ball bearings and overload protection.
  7. REFRIGERANT CIRCUIT
    - a. Provide refrigerant circuits, factory supplied and piped.
    - b. Provide hot gas bypass for lead compressor circuit.
    - c. Provide for each refrigerant circuit:
      - 1) Liquid line solenoid valve
      - 2) Filter dryer (replaceable core type)
      - 3) Liquid line sight glass and moisture indicator
      - 4) Thermal expansion valve for maximum operating pressure
      - 5) Charging valve
      - 6) Insulated suction line
      - 7) Discharge line check valve
      - 8) Compressor service valves
      - 9) Pressure relief device
- D. CONTROLS
1. Provide provisions for local control as specified herein, and provisions for remote start/stop capabilities and run status light. Locate on chiller, mount steel control panel, containing starters, power and control wiring, molded case disconnect switch, factory wired with single-point power connection.
  2. For each compressor, provide across-the-line starter, non-recycling compressor over load, starter relay, and control power transformer. Provide manual reset current overload protection.
  3. Provide the following devices on a Nema 4X control panel face:
    - a. Compressor run lights
    - b. System start/stop switch
    - c. Control power fuse or circuit breaker
    - d. Compressor lead/lag switch
  4. Provide the following safety controls with indicating lights arranged so that operating any one will shut down machine and require manual reset:
    - a. Low chilled water temperature switch
    - b. High discharge pressure switch for each compressor
    - c. Low suction pressure switch for each compressor
    - d. Oil pressure switch
    - e. Flow switch in chilled water line
    - f. Relay for remote mounted emergency shutdown
  5. Provide the following operating controls:
    - a. Multi-step leaving chilled water temperature controller which cycles compressor and activates compressor capacity device(s).
    - b. Five minute off timer prevents compressor from short cycling.

- c. Periodic pumpout timer to pump down on chilled water flow and high evaporator refrigerant pressure.
- d. Hot gas bypass sized for minimum compressor loading on all compressor circuits that bypass hot refrigerant gas to evaporator.
- e. Automatic start/stop controls for chilled water pump
6. Provide pre-piped gauge board with pressure gauges for suction and discharge refrigerant pressures and oil pressures.
7. Provide alarm package with test button and indicating lights which indicate control circuit is energized and compressor is running and will light an indicating light upon detection of compressor malfunction, low chilled water temperature, or evaporator water flow failure.

E. MANUFACTURERS FIELD SERVICES

1. Prepare and start systems.
2. Supply service of factory-trained representative for a period of one day to supervise testing, dehydration and charging of machine, start-up, and instruction on operation and maintenance to Owner.

2.26 AIR COOLED CONDENSING UNITS

A. ACCEPTABLE MANUFACTURERS

1. York
2. Trane
3. Carrier

B. GENERAL: Provide air cooled condensing unit(s) of sizes, capacities, characteristics and at the locations indicated. Include in basic unit casing, compressor(s), condenser coils, condenser fans and motors, fan and coil guards, refrigerant charge, refrigerant piping and specialties, motor starters, electrical connection box, operating and safety controls. All components shall be factory piped, wired and tested.

C. CASING: Design for outdoor installation, provide weather protection for components and controls. Construct casing of galvanized steel, phosphatized with baked enamel finish or of heavy gauge aluminum.

D. COMPRESSOR(S): Hermetic, 1750 RPM, scroll type designed for indicated refrigerant.

1. Tip seals to provide efficient axial sealing while preventing scroll tip to base contact.
2. Controlled Orbit Design for radial sealing to incorporate minimum flank to flank contact for long service life.
3. Refrigerant flow through the compressor with 100% suction cooled motor.
4. Large suction side free volume and oil sump to provide liquid handling capability.
5. Annular discharge check valve and reverse vent assembly to provide low pressure drop, silent shutdown and reverse rotation protection.
6. Initial Oil charge.
7. Oil Level sightglass.
8. Vibration isolator mounts for compressors.
9. Brazed-type connections for fully hermetic refrigerant circuits.

E. CONDENSER COIL: Seamless copper tubes mechanically expanded into aluminum fins; provide sub-cooling coil; provide coil guards.

F. CONDENSER FANS: Vertical discharge propeller type. Fan blades shall be statically and dynamically balanced. Provide individual motor for each fan. Fan motors shall be inherently protected and be of ball bearing construction, permanently lubricated type.

- G. REFRIGERATION CIRCUIT: Copper tube with brazed joints, include shutoff valve with charging connection.
- H. CONTROLS & POWER CONNECTION: Factory wired in weather proof box. Include positive timer to prevent short cycling of compressors. Include low pressurestat; field power and control circuit terminal blocks; circuit breakers; motor contactors; control relays and control circuit on-off switch.
- I. HEAD PRESSURE CONTROL: Provide head pressure controls to allow unit to operate to indicated ambient temperature.
- J. CAPACITY CONTROL: Provide automatic multi-step capacity control of minimum control steps indicated.
- K. ACCESSORIES
  - 1. Hot gas bypass for compressor operation to 10% of full load.
  - 2. Control transformer.

#### 2.27 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. ACCEPTABLE MANUFACTURERS:
  - 1. Bell & Gossett, ITT
  - 2. Armstrong Pump
- B. DESCRIPTION: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump; designed for installation with pump and motor shafts mounted horizontally or vertically. Rate pump for 175-psig minimum working pressure and a continuous water temperature of 250 deg F.
- C. CONSTRUCTION:
  - 1. Casing: Radially split, cast iron, with replaceable bronze wear rings, threaded gage tappings at inlet and outlet, and threaded companion-flange connections.
  - 2. Impeller: ASTM B 584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. Trim impeller to match specified performance.
  - 3. Pump Shaft: Stainless steel.
  - 4. In subparagraph below, select first option for temperature rating of 225 deg F (107 deg C); select second option for 250 deg F (121 deg C).
  - 5. Mechanical Seal: Carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.
  - 6. Select subparagraph above or first subparagraph below. Packing seal is rated for 200 deg F (93 deg C).
  - 7. Packing Seal: Stuffing box, with a minimum of four rings of graphite-impregnated braided yarn with bronze lantern ring between center two graphite rings, and bronze packing gland.
  - 8. Pump Bearings: Permanently lubricated ball bearings.
- D. MOTOR: Open, drip-proof, with regreaseable ball bearings, conform with NEMA specifications. All motors 1 HP or over shall meet the full load nominal efficiency requirements of EPA Act 1992. These standards are the same as those listed in NEMA MG1-1993, Table 12-10. Testing of efficiency shall be performed in accordance with IEEE Standard 112, Test Method B.

#### 2.28 BASE MOUNTED END SUCTION PUMPS

- A. ACCEPTABLE MANUFACTURERS
  - 1. Bell & Gossett, ITT
  - 2. Armstrong Pump
- B. GENERAL: Provide base mounted end suction pumps where indicated, and of capacities and having characteristics as schedules or indicated.
- C. TYPE: Centrifugal, single stage, direct connected.
- D. CASING: Cast iron, bronze fitted, split volute, single suction rated for 175 psi pressure, renewable bronze wearing rings, suction and discharge gage tappings.
- E. IMPELLER: Bronze, fully enclosed, keyed to shaft, statically and dynamically balanced.
- F. COUPLING GUARD: Coupling guard shall be compliant with ANSI B15.1, Section 8 and OSHA 1910.219. Provide slotted viewing windows for inspection.
- G. SHAFT: High grade alloy steel with copper, bronze or stainless steel shaft sleeves.
- H. BEARINGS: Regreaseable ball bearings.
- I. DRIVE: Flexible coupling with coupling guard.
- J. SEALS: Flushed, Mechanical seals.
- K. BASEPLATE: Fabricated steel with open grouting area.
- L. MOTOR: Open, drip-proof, with regreaseable ball bearings, conform with NEMA specifications. All motors 1 HP or over shall meet the full load nominal efficiency requirements of EPA Act 1992. These standards are the same as those listed in NEMA MG1-1993, Table 12-10. Testing of efficiency shall be performed in accordance with IEEE Standard 112, Test Method B.

## 2.29 MOTORS AND MOTOR STARTERS

- A. MOTOR ACCEPTABLE MANUFACTURERS
  - 1. General Electric
  - 2. Baldor
  - 3. Lincoln
- B. GENERAL CONSTRUCTION AND REQUIREMENTS
  - 1. Motors Less Than 250 Watts, for Intermittent Service: Equipment manufacturer's standard and need not conform to these specifications.
  - 2. Single Phase Motors: PSC where available.
  - 3. Electrical Service:
  - 4. Refer to DIVISION 16 – ELECTRICAL for required electrical characteristics.
  - 5. Open drip-proof type except where specifically noted otherwise.
  - 6. Design for continuous operation in 40 degrees C environment.
  - 7. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
  - 8. Motors connected to variable frequency drives shall meet requirements of NEMA MG-11, Part 31 and stated as frequency drive compatible. Motors shall be suitable for use with repeated voltage peaks of 1600 volts with rise time of 0.1 microseconds or greater.
  - 9. Explosion-Proof Motors: UL approved for hazard classification.

10. Visible Nameplate: Indicating manufacturer's name and model number, motor horsepower, RPM, frame size, voltage, phase, cycles, full load amps, insulation system class, service factor, maximum ambient temperature, temperature rise at rated horsepower, minimum efficiency.
  11. Wiring Terminations:
    - a. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
    - b. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.
- C. SINGLE PHASE POWER - SPLIT PHASE MOTORS
1. Starting Torque: Less than 150 percent of full load torque.
  2. Starting Current: Up to seven times full load current.
  3. Breakdown Torque: Approximately 200 percent of full load torque.
  4. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve or ball bearings.
  5. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.
- D. SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS
1. Starting Torque: Exceeding one fourth of full load torque.
  2. Starting Current: Up to six times full load current.
  3. Multiple Speed: Through tapped windings.
  4. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.
- E. SINGLE PHASE POWER - CAPACITOR START MOTORS
1. Starting Torque: Three times full load torque.
  2. Starting Current: Less than five times full load current.
  3. Pull-up Torque: Up to 350 percent of full load torque.
  4. Breakdown Torque: Approximately 250 percent of full load torque.
  5. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.
  6. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve ball bearings.
  7. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.
- F. THREE PHASE POWER - SQUIRREL-CAGE MOTORS
1. Starting Torque: Between 1 and 1-1/2 times full load torque.
  2. Starting Current: Six times full load current.
  3. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.
  4. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B energy efficient motors.
  5. Insulation System: NEMA Class B or better.
  6. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
  7. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.



8. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum AFBMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt centre line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
  9. Sound Power Levels: To NEMA MG 1.
  10. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.
  11. Weatherproof Epoxy Sealed or Treated Motors: Epoxy seal windings using vacuum and pressure to coat windings with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.
  12. Nominal Efficiency: To NEMA MG 1, energy efficient for frame sizes 215T and larger.
- G. Starters shall be in NEMA type 1 general purpose wall-mounted enclosures, except NEMA type 3R enclosures shall be used where the starter is exposed to the weather and NEMA type 7 enclosures shall be used in all hazardous locations. Starters shall be sized per NEMA standards to match motor voltage and horsepower. Overload relays shall be provided in each conductor to the motor. These relays shall be of the bi-metallic "inverse-time" type. Heaters shall be provided of the correct size for the motor controlled. Two (2) sets of auxiliary contacts shall be provided with each starter in addition to those needed for normal operation, or in addition to those required by the wiring diagrams. These auxiliary contacts shall be form C, "normally open/closed".
- H. Start-stop momentary pushbuttons shall be located in the covers of the starter enclosure unless other type of starting switches are required. Red and green pilot lights shall be located in the cover of the starter enclosure to indicate position of main contacts. H-O-A switches shall be included in the starter for all mechanical equipment with automatic control signals.
- I. Magnetic or manual starters shall be manufactured by one of the following:
1. General Electric Company
  2. Square D Company
  3. Allen-Bradley Company

## 2.30 VARIABLE SPEED DRIVES

### A. ACCEPTABLE MANUFACTURERS

1. ABB

### B. VARIABLE MOTOR SPEED DRIVES

1. Provide adjustable frequency motor drives consisting of pulse width modulation inverter for use on standard NEMA induction motors.
2. Provide ventilated enclosure for installation as free standing or wall mounted unit.
3. Logic shall be microprocessor based.
4. Power factor shall be not less than 0.95 through full range of frequencies.
5. Input: Refer to drawings for VAC and phase, plus or minus 10%.
6. Output: Refer to drawings for VAC and phase, 6 - 60 Hz.
7. Digital Displays:
  - a. Out frequency, voltage and amps.
  - b. Overcurrent - OC.
  - c. Overvoltage - OV.
  - d. Current Limit - CL.
  - e. Voltage Limit - VL.
  - f. IIT Protection - MT.
  - g. Ground Fault - GF.

- h. Improper Input Voltage Selected - LO-V, HI-V.
- i. Minimum and Maximum Speed Improper Selection - MNMX.
- j. Overtemperature - OT.
- 8. Field settable adjustments, controls and outputs:
  - a. Adjustable Current Limit -(60-11)% of drives rated current).
  - b. Adjustable volts per hertz (V/Hz) +10%, -10%.
  - c. Adjustable Acceleration Rate.
  - d. Adjustable Deceleration Rate.
  - e. Adjustable Maximum Speed 0 to 100%.
  - f. Adjustable Minimum Speed 0 to 100%.
  - g. Adjustable Speed Input Gain 1:1 to 10:1.
  - h. Adjustable Speed Input Offset 0 - 50%.
  - i. Speed Command Inverting Switch.
  - j. Adjustable Analog Output of 0-1 to 0-10 VAC proportional to volts amps or hertz.
  - k. Digital Output of 12 VDC.
  - l. Adjustable Output Boost.
  - m. Adjustable Thermal overload protection 60% to 100% of drive rating.
  - n. Three sets of single pole double throw contacts indicating run, trip and current limit.
  - o. Automatic restart after a fault to a maximum of 5 attempts.
  - p. Set point mode of operation from a transducer input signal.
  - q. RS232 Port Communication Capacity.
- 9. Acceptable Inputs:
  - a. DC voltage 0-10 VDC.
  - b. DC current 0-50 MaDC.
- 10. Acceptable Start/Stop Commands:
  - a. Closure of contact or switch.
- 11. Options to be provided:
  - a. Prewired H-O-A switch.
  - b. Manual transfer to line power via contactors and including motor thermal overload and fuse protection while in bypass operation.
  - c. Service switch which provides ability to service controller (electrically isolated) while in bypass operation without having to remove power to the motor.
  - d. 5% line reactor

## 2.31 VARIABLE VOLUME TERMINAL BOXES

### A. ACCEPTABLE MANUFACTURERS

- 1. Titus Products Div.; Philips Industries, Inc.
- 2. Nailor
- 3. Metalaire
- 4. JCI

### B. SUBMITTALS

- 1. For each product indicated, include the following:
  - a. Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
  - b. Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
  - c. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
  - d. Wiring Diagrams: Power, signal, and control wiring.

2. Coordination Drawings: Show all VAV terminals on Coordination drawings. Clearly indicate access and service area requirements. Refer to "COORDINATION DRAWINGS" this SECTION.

C. GENERAL

1. Provide where shown on drawings variable volume terminal boxes with hot water reheat coils and pressure independent volume controllers.
- D. Terminals shall be certified under the latest edition of ARI Standard 880. Leakage shall be a maximum of 2 percent of design at 3 inches inlet static pressure.
- E. The terminal casing shall be minimum 22 gauge galvanized steel. Units designed for hospital application shall have liner system with rigid insulation capped with metal nosings/corners to ensure that no insulation or sound attenuator materials come in contact with the air stream. Taped insulation shall not be allowed.
- F. The terminal box shall incorporate multi point center-averaging velocity sensors. The sensor must provide control signal accuracy of +/- 5% at any inlet condition.
- G. The terminal box with Hot water coils shall be provided with factor gasketed access door with cam lock for inspection of heating coil.

2.32 OUTDOOR INSTALLED AIR HANDLER

A. ACCEPTABLE MANUFACTURERS

1. York
2. Trane
3. Carrier

- B. Unit must be specifically designed for outdoor installation.
- C. Factory Fabricate draw-thru type air handling units with fan sections, coil sections, access sections, mixing boxes, filter sections, discharge plenums, humidifier section.
- D. The unit shall be able to withstand up to 1.5 times design static pressure, or 10-inch wc whichever is less, with no more than 0.005 inch deflection per inch of panel span.
- E. Base shall be welded supporting the entire length and width of the unit. Units shipped in one piece shall have at a minimum six points of lift. These lift points shall be designed to accept standard rigging devices. The unit base design shall allow unit to rest on top of roofcurb when field installed. Entire length and width under base shall be sealed in the field with curb gasketing for weather tight seal.
- F. CASING
1. All panels shall be double wall construction. Interior and exterior panels shall be constructed of galvanized steel. Foam panel insulation system shall provide a minimum R value of 12. Insulation shall conform to NFPA 90 requirements. Unit casing must have thermal conductivity as specified using similar construction or superior construction as that which is specified. An R Value of 8 will not be acceptable. Four-inch wall shall be used to achieve the specified R value in lieu of a 2-inch wall construction with lower R value.
  2. Panels shall be fully removable to allow for a proper way to thoroughly clean panels and to access internal parts. If panels are not removable, then manufacturer shall provide

- access sections with doors between all internal components to ensure access and cleanability of the air handler.
3. Access doors shall be constructed with a double-wall of solid G90 galvanized steel interior panel. Gasketing around the full perimeter of the access door shall be used to prevent air and water leakage. Preferred door handle shall not penetrate door casing with single-handle latch.
  4. To facilitate inspection of internal components, provide sealed tempered glass view windows in access doors as specified on schedule.
  5. External surface of unit casing shall be prepared and factory coated with a minimum 1.5 mil enamel finish or equal. Unit casing exterior with factory coating shall be able to withstand a salt spray test in accordance with ASTM B117 for a minimum of 672 consecutive hours. Unit casing will be provided with manufacturer's standard color.
  6. Unit roof shall be sloped a minimum .25 inch per foot either from one side of unit to other or from center to sides of the unit. Roof assembly shall overhang all walls of units by 2 inch minimum.
  7. For units with outside air requirements, manufacturer shall provide inlet hood with high performance sine wave moisture eliminator to prevent water carryover into unit casing from outside air. Hoods shall be sized for 100% economizer cycle. If eliminator is not factory provided, contractor shall be responsible for field supplying and installing in manufacturer's standard outside air inlet hood (s). If louvers are provided, then louvers shall be tested by an Independent AMCA approved laboratory for water carryover and air pressure drop in accordance with AMCA Standard 500, and testing reports shall be supplied with the submittal data.
  8. Galvanized steel roof mounting curb with wood nailing strip, and neoprene gasket shall be supplied by the unit manufacturer. If unit requires external piping cabinet, a separate curb shall be supplied for support of the external cabinet.
- G. DRAIN PAN CONSTRUCTION: The sealed double wall drain pan shall be constructed of Stainless steel and insulated to prevent sweating. The bottom of the drain pan shall be sloped in two planes which pitch the condensate to the drain connection. The drain pan, when the unit is installed and trapped per the manufacturer's installation manual, shall be designed to leave puddles no more than 2-inches in diameter and no more than 1/8-inch deep no longer than 3 minutes following step 4 of the following test. The test steps are:
1. Temporarily plug the drain pan.
  2. Fill the drain pan with 1/2-inch of water or the maximum allowed by the drain depth, whichever is smaller.
  3. Start the fan if it is a draw-thru unit. Do not operate the fan if it is a blow-thru unit.
  4. Remove the temporary plug.
- H. FAN SECTIONS
1. On units with standard Air Foil fans scheduled, provide supply fan section(s) with AF double width, double inlet centrifugal fan designed and suitable for class of service indicated in the unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Key fan wheels to fan shaft to prevent slipping.
  2. Provide self-aligning, grease lubricated pillow-block ball bearings selected for L-50 200,000 hour average life per ANSI/AFBMA 9. Extend both grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to drive side bearing support.
  3. On Plug fan units, provide supply fan sections with AF single width, single inlet centrifugal plug fans designed and suitable for class of service indicated on unit schedule. Fan shaft to be properly sized and protectively coated with lubricating oil. Fan shafts shall be solid and properly designed so that fan shaft does not pass through first critical speed as unit

comes up to rated RPM. Fans shall be statically and dynamically tested as an assembly at the required RPM to meet design specifications. Key fan wheels to fan shaft to prevent slipping.

4. Equip centrifugal plug fans with self-aligning, grease lubricated pillow-block ball bearings selected for L-50 400,000 hour average life per ANSI/AFBMA 9. Extend both grease lubrication fittings to drive side of unit with plastic tubes and zerk fittings rigidly attached to drive side bearing support.
5. Mount fans on isolation bases. Internally mount motors on same isolation bases and internally isolate fans and motors with 2 inch spring seismic isolators. Install flexible canvas ducts between fan and casings to ensure complete isolation. Flexible canvas ducts shall comply with NFPA 90A. If no isolators or flexible canvas duct is provided, then the entire unit shall be externally isolated from the supply duct work and piping by contractor in order to avoid transmission of noise and vibration through the ductwork.
6. Fan sections shall have full height, double wall, hinged doors on drive side for inspection and maintenance of internal components. Construct doors in accordance with Article 2.03 Paragraph E.
7. Weigh fan and motor assembly at AHU manufacturer's factory for isolator selection. Statically and dynamically balance fan section assemblies. Fan section assemblies include fan wheels, shafts, bearings, drives, belts, isolation bases and isolators. Allow isolators to free float when performing fan balance. Measure vibration at each fan shaft bearing in horizontal, vertical and axial directions. Balance at design RPM as scheduled on drawings.

I. MOTORS AND DRIVES

1. Factory install all motors on slide base to permit adjustment of belt tension.
2. Fan Motors shall be heavy duty, premium efficiency open drip-proof, operable at 460 Volts, 60 Hz, 3-phase.
3. V-Belt Drive shall be variable pitch rated on constant volume units and fixed pitch on fans driven by frequency inverters. The service factor shall be at 1.5 times the motor nameplate.

J. VARIABLE FREQUENCY DRIVES

1. Comply with "VARIABLE FREQUENCY DRIVES" this SECTION.

K. COILS SECTION

1. Coils shall be manufactured by the same company as the supplier of the air handling unit. Install coils such that headers and return bends are enclosed by unit casings.
2. The units insulation shall meet UL 181 requirements. The air stream surface of the insulation shall be double wall constructed such that it is not biodegradable, repels water and it can be cleaned to prevent microbial growth. The manufacturer's maintenance instructions shall describe the proper cleaning procedure for the unit.
3. Construct coils of plate fins and seamless tubes. Fins shall have collars drawn, belled and firmly bonded to tubes by means of mechanical expansion of tubes. Do not use soldering or tinning in bonding process.
4. Construct coil casings of stainless steel with formed end supports and top and bottom channels. If two or more coils are stacked in unit, install intermediate drain channels between coils to drain condensate to main drain pans without flooding lower coils or passing condensate through airstream.

L. WATER COOLING COILS

1. Clearly label supply and return headers on outside of units such that direction of coil water flow is counter to direction of unit airflow.
2. Coils shall be proof tested to 300 psig and leak tested to 200 psig air pressure under water.
3. Construct headers of round copper pipe or cast iron.

4. Construct tubes of 1/2 inch O.D. minimum .016 inch thick copper and construct fins of aluminum.

M. STEAM HEATING COILS

1. Clearly label supply and return connections on outside of units.
2. Provide non-freeze steam distributing type coils. Pitch steam coils in units for proper drainage of steam condensate from coils.
3. Proof test coils to 300 psig air under water and leak test coils to 200 psig air pressure under water.
4. Construct headers of cast iron or round copper pipe.
5. Inner tubes shall have orifices that ensure even steam distribution across coil face. Direct orifices toward return connections to ensure steam condensate is discharged from coils.

N. REFRIGERANT COOLING COILS (Alternate)

1. Clearly label suction and liquid connections on outside of units.
2. Proof test coils to 450 psig air under water and leak test coils to 300 psig air pressure under water. Dry insides of coils after testing and seal all connections.
3. Construct suction headers of copper tubing. Suction connections shall penetrate unit casings to allow for sweat connections to refrigerant lines.
4. Coils shall have equalizing type vertical distributors sized in conjunction with capacities of coils.

O. FILTERS

1. Provide factory-fabricated filter section of the same construction and finish as unit casings. Filter sections shall have filter guides and full height, double-wall, hinged doors for filter removal.
2. Filter sections shall flange to other unit components. Provide filter blockoffs as required to prevent air bypass around filters.
3. Provide 2-inch angled pre-filter sections with 30% efficient pleated filters. Filters shall be removable from one side(s) of filter sections.
4. Provide high efficiency final filter sections with 12" cartridge filters. High efficiency filters shall be 90% efficient and rated in accordance with ASHRAE 52 and UL class 1 or class 2. Filters shall be removable from one side of filter sections.

P. DAMPERS

1. Provide internally mounted ultra low leak outside air dampers as scheduled on drawings. Dampers shall be Ruskin CD60 double skin airfoil design or equivalent. Construct damper blades and damper frames of galvanized steel. Provide parallel blade action with metal compressible jamb seals and extruded vinyl blade edge seals. Blades shall rotate on stainless steel sleeve bearings. Damper blade lengths shall not exceed 60 inches. Leakage rate shall not exceed 5 CFM/square foot at one inch water gage and 9 CFM/square foot at 4 inches water gage. All Leakage testing and pressure ratings will be based on AMCA Publication 500.

2.33 RADIANT HEATING PANELS

A. ACCEPTABLE MANUFACTURERS

1. Sterling Company
2. AIRTEX Radiant Systems; a division of Engineered Air Ltd.
3. Rosemex Products.

B. GENERAL

1. Provide Hydronic ceiling radiant panels of sizes and in the locations indicated. Radiant Panels shall be of the finish, style, type, capacities, characteristics and with the accessories indicated.
2. Refer to controls paragraph of these specifications for controls requirement.
3. Refer to detail sheet for valves, vents and other hydronic components not called for by this section of the specification but required for proper installation
4. Radiant panels shall have a 5 year warranty against discoloration.

C. LINEAR RADIANT PANELS

1. Constructed of extruded aluminum planks.
2. Width and number of tubes as per design specifications.
3. Tube saddle shall be an integral part of the aluminum plank.
4. Each panel shall be factory supplied in standard white polyester powder coat
5. Circulation tubing shall be 16 mm (5/8") O.D. round tubing mechanically fastened to the plank. A non-hardening heat transfer paste is required between the tubing and the aluminum saddle.
6. Planks shall interlock using tongue and groove connection and be held together using aluminum or steel cross channels with spring clips.
7. All plank interlocking to be done at the factory with return copper coil factory installed prior to going on site. No site assembly permitted.
8. Backing Insulation: Minimum 1-inch-thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
9. Copper coil is to be continuous. If the manufacturer cannot supply a continuous coil, then return bends must be factory installed and a pressure test report must be submitted to the Mechanical Consultant.
10. The length of the panels shall be field measured and shall run wall to wall unless otherwise indicated on the drawings. The factory to allow for expansion before the final cut. No site cutting allowed.
11. Panel performance shall be certified in accordance with ASHRAE Std 138 Method of Testing Radiant Heating and Cooling Panels. Capacities of installed panels shall be as shown on the drawing.

D. MODULAR RADIANT PANELS:

1. Modular extruded aluminum panel with serpentine water piping, suitable for lay-in installation flush with T-bar ceiling grid, surface mounting, or recessed mounting.
2. Panels: Minimum 0.0336-inch- thick, galvanized-steel sheet.
3. Backing Insulation: Minimum 2-inch-thick, mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB with factory-applied jacket.
4. Exposed-Side Panel Finishes:
  - a. Apply silk-screened finish to match appearance of Architect-selected acoustical ceiling tiles.
  - b. Factory prime coated, ready for field painting.
  - c. Baked-enamel finish in manufacturer's custom paint color as selected by Architect.
5. Factory Piping: ASTM B 88, Type L copper tube with ASME B16.22 wrought-copper fittings and brazed joints. Piping shall be mechanically bonded to panel.
6. Surface-Mounting Trim: Sheetmetal with baked-enamel finish in manufacturer's custom paint color as selected by Architect.

E. ACCESSORIES:

1. Panel with drape track recess.
2. Male bullnose panel.
3. Female bullnose panel.
4. Male corner panel.

5. Female corner panel.
6. Inside corner panel.
7. Filler panel.

#### 2.34 STEAM-INJECTION HUMIDIFIERS

- A. Acceptable Manufacturers:
  1. Armstrong International, Inc.
  2. Nortec Industries, Inc.
- B. Description: Steam valve, separator, and dispersion tube extending across entire width of duct and equipped with mounting brackets for both ends of tube.
- C. Dispersion Tube: ASTM A 666, Type 304 stainless steel, jacketed; insulated with 1/2-inch fiberglass and stainless-steel jacket.
- D. Control Valve: Normally closed valve, with seat and stem matched to deliver required steam flow.
  1. Actuator: Coordinate/comply with the requirements of "AUTOMATIC TEMPERATURE CONTROLS" this SECTION.
- E. Steam Separator: Integral with control valve.
  1. Material: Type 304 stainless steel.
- F. Steam Trap: Inverted-bucket type, sized for maximum condensate flow.
- G. Optional Accessories: Include the following:
  1. Wall-mounted or return-duct-mounted humidistat.
  2. Duct-mounted, high-limit humidistat.
  3. Temperature switch to prevent cold operation.
  4. In-line on-off steam control valve for automatic and total shutdown of humidifier.
  5. In-line strainer.
  6. Airflow switch to prevent humidifier operation when there is no airflow.

#### 2.35 SOUND ATTENUATORS

- A. Provide where shown on drawings duct silencers with acoustical performance characteristics, pressure drops and dimensions shown on schedules. Basis of design for silencers shall be Industrial Acoustics Company. Substitute manufacturers must meet all acoustical and pressure drop requirements of silencers listed in schedules as well as construction and testing and certification requirements listed in this specification.
- B. Outer casings of silencers shall be made of 22 gauge galvanized steel. Seams shall be lock formed and mastic filled. Interior partitions of silencers shall be made of not less than 26 gauge galvanized perforated steel. Filler material shall be of inorganic mineral or glass fiber of a density sufficient to obtain the specified acoustic performance and be packed under not less than 5% compression to eliminate voids due to vibration and settling. Material shall be inert, vermin and moisture proof. Silencers shall not fail structurally when subjected to a differential air pressure of 8" W.C. inside to outside of casing.
- C. Combustion rating of silencer when tested in accordance with ASTM E 84 shall be flame spread of 25 or less, smoke developed of 15 or less and fuel contribution of 20 or less.



- D. Silencer ratings shall be determined in a duct to reverberant room test facility which provides for air flow in both directions through the test silencer in accordance with ASTM E477.
- E. With submittals the manufacturer shall supply certified test data of Dynamic insertion loss, self noise power levels, and aerodynamic performance for reverse and forward flow test conditions. test data shall be for a standard product. All rating tests shall be conducted in the same facility, shall utilize the same silencer and shall be open to inspection upon request from the Engineer.
- F. For silencers used in Hospital, Medical Office other health care applications packless silencers shall be used. Packless silencers shall also be used for other applications if specifically called for on the schedules. These silencers shall not use any sound absorptive material of any kind. Packless silencers shall attenuate air transmitted noise solely by virtue of controlled impedance membranes and broadly tuned resonators.

## 2.36 AUTOMATIC TEMPERATURE CONTROLS – FACILITIES MANAGEMENT SYSTEM

### A. ACCEPTABLE MANUFACTURERS

- a. Honeywell

### B. EXTENSION OF EXISTING BUILDING AUTOMATION SYSTEM

- 1. The work shall be an extension of the existing facilities management system. Provide all necessary components for a complete operational system.
- 2. Provide new or updated graphics and operator station software as necessary to control the new components from the existing Operator workstation.
- 3. Extend the existing Local Area Network as necessary.

### C. GENERAL

- 1. The Automatic Temperature Control (ATC) Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Facilities Management Systems (FMS) of similar size, scope and complexity to the FMS specified in this Contract.
- 2. The ATC Contractor shall be a recognized national manufacturer, installer and service provider of FMS. Distributors, manufacturer's representatives and wholesalers will not be acceptable.
- 3. The ATC Contractor shall have a branch facility within a 50-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. This branch facility shall provide the work for this project. This support facility shall have spare parts and all necessary test and diagnostic equipment required to install, commission and service the specified FMS.
- 4. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the ATC business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
- 5. The FMS architecture shall consist of the products of a manufacturer regularly engaged in the production of Facility Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.
- 6. FMS Manufacturers system shall be Direct Digital Control (DDC) BACNET compatible. Comply with ASHRAE 135 for FMS control components.

### D. SYSTEM DESCRIPTION

- 1. The Basis of Design Is Honeywell
- 2. The FMS shall be a complete Direct Digital Control (DDC) system designed for use on Intranets and the Internet. This functionality shall extend into the equipment rooms.

- Primary nodes located in equipment rooms and similar shall be fully IT compatible devices that mount and communicate directly on the IT infrastructure.
3. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the ATC manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser such as Internet Explorer or Netscape.
  4. The ATC work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, verification, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items as Specified in these Division documents which are required for the complete, fully functional and commissioned system.
  5. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software and configurations to be provided for this Project.
  6. Manage and coordinate the ATC work in a timely manner in consideration of the Project schedules. Coordinate cooperatively with the associated work of other trades so as to assist the progress and not impede or delay the work of associated trades.
  7. The FMS as provided shall incorporate, at minimum, the following integrated features, functions and services:
    - a. Operator information, alarm management and control functions at any Operator's console without the need to purchase special software from the ATC manufacturer for those consoles.
    - b. Enterprise-level information and control functions.
    - c. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
    - d. Diagnostic monitoring and reporting of FMS functions.
    - e. Offsite monitoring and management
    - f. Energy management
  8. The FMS shall be designed entirely for use on intranets and internets. All networking technology used at the Tier 1 level shall be off the shelf, industry standard technology fully compatible with other owner provided networks in the facility.
  9. All aspects of the user interface shall be via browsers. Any PCs used as operator interface points shall not require the purchase of any special software from the manufacturer in order to provide the complete user interface as described herein.
  10. The user interface will be complete as described herein, providing complete tool sets, operational features, multi- panel displays, and other display features. Systems which merely provide HTML based web pages as the operator interface will not be acceptable.
  11. The primary components of the system will be the Control Units located at the highest level of the network architecture.
  12. The FMS shall consist of a number of control units and associated equipment connected by industry standard network practices. All communication between control units shall be by digital means only.
  13. The FMS network shall at minimum comprise of the following:
    - a. Network processing, data storage and communication equipment.
    - b. Routers, bridges, switches, hubs, modems and like communications equipment.
    - c. Active processing Nodes including field panels.
    - d. Intelligent and addressable elements and end devices.
    - e. Third-party equipment interfaces.
    - f. Other components required for a complete and working FMS.
  14. All FMS features shall be accessible via Enterprise Intranet and Internet browser with equivalent FMS access control for user access.

15. The FMS shall support auto-dial/auto-answer communications to allow FMS nodes to communicate with other remote FMS Nodes via standard telephone lines - DSL or voice grade.
16. Provide licenses for all software residing in the FMS and transfer these licenses to the Owner prior to completion.
17. Power Fail / Auto Restart
  - a. Provide for the automatic orderly and predefined shutdown of parts or all of the FMS following total loss of power to parts or all of the FMS.
  - b. Provide for the automatic orderly and predefined startup of all parts of the FMS following total loss of power to those parts or all of the FMS. Archive and annunciate time and details of restoration.
  - c. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.
  - d. Maintain the FMS real-time clock operation during periods of power outage for a minimum of 72 hours.
18. Downloading And Uploading
  - a. Provide the capability to generate FMS software-based sequences, database items and associated operational definition information and user-required revisions to same at any Operator PC, and the means to download same to the associated control units.

E. SUBMITTALS

1. Shop Drawings, Product Data, and Samples
2. The ATC Contractor shall submit a list of all shop drawings with submittal dates within 30 days of contract award.
3. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect for Contract compliance.
4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the ATC Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Architect.
5. At a minimum, submit the following:
  - a. FMS network architecture diagrams including all nodes and interconnections.
  - b. Schematics, sequences and flow diagrams.
  - c. Points schedule for each real point in the FMS, including: Tag, Point Type, System Name and Display Units. [Node Type, Address, Cable Destination, Module Type, Terminal ID, Panel, Slot Number, Reference Drawing, and Cable Number.]
  - d. Samples of Graphic Display screen types and associated menu penetrations to show hierarchy and functional interrelationships.
  - e. Detailed Bill of Material list for each Node, identifying quantity, part number, description, and optional features.
  - f. Control Damper Schedule including a separate line for each damper and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Blade Type, Bearing Type, Seals, Duct Size, Damper Size, Mounting, and Actuator Type.
  - g. Control Valve Schedules including a separate line for each valve and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Calculated CV, Design Pressure, Actual Pressure, and Actuator Type.
  - h. Room Schedule including a separate line for each VAV box and terminal unit indicating minimum/maximum cfm, pickup gain, box area, and bias setting.
  - i. Details of all FMS interfaces and connections to the work of other trades.
  - j. Product data sheets for all products including software.

- k. Training provided, including outlines for each session.

#### F. RECORD DOCUMENTATION

1. Operation and Maintenance Manuals shall be provided to the Owner's Representative upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the FMS provided:
  - a. Table of contents.
  - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
  - c. Manufacturers product data sheets for all products including software.
  - d. System Operator's manuals.
  - e. Archive copy of all site-specific databases and sequences.
  - f. network diagrams.
  - g. Wiring termination schedules.
  - h. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the project record drawings and data sheets. A logically organized table of contents shall provide dynamic links to view and print all project record drawings and product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents. The CD-ROM(s) shall contain adequate space for future system updates.
3. On-line Documentation: After completion of all the tests and adjustments listed above, the contractor shall install the following information on the FMS:
  - a. "AS BUILT" drawing files
  - b. Detailed catalog data on all installed system components with address and phone number of factory repair service.

#### G. WARRANTY

1. Provide a one-year labor and material warranty on the FMS.
2. If within twelve (12) months from the date of acceptance of product, upon written notice from the owner, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the ATC Contractor at the cost of the ATC Contractor.
3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during ATC Contractor's normal business hours.
4. Maintain an on-site record of all work done, all items removed from site, all items returned to site, all new replacement items installed and all remedial programming and database entry work undertaken including software revisions installed. Maintain a record of all recalibrations required as a result of Warranty service.

#### H. COMMISSIONING

1. Fully commission all aspects of the Facility Management System work.
2. Acceptance Check Sheet
  - a. Prepare a check sheet that includes all points for all functions of the FMS
  - b. Submit the check sheet to the Engineer for approval one month prior to testing.
  - c. Complete the check sheet for all items and functions of the FMS and initial each entry with time/date as record of having fully calibrated and tested the FMS. Submit to Engineer.
3. The Engineer will use the check sheet as the basis for acceptance testing with the ATC Contractor.
4. VAV box performance verification and documentation:
  - a. The ATC Contractor shall test each VAV box for where the dampers in one half of a group of boxes are stepped towards full open while the other half are stepped

towards full closed. At each step, after a settling time, box air flows and damper positions will be sampled. Following the cycle, a pass/fail report indicating results shall be produced. Possible results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.

- b. The ATC Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance. The sampling shall take place after completion of Test and Balance, when design cooling and heating media have been available and occupied conditions approximated for five consecutive days.
5. Provide all necessary specialist labor, materials and tools to demonstrate to the Engineer that the FMS has been commissioned and is operating in compliance with the contract. Prepare a list of noted deficiencies signed by both the Engineer and the ATC Contractor.
6. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

#### I. OPERATOR STATION

1. Utilize existing workstation. Upgrade memory, storage, and software as required to support new system points.

#### J. CONTROL UNITS

1. Units: Modular in design and consisting of processor board with programmable RAM memory, local operator access and integral interface equipment.
2. Memory shall be backed up with non volatile EEPROM.
3. Control Units Functions:
  - a. Monitor or control each input/output point.
  - b. Completely independent with hardware clock/calendar and software to maintain control independently.
  - c. Acquire, process, and transfer information to operator station or other control units on network.
  - d. Accept, process, and execute commands from other control unit's or devices or operator stations.
  - e. Access both data base and control functions simultaneously.
  - f. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.
  - g. Perform in stand-alone mode:
    - 1) Start/stop.
    - 2) Duty cycling.
    - 3) Automatic Temperature Control.
    - 4) Demand control via a sliding window, predictive algorithm.
    - 5) Event initiated control.
    - 6) Calculated point.
    - 7) Scanning and alarm processing.
    - 8) Full direct digital control.
    - 9) Trend logging.
    - 10) Global communications.
    - 11) Maintenance scheduling.
4. Global Communications:
  - a. Broadcast point data onto network, making that information available to all other system control units.
  - b. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.
5. Input/Output Capability:

- a. Discrete/digital input (contact status).
- b. Discrete/digital output.
- c. Analog input.
- d. Analog output.
- e. Pulse input (5 pulses/second).
- f. Pulse output (0-655 seconds in duration with 0.01 second resolution).
6. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Install control unit's with minimum 30 percent spare capacity.
7. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.
8. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.
9. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:
  - a. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.
  - b. Control output points but change only data base state or value; leave external field hardware unchanged.
  - c. Enable control actions on output points but change only data base state or value.
10. Local display and adjustment panel: [Portable] [or] [Integral to] control unit, containing digital display, and numerical keyboard. Display and adjust:
  - a. Input/output point information and status.
  - b. Controller set points.
  - c. Controller tuning constants.
  - d. Program execution times.
  - e. High and low limit values.
  - f. Limit differential.
  - g. Set/display date and time.
  - h. Control outputs connected to the network.
  - i. Automatic control outputs.
  - j. Perform control unit diagnostic testing.
  - k. Points in "Test" mode.
11. Each Control unit shall be equipped with the necessary un-interruptible power such that it will not cease operation during minor power outages, including those that occur upon transfer to emergency generator or other local power source not provided by the utility.

K. LOCAL AREA NETWORKS (LAN)

1. Provide communication between control units over local area network (LAN).
2. LAN Capacity: Extend existing BAS LAN to all new equipment and points.
3. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.
4. LAN Data Speed: Minimum 100 Mbs.
5. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.
6. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.
7. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

L. OPERATING SYSTEM SOFTWARE

1. Input/Output Capability From Operator Station:
  - a. Request display of current values or status in tabular or graphic format.
  - b. Command selected equipment to specified state.
  - c. Initiate logs and reports.
  - d. Change analog limits.
  - e. Add, delete, or change points within each control unit or application routine.
  - f. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.
  - g. Add new control units to system.
  - h. Modify and set up maintenance scheduling parameters.
  - i. Develop, modify, delete or display full range of color graphic displays.
  - j. Automatically archive select data even when running third party software.
  - k. Provide capability to sort and extract data from archived files and to generate custom reports.
  - l. Support two printer operations.
    - 1) Alarm printer: Print alarms, operator acknowledgements, action messages, system alarms, operator sign-on and sign-off.
    - 2) Data printer: Print reports, page prints, and data base prints.
  - m. Select daily, weekly or monthly as scheduled frequency to synchronize time and date in digital control units. Accommodate daylight savings time adjustments.
  - n. Print selected control unit data base.
2. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.
3. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:
  - a. Add and delete points.
  - b. Modify any point parameter.
  - c. Change, add, or delete English language descriptors.
  - d. Add, modify, or delete alarm limits.
  - e. Add, modify, or delete points in start/stop programs, trend logs, etc.
  - f. Create custom relationship between points.
  - g. Create or modify DDC loops and parameters.
  - h. Create or modify override parameters.
  - i. Add, modify, and delete any applications program.
  - j. Add, delete, develop, or modify dynamic color graphic displays.
4. Dynamic Color Graphic Displays:
  - a. Utilizes custom symbols or system supported library of symbols.
  - b. Sixteen 256 colors.
  - c. Sixty (60) outputs of real time, live dynamic data per graphic.
  - d. Dynamic graphic data.
  - e. 1,000 separate graphic pages.
  - f. Modify graphic screen refresh rate between 1 and 60 seconds.
5. Operator Station:
  - a. Accept data from LAN as needed without scanning entire network for updated point data.
  - b. Interrogate LAN for updated point data when requested.
  - c. Allow operator command of devices.
  - d. Allow operator to place specific control units in or out of service.
  - e. Allow parameter editing of control units.
  - f. Store duplicate data base for every control unit and allow down loading while system is on line.
  - g. Control or modify specific programs.
  - h. Develop, store and modify dynamic color graphics.

- i. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.
6. Alarm Processing:
  - a. Off normal condition: Cause alarm and appropriate message, including time, system, point descriptor, and alarm condition. Select alarm state/value and which alarms shall cause automatic dial-out.
  - b. Critical alarm or change-of-state: Display message, stored on disk for review and sort, or print.
  - c. Print on line changeable message, up to 60 characters in length, for each alarm point specified.
  - d. Display alarm reports on video. Display multiple alarms in order of occurrence.
  - e. Define time delay for equipment start-up or shutdown.
  - f. Allow unique routing of specific alarms.
  - g. Operator specifies if alarm requires acknowledgement.
  - h. Continue to indicate unacknowledged alarms after return to normal.
  - i. Alarm notification:
    - 1) Automatic print.
    - 2) Display indicating alarm condition.
    - 3) Selectable audible alarm indication.
7. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.
8. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.
9. Messages:
  - a. Automatically display or print user-defined message subsequent to occurrence of selected events.
  - b. Compose, change, or delete any message.
  - c. Display or log any message at any time.
  - d. Assign any message to any event.
10. Reports:
  - a. Manually requested with time and date.
  - b. Long term data archiving to hard disk.
  - c. Automatic directives to download to transportable media such as floppy diskettes for storage.
  - d. Data selection methods to include data base search and manipulation.
  - e. Data extraction with mathematical manipulation.
  - f. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.
  - g. Generating reports either normally at operator direction, or automatically under work station direction.
  - h. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.
  - i. Include capability for statistical data manipulation and extraction.
  - j. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.
11. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.
12. Data Collection:
  - a. Automatically collect and store in disk files.
  - b. Daily electrical energy consumption, peak demand, and time of peak demand for up to electrical meters over 2 year period.
  - c. Daily consumption for up to 30 meters over a 2 year period.



- d. Daily billable electrical energy consumption and time for up to 1024 zones over a 10 year period.
- e. Provide archiving of stored data for use with system supplied custom reports.
- 13. Graphic Display: Support graphic development on work station with software features:
  - a. Page linking.
  - b. Generate, store, and retrieve library symbols.
  - c. Single or double height characters.
  - d. Sixty (60) dynamic points of data per graphic page.
  - e. Pixel level resolution.
  - f. Animated graphics for discrete points.
  - g. Analog bar graphs.
  - h. Display real time value of each input or output line diagram fashion.
- 14. Dynamic Color Graphics
  - a. Provide dynamic 256 color graphics for the following systems:
    - 1) Boiler Plant including pumps.
    - 2) Chiller plant including pumps and cooling tower
    - 3) Each air handling unit.
    - 4) Floor plans including each terminal box on each floor.
  - b. Graphical displays shall update in real time and shall include every point which is monitored or controlled. Ie a cooling tower graphic shall include entering and leaving condenser water temperature, fan(s) status, fan(s) speed and bypass valve position (if a bypass valve is used).
  - c. All access to graphics shall be via mouse input - no keyboard input shall be required. Each point shall be a maximum of three mouse clicks away ie choose desired floor plan, click on volume box on floor plan, click on point on volume box to be accessed.
  - d. Schematics included with the construction documents shall be used as a basis for producing the graphics. Points which are in alarm shall be clearly indicated on each graphic.
  - e. Graphics of variable volume boxes shall be included on each floor plan and shall reference the variable volume box number on the contract documents HVAC schedule. Graphics shall list for each box the rooms or areas served by the box.
- 15. Maintenance Management:
  - a. Run time monitoring, per point.
  - b. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.
  - c. Equipment safety targets.
  - d. Display of maintenance material and estimated labor.
  - e. Target point reset, per point.
- 16. Advisories:
  - a. Summary which contains status of points in locked out condition.
  - b. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.
  - c. Report of power failure detection, time and date.
  - d. Report of communication failure with operator device, field interface unit, point, programmable control unit.

**M. TERMINAL BOX UNIT CONTROLLERS**

- 1. The controls contractor shall furnish the terminal control unit controller, damper motor, and flow transducer for installation on each terminal unit by the terminal unit manufacturer under Division 15. These devices shall be delivered to the terminal unit manufacturer's factory in sufficient time for the terminal unit manufacturer to meet their schedule obligations. The cost of factory mounting, wiring, enclosure to meet local code and any factory testing and programming of the terminal control unit shall be included by the terminal box manufacturer.

2. The control contractor shall be responsible for installation of space sensors and communications transmission bus.
3. The terminal box manufacturer shall provide a flow cross or two (2) pipe sensor suitable for interfacing with a Microbridge flow transducer.
4. The sheetmetal contractor shall provide a minimum of three (3) duct diameters of straight duct upstream from the terminal box inlet.
5. The sheetmetal contractor shall insure all terminal box controllers are located a minimum of three (3) feet from all obstructions (walls, pipes, etc.) so as to remain accessible.
6. The sheetmetal contractor shall provide for dry storage of terminal units and mounted terminal box controllers upon receipt at jobsite.
7. The air flow balancing contractor shall check all terminal units and make any changes in the air flow parameters to ensure that the terminal box controls perform in accordance with the approved specifications and schedules.
8. Terminal Equipment Control Units (TEC's) shall be provided for direct digital control of terminal vav boxes as specified. Units shall be UL Listed (UL916 PAZX, 864 UDTZ) and CSA approved.
9. The VAV box controllers shall be powered from a 24 VAC source and shall function normally under an operating range of 18 to 28 VAC (-25% to +17%), allowing for power source fluctuations and voltage drops. The BMCS contractor shall provide a dedicated power source and separate isolation transformer for each controller unable to function normally under the specified operating range. The controllers shall also function normally under ambient conditions of 32-122 Deg.F. and 10% to 95%RH (non-condensing). Provide each controller with a suitable cover or enclosure to protect the intelligence board assembly.
10. The controller shall include a differential pressure transducer that shall connect to the terminal unit manufacturer's standard averaging air velocity sensor to measure the average differential pressure in the duct. The controller shall convert this value to actual air flow. Single point air velocity sensing is not acceptable. The differential pressure transducer shall have a measurement range of 0 to 4000 f.p.m. and measurement accuracy of +/- 5% at 400 to 4000 fpm , insuring primary air flow conditions shall be controlled and maintained to within +/- 32 FPM of setpoint at the specified parameters. The BMCS contractor shall provide the velocity sensor if required to meet the specified functionality.
11. Each controller shall include provisions for manual and automatic calibration of the differential pressure transducer in order to maintain stable control and insuring against drift over time. Calibration shall be accomplished by stroking the terminal unit damper actuator to a 0% position so that a 0 cfm air volume reading is sensed. The controller shall automatically accomplish this whenever the system mode switches from occupied to unoccupied or vice versa. Manual calibration may be accomplished by either commanding the actuator to 0% via the portable terminal or by depressing the room sensor override switch. Calibration of the transducer at the controller location shall not be necessary.
12. The VAV box controller shall interface to a matching room temperature sensor as previously specified. The controller shall function to maintain space temperature to within +/- 1.5 Deg. of setpoint at the room sensor location.
13. A damper actuator shall mount on the damper shaft and shall provide complete modulating control of the damper.
  - a. The actuator motor shall de-energize when the damper has reached the operator or system determined position.
  - b. Damper actuator position status shall be monitored from the central or remote operator's terminal and shall be displayed in percent open notation. Systems which provide only end switch feedback are not acceptable.
  - c. The actuator shall be a removable and separate device from the Terminal Equipment Control Unit. If integral to the Terminal Equipment Control Unit, the

actuator shall be removable for servicing without removing the Terminal Equipment Control Unit.

14. The valve actuators shall mount on the valve body and provide complete modulating control of the valve.
  - a. The valve actuator motor shall be of the non-stall type and shall de-energize when the valve has reached either the operator or system determined position.
  - b. Valve position status shall be monitored from the central or remote operator's terminal and shall be displayed in percent open notation. Systems which provide only end switch feedback are not acceptable.
  - c. Changes made during setup or normal operation to the Terminal Equipment Control Unit by the portable operator's terminal or central terminal shall not be affected by loss of communication on the LAN communication bus.
  - d. It shall not be necessary to disconnect the communications bus for communication between the Portable Operator's Terminal and the Terminal Equipment Control Unit.
  - e. Each controller performing space heating control shall incorporate an algorithm allowing for modulation of a hot water reheat valve as required to satisfy space heating requirements. Each controller shall also incorporate an algorithm that allows for resetting of the associated air handling unit discharge temperature if required to satisfy space cooling requirements. This algorithm shall function to signal the respective Network controller to perform the required discharge temperature reset in order to maintain space temperature cooling setpoint.

#### N. SENSORS

1. Electronic Sensors: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
2. Thermistor temperature sensors as follows:
  - a. Accuracy: Plus or minus 0.36 deg F at calibration point.
  - b. Wire: Twisted, shielded-pair cable.
  - c. Insertion Elements in Ducts and equipment: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  - d. Averaging Elements in Ducts and equipment: 72 inches long, flexible use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
  - e. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
  - f. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
  - g. Room Security Sensors: Stainless-steel cover plate with insulated back and security screws.
3. Resistance Temperature Detectors: Platinum.
  - a. Accuracy: Plus or minus 0.2 percent at calibration point.
  - b. Wire: Twisted, shielded-pair cable.
  - c. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
  - d. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
  - e. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
  - f. Room Sensors refer to construction and accessories below.
  - g. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
4. Humidity Sensors: Bulk polymer sensor element.
  - a. Accuracy: 5 percent full range with linear output.
  - b. Room Sensors: Span of 25 to 90 percent relative humidity with 2% accuracy.

- c. Duct and Outside-Air Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
  5. Room Security Sensors: Stainless-steel 304 flush mount cover plate with insulated back and security screws.
  6. Room Sensor Cover Construction (non psychiatric patient areas only): Manufacturer's standard locking covers.
    - a. Set-Point Adjustment: exposed, digital.
    - b. Set-Point Indication: exposed, digital.
    - c. Thermometer: exposed, digital.
    - d. Color: Off-White
  7. Room Sensor accessories include the following:
    - a. Insulating Bases: For thermostats located on exterior walls.
  8. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
    - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
    - b. Output: 4 to 20 mA.
    - c. Building Static-Pressure Range: 0 to 0.25 inch wg
    - d. Duct Static-Pressure Range: 0 to 5 inches wg.
  9. Pressure Transmitters: Direct acting for gas, liquid, or steam service; range suitable for system; proportional output 4 to 20 mA.
  10. Equipment operation sensors as follows:
    - a. Status Inputs for Fans: Differential-pressure switch with adjustable range of 0 to 5 inches wg.
    - b. Status Inputs for Pumps: Differential-pressure switch piped across pump with adjustable pressure-differential range of 8 to 60 psig
    - c. Status Inputs for Electric Motors: Current-sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.
  11. Electronic Valve/Damper Position Indication: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.
  12. Water-Flow Switches: Pressure-flow switches of bellows-actuated mercury or snap-acting type, with appropriate scale range and differential adjustment, with stainless-steel or bronze paddle. For chilled-water applications, provide vapor proof type.
- O. AIRFLOW/TEMPERATURE MEASUREMENT DEVICES
  1. Manufacturer
    - a. The model numbers and components below are based on the IAQ Gold Series system by Ebtron Inc. This specification is meant to establish a standard of quality only and is not meant to limit competitive bidding by other manufacturers. Requirements below for data logging may be performed at DDC panel if desired.
  2. Provide airflow/temperature measurement devices where indicated on the plans and/or specifications. Fan inlet measurement devices shall not be substituted for duct or plenum measurement devices indicated on the plans.
  3. Each measurement device shall consist of one or more sensor probe assemblies and a single microprocessor-based transmitter. Each sensor probe assembly will contain one or more independently wired sensor housings. Multiple sensor housings shall be equally weighted and averaged by the transmitter prior to output. Pitot tubes and arrays are not acceptable. Vortex shedding flow meters are not acceptable.
  4. All Sensor Probe Assemblies
    - a. Each sensor housing shall be manufactured of a U.L. listed engineered thermoplastic.
    - b. Each sensor housing shall utilize two hermetically sealed, bead-in-glass thermistor probes to determine airflow rate and ambient temperature. Devices that use "chip" type thermistors are unacceptable. Devices that do not have 2 thermistors in each sensor housing are not acceptable.

- c. Each sensor housing shall be calibrated at a minimum of 16 airflow rates and have an accuracy of +/-2% of reading over the entire operating airflow range. Each sensor assembly shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
    - 1) Devices whose accuracy is the combined accuracy of the transmitter and sensor probes must demonstrate that the total accuracy meets the performance requirements of this specification throughout the measurement range.
  - d. The operating temperature range for the sensor probe assembly shall be -20° F to 160° F. The operating humidity range for the sensor probe assembly shall be 0-99% RH (non-condensing).
  - e. Each temperature sensor shall be calibrated at a minimum of 3 temperatures and have an accuracy of +/-0.15° F over the entire operating temperature range. Each temperature sensor shall be calibrated to standards that are traceable to the National Institute of Standards and Technology (NIST).
  - f. Each sensor probe assembly shall have an integral, U.L. listed, plenum rated cable and terminal plug for connection to a remotely mounted transmitter. All terminal plug interconnecting pins shall be gold plated.
  - g. Each sensor assembly shall not require matching to the transmitter in the field.
  - h. A single manufacturer shall provide both the airflow/temperature measuring probe(s) and transmitter at a given measurement location.
5. Duct and Plenum Sensor Probe Assemblies
- a. Sensor housings shall be mounted in an extruded, gold anodized, 6063 aluminum tube probe assembly.
  - b. The number of sensor housings provided for each location shall be determined by the manufacturer based on the requirements of the application.
  - c. Probe assembly mounting brackets shall be constructed of 304 stainless steel. Probe assemblies shall be mounted using one of the following options:
    - 1) Insertion mounted through the side or top of the duct
    - 2) Internally mounted inside the duct or plenum
    - 3) Standoff mounted inside the plenum
  - d. The operating airflow range shall be 0 to 5,000 FPM unless otherwise indicated on the plans.
6. Fan Inlet Sensor Probe Assemblies
- a. Sensor housings shall be mounted on 304 stainless steel blocks.
  - b. Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel plated steel.
  - c. Mounting feet shall be constructed of 304 stainless steel.
  - d. The operating airflow range shall be 0 to 10,000 FPM unless otherwise indicated on the plans.
7. Transmitters
- a. The transmitter shall have an LCD display capable of displaying airflow and temperature. Airflow shall be field configurable to be displayed as a velocity or a volumetric rate.
  - b. The transmitter shall be capable of displaying the individual airflow and temperature readings of each sensor on the LCD display.
    - 1) The transmitter shall operate on 24 VAC. The transmitter shall not require an isolated power source.
  - c. The operating temperature range for the transmitter shall be -20° F to 120° F. The transmitter shall be protected from weather and water.
  - d. The transmitter shall be capable of communicating with the host controls using one of the following interface options:
    - 1) Linear analog output signal: Field selectable, fuse protected and isolated, 0-10VDC and 4-20mA (4-wire)

- 2) RS-485: Field selectable BACnet-MS/TP, ModBus-RTU and Johnson Controls N2 Bus
  - 3) 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, ModBus-TCP and TCP/IP
  - 4) LonWorks Free Topology
8. The measuring device shall be UL listed as an entire assembly.
  9. The manufacturer's authorized representative shall review and approve placement and operating airflow rates for each measurement location indicated on the plans and/or called for in specifications. A written report shall be submitted to the consulting mechanical engineer if any measurement locations do not meet the manufacturer's placement requirements.

P. AUTOMATIC CONTROL VALVES:

1. All automatic control valves shall be fully proportioning with modulating plug or V-port inner guides, unless otherwise specified. The valves shall be quiet in operation and fail-safe in either normally open or normally closed position in the event of power failure. All valves shall be capable of operation in sequence when required by the sequence of operation. All control valves shall be sized by the control manufacturer and shall be guaranteed to meet the heating loads as specified. All control valves shall be suitable for the pressure conditions involved. Valve operators shall be of the electronic actuating type and be fully modulating or two position type as indicated under the sequence of operation. Body pressure rating and connection type (screwed or flanged) shall conform to pipe schedule in this specification.
  - a. All valves sequenced with other valves, or control devices, shall be equipped with pilot positioners.
  - b. Hot water control valves shall be single-seated type with equal percentage flow characteristics. The valve discs shall be composition type with bronze trim.

Q. DAMPERS:

1. Automatic dampers, furnished by the Control Contractor shall be single or multiple blade as required. Dampers are to be installed by the sheetmetal contractor under the supervision of the temperature control contractor. All blank-off plates and conversions necessary to install smaller than duct size dampers are the responsibility of the sheetmetal contractor.
  - a. All damper frames are to be constructed of #13 gauge galvanized sheetmetal and shall have flanges for duct mounting.
  - b. Damper blades shall not exceed 6" in width. All blades are to be of corrugated type construction, fabricated from two (2) sheets of #22 galvanized sheet steel, spot welded together. Blades are to be suitable for high velocity performance.
  - c. All damper bearings are to be made of nylon. Bushings that turn in the bearings are to be oil-impregnated sintered metal.
  - d. Replaceable butyl rubber seals are to be provided with the damper. Seals are to be installed along the top, bottom and sides of the frame and along each blade edge. Seals shall provide a tight-closing, low-leakage damper. Leakage and flow characteristic charts must be submitted to the engineer prior to approval of dampers.

R. DAMPER OPERATORS:

1. Electronic direct-coupled actuation shall be provided.
2. The actuator shall be direct-coupled over the shaft, enabling it to be mounted directly to the damper shaft without the need for connecting linkage. The fastening clamp assembly shall be of a "V" bolt design with associated "V" shaped toothed cradle attaching to the shaft for maximum strength and eliminating slippage. Spring return actuators shall have a "V" clamp assembly of sufficient size to be directly mounted to an integral jackshaft of

- up to 1.05 inches when the damper is constructed in this manner. Single bolt or set screw type fasteners are not acceptable.
3. The actuator shall have electronic overload or digital rotation sensing circuitry to prevent damage to the actuator throughout the entire rotation of the actuator. Mechanical end switches or magnetic clutch to deactivate the actuator at the end of rotation are not acceptable.
  4. For power-failure/safety applications, an internal mechanical spring return mechanism shall be built into the actuator housing. Non-mechanical forms of fail-safe operation are not acceptable.
  5. All spring return actuators shall be capable of both clockwise or counterclockwise spring return operation by simply changing the mounting orientation.
  6. Proportional actuators shall accept a 0 to 10 VDC or 0 to 20 mA control input and provide a 2 to 10 VDC or 4 to 20 mA operating range. An actuator capable of accepting a pulse width modulating control signal and providing full proportional operation of the damper is acceptable. All actuators shall provide a 2 to 10 VDC position feedback signal.
  7. All 24 VAC/VDC actuators shall operate on Class 2 wiring and shall not require more than 10 VA for AC or more than 8 watts for DC applications. Actuators operating on 120 VAC power shall not require more than 10 VA. Actuators operating on 230 VAC power shall not require more than 11 VA.
  8. All non-spring return actuators shall have an external manual gear release to allow manual positioning of the damper when the actuator is not powered. Spring return actuators with more than 60 in-lb torque capacity shall have a manual crank for this purpose.
  9. All modulating actuators shall have an external, built-in switch to allow the reversing of direction of rotation.
  10. Actuators shall be provided with a conduit fitting and a minimum three-foot electrical cable and shall be pre-wired to eliminate the necessity of opening the actuator housing to make electrical connections.
  11. Actuators shall be Underwriters Laboratories Standard 873 listed and Canadian Standards Association Class 4813 02 certified as meeting correct safety requirements and recognized industry standards.
  12. Actuators shall be designed for a minimum of 60,000 full stroke cycles at the actuator's rated torque and shall have a 2-year manufacturer's warranty, starting from the date of installation. Manufacturer shall be ISO9001 certified.

S. DDC COMPONENT INSTALLATION

1. EXAMINATION

- a. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, and wiring is installed prior to installation proceeding.

2. INSTALLATION

- a. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.
- b. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation.
- c. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.
- d. All electric wiring and wiring connections, either line voltage or low voltage, required for the installation of the temperature control system, as herein specified, shall be provided by the temperature control contractor unless specifically shown on the electrical drawings or called for in the electrical specifications. The wiring installation shall be in accordance with National and Local Codes and with the Electrical portion of these specifications. All wiring shall be run concealed wherever possible. Exposed wiring shall be run in raceways. Raceways shall be

Wiremold 200 series with all elbows, raceways, covers, mounting stops, box extensions and wiring for a complete and neat installation.

- e. All wiring shall comply with the requirements of the DIVISION 16 – ELECTRICAL.
3. MANUFACTURER'S FIELD SERVICES
- a. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.
  - b. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.
  - c. Provide basic operator training for 3 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

T. SEQUENCE OF OPERATION

- 1. General
  - a. All setpoints and time delays mentioned in the following sequences shall be adjustable by the operator without any hardware or software revisions.
  - b. All sequences of operations shall be performed by direct digital control (DDC) panels. Software in the DDC panels shall determine occupied, and unoccupied mode of operation. Names for all points and variables shall be coordinated with owner and/or Engineer.
  - c. Fail-safe positions are position that devices will go to when de-energized: no = normally open, nc = normally closed. All heating coils (pre-heat, heating and reheat) shall have two way control valve arrangement with the normally open position (stay open on power failure) to the coil.
  - d. Whenever a piece of HVAC equipment is off per the control system or main power is disconnected, the control devices for the unit shall go to their fail-safe position.
  - e. Supply and return smoke isolation dampers (nc) for air handling shall close whenever associated unit is off. Provide end switches to verify position of dampers before unit starts.
  - f. For air handling units outdoor air flow measuring stations (FMS) shall be used to monitor and display respective air volumes on attached magnehelics (calibrated in cfm) and at the control systems central computer display via transducers. The airflows shall be used by the control system to track return fan with the supply fan, and to measure and ensure that minimum outside air for ventilation is maintained.
  - g. All cooling coils shall have three way control valve arrangement and shall fail in the closed position (stay closed on power failure) to the coil.
  - h. Air handling units shall have outdoor air, supply air and return air flow measuring stations (AFMS) to monitor and display respective air volumes on attached magnehelics (calibrated in cfm) and at the control systems central PC display via transducers. The airflows shall be used by the control system to track return fan with the supply fan, and to measure and log the actual outdoor air coming into air handler, to pressurize the building and ensure that minimum outside air for ventilation is maintained.
  - i. Dampers shall be provided by automatic temperature controls contractor including those for air handling units.
- 2. CRITICAL SYSTEMS
  - a. Refer to drawings for equipment and systems on emergency power. All associated DDC components required to operate equipment on emergency power will be on the emergency power system. System include but are not limited to the following:
    - 1) Heating Plant
      - a) Hot Water Pumps
      - b) Heat Exchangers
      - c) Controls
      - d) Air Handlers



3. FIRE ALARM INTERLOCKS
  - a. Air Handler Smoke Control: Smoke detector, located in supply and return air, signals alarm, stops fans, and closes smoke dampers when products of combustion are detected in airstream.
4. AIR-HANDLING UNIT CONTROL SEQUENCES – VARIABLE AIR VOLUME
  - a. Supply-Fan Control: System starts fan to run continuously during occupied periods. Modulate variable-speed fan drive to maintain supply duct static pressure.
    - 1) Set variable-speed drive to minimum speed when fans are stopped.
    - 2) Demand-based Static pressure reset:
      - a) Static Pressure shall be determined within the range of 0.5" to MaxP by a continuously polling direct-acting control loop whose control point is the damper position of the most open VAV damper and whose setpoint is 90% open.
      - b) MaxP shall be determined by the air balancing contractor in conjunction with the control contractor as required to provide design airflow in all boxes downstream of the duct static pressure sensor.
  - b. Upon command for start associated smoke dampers shall open and shall be proven open by end switch prior to start of fans.
  - c. Fans shall ramp slowly up to speed on fan start.
  - d. Return-Air Fan Control: System starts fan to run continuously during occupied periods. System modulates return-air fan variable-speed fan drive to maintain differential setpoint CFM as measured at the air flow measuring stations. The differential setpoint CFM shall be the supply to return air CFM differential required to maintain a positive building pressure.
  - e. On systems with return variable air volume boxes modulate variable-speed fan drive to maintain return duct static pressure.
    - a) Demand-based Static pressure reset: Static Pressure shall be determined within the range of 0.5" to MaxP by a continuously polling direct-acting control loop whose control point is the damper position of the most open VAV damper and whose setpoint is 90% open. MaxP shall be determined by the air balancing contractor in conjunction with the control contractor as required to provide design airflow in all boxes downstream of the duct static pressure sensor.
  - f. Freeze Protection: Heating Coil interlaced freezestat, located before supply fan, signals alarm, stops fan, and closes outside-air dampers when temperature falls below 37 deg F.
  - g. High-Temperature Protection: Duct-mounted thermostat, located in return air, signals alarm, stops fan, and closes outside-air dampers when temperature rises above 200 deg F
  - h. Smoke Control: Smoke detector, located in return and supply air, signals alarm, stops fans, and closes smoke dampers when products of combustion are detected in air stream.
  - i. Mixed-Air Control: During occupied periods, when fan is running, system modulates outside-air return-air, and relief-air dampers to maintain discharge supply air temperature.
    - 1) During occupied periods, when fan is running, open outside-air dampers to minimum position.
    - 2) During heating sequence, set outside-air dampers to minimum position.
    - 3) When outside-air temperature exceeds return-air temperature, set outside-air dampers to minimum position.
    - 4) When outside-air enthalpy exceeds return-air enthalpy, set outside-air dampers to minimum position.
    - 5) During unoccupied periods, position outside-air and relief-air dampers closed and return-air dampers open.

- j. Filters: During occupied periods, when fan is running, differential air-pressure transmitter signals alarm when low- and high-pressure conditions exist.
- k. Steam Preheat Coil: During occupied periods, when fan is running system modulates control valve to maintain supply-air temperature. Coil interlaced freeze-stat thermostat on discharge side of preheat coil stops fan when any part of coil face temperature falls below 38 deg F.
- l. DX Cooling Coil (Alternate): When fan is running, system modulates valve and associated air cooled condensing unit to maintain supply-air temperature.
  - 1) System resets supply-air temperature in response to greatest cooling demand and outside air temperature.
  - 2) During unoccupied periods, when fan is off, associated air cooled condensing unit is off.
  - 3) During unoccupied periods, when fan is on, enable normal control.
- m. Hydronic Cooling Coil: During occupied periods, when fan is running, system modulates control valve to maintain supply-air temperature.
  - 1) System resets supply-air temperature in response to greatest cooling demand and outside air temperature.
  - 2) During unoccupied periods, when fan is off, return valve to closed position.
- n. Condensate pan High limit: Provide high limit float switch to alarm at DDC and shut down associated air cooled condensing unit when air handler condensate pan is near overflow condition.
- o. Coordination of Air-Handling Unit Sequences: Ensure that mixed-air, heating-coil, and cooling-coil controls have common inputs and do not overlap in function.
- p. Operator Station Display: Indicate the following on operator workstation display terminal:
  - 1) System graphic.
  - 2) System on-off indication.
  - 3) System occupied/unoccupied mode.
  - 4) System fan on-off indication.
  - 5) Return fan on-off indication.
  - 6) Return-fan-inlet static pressure indication.
  - 7) Return-fan-discharge static pressure indication.
  - 8) Outside-air-temperature indication.
  - 9) Outside-air-enthalpy
  - 10) Relative humidity indication.
  - 11) Outside-air airflow rate – Air flow measuring station.
  - 12) Preheat-coil air-temperature indication.
  - 13) Preheat-coil air-temperature set point.
  - 14) Preheat-coil control-valve position.
  - 15) Mixed-air-temperature indication.
  - 16) Mixed-air-temperature set point.
  - 17) Mixed-air damper position.
  - 18) Filter air-pressure-drop indication.
  - 19) Filter low-air-pressure set point.
  - 20) Filter high-air-pressure set point.
  - 21) Condensate pan high limit indication.
  - 22) Supply-fan-discharge air-temperature indication.
  - 23) Supply-fan-discharge air-temperature set point.
  - 24) Cooling-coil air-temperature indication.
  - 25) Cooling-coil control-valve position.
  - 26) Associated air cooled condensing unit indication (Alternate).
  - 27) Supply-fan-inlet static-pressure indication.
  - 28) Supply-fan-discharge static-pressure indication.
  - 29) Supply-fan-discharge static-pressure set point.
  - 30) Supply duct VAV static-pressure indication.

- 31) Supply duct VAV static-pressure set point: Maximum, Minimum, Optimized.
  - 32) Supply-fan airflow rate – Air Flow measuring station.
  - 33) Supply-fan speed.
  - 34) Return -air-temperature indication.
  - 35) Return -air- enthalpy indication.
  - 36) Economizer mode indication.
  - 37) Return-air-inlet static-pressure indication.
  - 38) Return-fan-inlet static-pressure set point.
  - 39) Differential cfm set point.
  - 40) Differential cfm indication.
  - 41) Return-fan airflow rate. – Air Flow measuring station
  - 42) Return fan speed.
  - 43) Building static-pressure indication.
  - 44) Building static-pressure set point.
- q. Safeties/Alarms
- 1) The following safeties, each with its own software manual reset, shall shut down unit and the control system shall initiate respective alarm. All safeties shall be hardwired into fan motor starter circuits with auxiliary contact to register alarm and provide software override capability at FMS central panel. Manual reset shall be accomplished by entering a command at the DDC workstation rather than going to piece of equipment involved.
    - a) Supply smoke detector (SD) and return smoke detectors for air handlers are activated. Smoke detectors shall be furnished and wired to the fire alarm system under the work of Division 16, ATC contractor shall mount detectors and wire to control system. All air handling units are to have smoke detectors.
    - b) Air handlers supply/return fan discharge static pressure high limit (SPH) indicates more than 4 1/2 " w.g. when the unit status is on (with a 5 minute delay). This will prevent overpressurizing ductwork if supply fan is on with supply smoke damper. While it is the intention to provide normally open VAV boxes for zones served by air handler number 2, if normally closed boxes are installed on the job, then this contractor shall install static pressure high limit in this air handler as well.
    - c) Air handlers supply/return fan inlet static pressure low limit (SPL) indicates less than -2 1/2" negative static pressure when the unit status is on (with a 5 minute delay). This will prevent duct collapse if return fan is on with return smoke damper being closed.
    - d) Freezestat falls to 38 F. Software manual reset of freezestat shall be required. All air handlers shall have freezestats. Length of freezestat capillary shall be minimum of 20'. Capillary shall cover the entire face area of the coil. Use more than one freezestat if required to fully cover coil face area.
- r. The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
- 1) Supply, return, or exhaust fans are commanded to run and anytime after a 15 second delay the control system senses no running status via the fans current transformer relays (ct).
  - 2) Filter differential pressure switch, across filter section, senses greater than 1.5"w.g. for 15 minutes.

- 3) Discharge air temperature sensor goes 5 degrees below the minimum cooling discharge air temperature setpoint for 10 minutes when fan status is on.
5. VAV AIR TERMINAL UNIT SEQUENCES:
- a. Room sensor modulates VAV damper and coil control valve. Room sensor reports temperature.
  - b. Rooms with ceiling radiant heat panels: The radiant heat panels control valve shall be controlled by the associated VAV box room sensor to ensure that heating is not called for when in cooling mode.
  - c. Operator Workstation: Display the following data:
    - 1) Room/area served.
    - 2) Room occupied/unoccupied.
    - 3) Room temperature.
    - 4) Room temperature set point, occupied.
    - 5) Room temperature set point, occupied standby.
    - 6) Room temperature set point, unoccupied.
    - 7) Air-damper position as percent open.
    - 8) Control-valve position as percent open.
    - 9) Terminal unit discharge air temperature.
  - d. Safeties/Alarms
    - 1) The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
      - a) Any space temperature is more than five degrees from setpoint as sensed by the terminal boxes DDC box controller for five minutes.
6. CHILLER PLANT CONTROLS
- a. Operator Workstation: Display the following data: Add data requirements in coordination with chiller manufacturers. Provide all required system points (and associated sensors and equipment) to display the following (at a minimum).
    - 1) Outside air temperature.
    - 2) Chillers' on-off status.
    - 3) Compressors' VFD power demand and speed.
    - 4) Entering chilled-water temperature.
    - 5) Entering chilled-water temperature set point.
    - 6) Leaving chilled-water temperature.
    - 7) Chilled water flow rate through chiller
    - 8) Chilled-water pressure drop through chiller.
    - 9) Operating status of primary chilled-water pumps (including drive speed).
    - 10) Power draw of primary chilled water pumps.
  - b. Chiller shall not start until flow is proved by water flow switch wired to chiller control panel. Flow switch shall be furnished and wired by this contractor.
  - c. Chilled water primary pumps shall be interlocked with chiller and shall not be energized unless chiller is energized. Standby pump shall run upon failure of any of the above.
  - d. The ATC contractor shall install any temperature controls supplied by chiller manufacturer including but not limited to discharge and return chilled water temperature sensors, flow switches, alarm points, etc.
  - e. This contractor shall wire from a common alarm contact in the chiller control panel to the FMS to alarm if any chiller alarms are activated.
  - f. Safeties

- 1) The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
  - a) Any alarm from the chiller control panel is initiated.
  - b) The chilled water supply or return temperature goes 5 degrees F below or above its setpoint for five minutes.
  - c) The chiller is commanded to run and anytime after a fifteen second delay the control system senses no running status via the chiller control panel.
  - d) Any pump is commanded to run and anytime after a 15 second delay the control system senses no running status via the pumps current transformer relays (ct).
7. HOT WATER PUMPS AND STEAM CONVERTER SEQUENCES
  - a. Hot water temperature sensor in hot water supply line shall modulate 1/3<sup>rd</sup>- 2/3<sup>rd</sup> control valves as required to maintain set point.
  - b. Start lead pump if the temperature is below 60 F or if there is any call for heat at any air handler control valves or if there is a call for heat at any of the DDC monitoring sensors.
  - c. Pumps shall have variable frequency drive to maintain differential pressure in system.
  - d. On the failure of one pump the stand-by pump will be started automatically.
  - e. A differential pressure by-pass valve will be provided to ensure that the heat exchanger always has required minimum flow.
  - f. Pumps shall have lead lag operation to equalize run time of each pump.
  - g. Operator Workstation: Display the following data:
    - 1) System Graphic
    - 2) Outside temperature.
    - 3) Heating-water supply temperature.
    - 4) Heating-water supply temperature set point.
    - 5) Operating status of primary circulating pumps.
    - 6) Differential pressure indication
    - 7) Differential pressure set-point
    - 8) Pump speed set-point
    - 9) Pump speed indication
    - 10) Differential pressure bypass control-valve position.
  - h. Safeties/Alarms
    - 1) The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
      - a) Any pump is commanded to run and anytime after a 15 second delay the control system senses no running status via the pumps current transformer relays (ct).
      - b) Temperature of hot water discharge at HX or return to HX varies more than five degrees from set point for more than five minutes.
8. EXHAUST FAN SEQUENCES

- a. All fans shall be controlled by the FMS. See the schedules for fan numbers and the areas which they serve.
  - b. Exhaust fans shall be started and stopped by a time based schedule in the DDC panel.
  - c. Provide motorized control dampers interlocked to exhaust fans. Dampers shall open when fans are energized.
  - d. Operator Workstation: Display the following data:
    - 1) Room/area or System served.
    - 2) Operating status of fan
    - 3) Fan failure indication
  - e. Safeties/Alarms
    - 1) The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
      - a) Exhaust fans are commanded to run and anytime after a 15 second delay the control system senses no running status via the fans current transformer relays (ct).
9. RADIATION SEQUENCES
- a. Occupied Cycle
    - 1) DDC thermostats shall modulate the radiation control valve to maintain space temperature at 68 degrees (adj).
  - b. Operator Workstation: Display the following data:
    - 1) Room/area served.
    - 2) Room temperature.
    - 3) Room temperature set point.
    - 4) Control-valve position as percent open.
  - c. Safeties/Alarms
    - 1) The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.
      - a) Any space temperature is more than five degrees from setpoint as sensed by the terminal boxes DDC box controller for five minutes.
10. CHEMICAL TREATMENT SYSTEM SEQUENCES
- a. Controls for water treatment system shall be by water treatment system manufacturer. FMS shall start stop and monitor the systems. Provide alarms on equipment failures back to the main building EMS system.
  - b. Safeties/Alarms
    - 1) The control system shall initiate an alarm, describing the alarm if any of the following conditions are met (all setpoints and time periods below shall be adjustable by user from the FMSs central console). Whenever a unit is shut down because of one of the safeties, the control system shall retain in memory the reading and setpoint of each device to help the operator in isolating the reason for the problem. All control system sensors shall have a high and low software alarm limit to indicate temperature problems or a faulty sensor.

- a) Any alarm for system control panel.

### PART 3 - EXECUTION

#### 3.1 PROTECTION

- A. Be responsible for the care and protection of all work included in this Section until it has been tested and accepted.
- B. After delivery and before, during and after installation, protect all equipment, materials and systems from injury or damage of all causes, as well as from theft. Such loss or damage shall be made good without expense to the Owner.
- C. Wherever factory finishes of paint, lacquer, baked enamel, etc., have been damaged or deteriorated during construction, use factory furnished painting materials and refinish or touch up the damage or deterioration, to the satisfaction of the Architect. Application shall be by skilled workers experienced in painting and finishing.

#### 3.2 INSTALLATION OF EQUIPMENT-GENERAL

- A. Install all equipment and products furnished and make system connections to such equipment in accordance with the manufacturer's instructions.
- B. Provide adequate clearances around equipment to permit replacement, normal servicing and maintenance.
- C. Install electrical devices furnished by manufacturer but not specified to be factory mounted.
- D. Ground equipment: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Install with required clearance for service and maintenance.
- F. Install piping and ductwork adjacent to machine to allow service and maintenance.

#### 3.3 CUTTING, PATCHING AND CORE DRILLING

- A. This contractor shall perform all cutting, channeling and coring up to six (6) inches in diameter required for the work of this section.
- B. Provide timely notification to other trades of openings required for mechanical work. Supply accurate details of location and size.
- C. Obtain written approval of structural engineer before cutting through structural members.

#### 3.4 WIRING

- A. Where the mechanical contractor is to provide wiring including but not limited to wiring provided under the Automatic temperature controls paragraph of this specification, the wiring including conduit and materials, shall conform to the requirements of the National Electrical Code and Division 16.

### 3.5 PAINTING

- A. Supply ferrous metal work, except piping and galvanized steel ductwork, with at least one factory prime coat, or paint one prime coat on the job.
- B. Clean and steel brush surfaces of welds. Then prime coat all steel supports and brackets.
- C. On uninsulated piping, steel brush and prime coat welds.
- D. Touch-up or repaint all surfaces damaged during shipment or installation and prepare surface for finish painting.
- E. Paint with flat black, all surfaces visible behind air diffusers and grilles, including surfaces behind grilles provided by others to which sheetmetal connects.
- F. Prime coat material and finish painting shall conform to the PAINTING paragraph of the architectural specifications.

### 3.6 FLASHING AND CURBS

- A. Curbs, other than pre-manufactured roof curbs, required for the work of this section will be provided under other sections. Pre manufactured curbs for fans and hoods furnished under this section will be installed by this contractor per the requirements of ROOFING and other divisions of the architectural work.
- B. Other curbs required for the work of this section including reinforcing steel. Will be provided by others at the expense of this contractor.
- C. Curbs are required for roof mounted equipment, around pipes passing through roof, and surrounding holes where pipes or groups of pipes and/or ducts pass through equipment room floors.
- D. All roof curbs shall be a at least eighteen inches (18") in height.
- E. Curbs around holes in equipment room floors shall be concrete or steel, extending at least six inches (6") above the finished floor. Provide a watertight connection between curb and floor.
- F. Fill spaces between curbs and pipes and ducts with firestopping material. Firestopping materials and installation methods are specified in DIVISION 7 Section "Through-Penetration Firestop Systems." Floor penetrations shall be watertight.
- G. This contractor shall provide flashing for pipe openings or pre - manufactured roof curbs. Work shall be done in accordance with the requirements of the architectural portion of these specifications.
- H. This contractor shall carry out all counter flashing for pipes and ducts passing through the roof. Provide counter flashing over flashing or curb. Pitch pockets are not acceptable.



### 3.7 CONCRETE

- A. Concrete required for the work of this section shall be carried out under the CAST IN PLACE CONCRETE section of the architectural specifications.
- B. Other concrete work required for the work of this section, including reinforcing steel and concrete required for inertia bases shall be carried out under the work of the architectural specification at the expense of the mechanical contractor.
- C. This contractor shall supply and set in position floating reinforced concrete inertia bases, which are provided under the Vibration Isolation paragraph of this specification.

### 3.8 LINTELS

- A. Lintels required for duct openings and other mechanical components shall be furnished under the MISCELLANEOUS METAL portion of the architectural specifications, and shall be installed under the MASONRY portion of the architectural portion of these specifications.
- B. This contractor shall coordinate with the general contractor and the structural engineer to ensure that openings are formed in accordance with requirements of the architectural portions of this specification listed above before proceeding with installation of mechanical work over lintels.

### 3.9 STEEL

- A. Steel which is required for the work of this section, and is not shown on the structural or architectural drawings, shall be furnished and installed by this contractor under the requirements of the appropriate sections of the architectural specifications.
- B. Steel shall have adequate strength to support equipment and materials during testing and under all operating conditions.
- C. Support suspended equipment from the bottom or from manufacturer's designated suspension points. Tanks and similar equipment with adequate beam strength shall be supported by saddles with a curvature to exactly match the equipment. Other equipment shall be supported continuously.
- D. Steel supports exposed to weather or in contact with water or otherwise in a humid atmosphere shall be either galvanized after fabrication or fabricated from materials having approved corrosion resistance. Welds shall be brushed clean and a coat of rust inhibiting paint applied.
- E. This contractor shall ensure that equipment is sufficiently rigid for point support by isolators specified in the VIBRATION ISOLATION paragraph of these specifications. Coordinate with supplier of vibration isolation and provide auxiliary structural support if required.

### 3.10 INSTALLATION OF THERMOMETERS AND GAUGES

- A. Install one pressure gage per pump, with taps before strainers and on suction and discharge of pump; pipe to gage.
- B. GENERAL

1. Install gage taps in piping.
2. Install pressure gages with pulsation dampers. Provide needle valve or ball valve to isolate each gage. Extend nipples and siphons to allow clearance from insulation.
3. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Ensure sockets allow clearance from insulation.
4. Install thermometers in air duct systems on flanges.
5. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.
6. Coil and conceal excess capillary on remote element instruments.
7. Install static pressure gages to measure across filters and filter banks, (inlet to outlet). On multiple banks, provide manifold and single gage.
8. Provide instruments with scale ranges selected according to service with largest appropriate scale.
9. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
10. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

### C. SCHEDULES

1. Pressure Gages.
  - a. Pumps.
    - 1) Location: Install one compound pressure gage per pump, with taps before suction diffuser or strainer and on suction and discharge of pump; pipe to gage with pet cock at each tap. Use pump body taps when available.
    - 2) Scale range: 0 - 100 psi.
  - b. Expansion tanks.
    - 1) Location: Inlet and Outlet
    - 2) Scale range: 0 - 100 psi
  - c. Chillers.
    - 1) Location: Chilled Water Inlet and Outlet, Condenser Water Inlet and Outlet
    - 2) Scale range: 0 - 100 psi
  - d. Shot Feeders.
    - 1) Location: Shot Feeder
    - 2) Scale range: 0 - 100 psi
  - e. Air Handler Coils.
    - 1) Location: Inlet and Outlet
    - 2) Scale range: 0 - 100 psi
  - f. Make-up Water.
    - 1) Location: Regulator valve inlet and outlet
    - 2) Scale range: 0 - 100 psi
  - g. Steam pressure reducing stations.
    - 1) Location: Inlet and outlet
    - 2) Scale range: To match system pressures
  - h. Heat Exchangers.
    - 1) Location: Steam Inlet, Hot water inlet and Outlet
    - 2) Scale range: 0 - 100 psi
2. Stem Type Thermometers:
  - a. Chilled water Headers to central equipment.
    - 1) Location: Inlet and Outlet
    - 2) Scale range: 0 - 100 F
  - b. Hot water Headers to central equipment.
    - 1) Location: Inlet and Outlet
    - 2) Scale range: 0 - 212 F
  - c. Air Handler Chilled Water Coils

- 1) Location: Inlet and Outlet
- 2) Scale range: 0 - 100 F
- d. Air Handler Hot Water Coils
  - 1) Location: Inlet and Outlet
  - 2) Scale range: 0 - 212 F
- e. Heat Exchangers.
  - 1) Location: Inlet and Outlet
  - 2) Scale range: 0 - 212 F
- f. Chillers - Chilled Water Inlet and Outlet, Condenser Water Inlet and Outlet
  - 1) Location: Inlet and Outlet
  - 2) Scale range: 0 - 100 F
3. Test Plug Location:
  - a. Control valves 3/4 inch & larger - inlets and outlets.
  - b. Coil - inlets and outlets.
  - c. Heat exchangers - inlets and outlets.
  - d. Chiller - inlets and outlets.
  - e. Reheat coils - inlets and outlets.
  - f. Cabinet heaters - inlets and outlets.
4. Dial Thermometer Location:
  - a. Each supply air zone.
  - b. Each return air zone.
  - c. Outside air.
  - d. Return air.
  - e. Mixed air.
5. Static Pressure and Filter Gages.
  - a. Built up filter banks.
    - 1) Location: Across Filters
    - 2) Scale range: 0 - 8" W.C.
  - b. Static pressure controllers
    - 1) Location: At static pressure controller
    - 2) Scale range: 0 - 8" W.C.
  - c. Packaged unit filter sections.
    - 1) Location: Across Filters
    - 2) Scale range: 0 - 8" W.C.

### 3.11 INSTALLATION OF PIPE AND PIPE FITTINGS

#### A. GENERAL

1. Hold piping close to walls, overhead construction, columns and other structural and permanent enclosure elements of building. Limit clearance to 2" where furring is shown for enclosure or concealment of piping, but allow for insulation thickness, if any. Where possible, locate insulated piping for 1" clearance outside insulation.
2. Install each run with minimum joints and couplings, but with adequate and accessible unions for disassembly and maintenance/replacement of valves and equipment.
3. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
4. Anchor piping for proper direction of expansion and contraction.
5. Align piping accurately at connections, within 1/16" misalignment tolerance.
6. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.
7. Fire and/or Smoke Barrier Penetrations: Maintain indicated fire/smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

8. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
  9. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
  10. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
  11. Install piping at indicated slopes.
  12. Install piping free of sags and bends.
  13. Install fittings for changes in direction and branch connections.
  14. Install escutcheons for penetrations of walls, ceilings, and floors.
- B. **THREADED JOINTS:** Thread pipe in accordance with ANSI B2.1; cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint compound, or pipe joint tape (Teflon) on male threads at each joint and tighten joint to leave not less than 3 threads exposed.
- C. **SOLDERED JOINTS:** Solder copper tube and fitting joints where indicated, in accordance with recognized industry practice. Cut tube ends squarely, ream to full diameter, and clean outside of tube ends and inside of fittings. Apply solder flux to joint areas of both tubes and fittings. Insert tube full depth into fitting, and solder in manner which will draw solder full depth and circumference of joint. Wipe excess solder from joint before it hardens.
- D. **WELDED JOINTS:** Weld joints in accordance with recognized industry standards as follows:
1. Weld only when ambient temperature is above 0 deg. F.
  2. Bevel pipe ends at a 37.5 deg. angle where possible, smooth rough cuts, and clean to remove slag, metal particles and dirt.
  3. Use pipe clamps or tack weld joints with 1" long welds; 4 welds for pipe sizes to 10", 8 welds for pipe sizes 12" to 20".
  4. Build up welds with stringer bead pass, followed by hot pass, followed by cover or filler pass. Eliminate valleys at center and edges of each weld. Weld by procedure which will ensure elimination of unsound or unfused metal, cracks, oxidation, blow-holes and nonmetallic inclusions.
  5. Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
- E. **FLANGED JOINTS:** Match flanges within piping system, and at connections with valves and equipment. Clean flange faces and install gaskets. Tighten bolts to provide uniform compression of gaskets.
- F. **CLEANING, FLUSHING, INSPECTING**
1. Clean exterior surfaces of installed piping systems of superfluous materials, and prepare for application of specified coating (if any). Flush out piping systems with clean water before proceeding with required tests. Inspect each run of each system for completion of joints, supports and accessory items.
- G. **PIPING TESTS**
1. Test pressure piping in accordance with ASME B 31.
  2. Fill system with water. Provide temporary equipment for testing, including pump and gages. Test piping systems before insulation is installed and remove control devices before testing. Test each natural section of each piping system independently but do not use piping system valves to isolate sections where test pressure exceeds valve pressure rating.
  3. Required test period is 2 hours.
  4. Test each piping system at 150% of operating pressure indicated, but not less than 25 psi test pressure.

5. Observe each test section for leakage at end of test period. Test fails if leakage is observed or if pressure drops exceeds 5% of test pressure.
6. Repair piping systems sections that fail required test, by disassembly and reinstallation, using new materials to the extent required to overcome leakage. Do not use chemicals, stop-leak compounds, mastics, or other temporary repair methods.
7. Drain test water from systems after testing and repair work has been completed.

### 3.12 INSTALLATION OF VALVES

- A. Locate valves so as to be accessible and so that separate support can be provided when necessary.
- B. Install valves with stems pointed up, in vertical position where possible, but in no case with stems pointed downward from horizontal plane unless unavoidable. Install valve drains with hose-end adapter for each valve that must be installed with stem below horizontal plane.
- C. Where insulation is indicated, install extended stem valves, arranged to receive insulation.
- D. Mechanical Actuators: Install mechanical actuators with chain operators where indicated. Extend chains to about 5' above floor and hook to clips to clear aisle passage.
- E. Install swing check valves in horizontal position with hinge pin horizontally perpendicular to center line of pipe.
- F. Install wafer check valves between 2 flanges in horizontal or vertical position.
- G. Install lift check valves in piping line with stem vertically upward.
- H. Valve Adjustment: After piping systems have been tested and put into service, but before final testing, adjusting, and balancing, inspect each valve for possible leaks, replace valve if leak persists.
- I. Cleaning: Clean factory finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

### 3.13 INSTALLATION OF PIPING SPECIALTIES

- A. PIPE ESCUTCHEONS: Install on each pipe penetration through floors, walls partitions and ceilings where penetration is exposed to view.
- B. Y-TYPE STRAINERS: Install full size of pipe line, install pipe nipple and blow-down valve except for strainers 2" and smaller ahead of control valves feeding individual terminals.
- C. DIELECTRIC UNIONS: Install at each piping joint between ferrous and non-ferrous piping.
- D. MECHANICAL SLEEVE SEALS: Loosely assembly rubber links around pipe with bolts and pressure plates located under each bolt head and nut. Push into sleeve and center. Tighten bolts until links have expanded to form watertight seal.
- E. FIRE BARRIER PENETRATION SEALS: Fill entire opening with sealing compound.

- F. PIPE SLEEVES: Install of type indicated where piping passes through walls, floors, ceilings, and roofs. Install sleeves accurately centered on pipe runs. Size sleeves so that piping and insulation (if any) will have free movement. Install length of sleeve equal to thickness of construction penetrated, and finish flush to surface; except for floor sleeves. Extend floor sleeves 1/4" above level finish floor or as indicated.
1. Install sheetmetal sleeves at interior partitions and ceilings other than suspended ceilings.
  2. Install steel pipe iron pipe sleeves at exterior penetrations; both above and below grade.
  3. Install steel or plastic sleeves except as otherwise indicated.
- G. SLEEVES SEALS
1. Lead and Oakum: Fill and pack annular space between sleeve and pipe with oakum, caulk with lead on both sides.

### 3.14 INSTALLATION OF HANGERS AND SUPPORTS

- A. INSERTS
1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
  2. Where concrete forms finished ceiling, provide inserts to be flush with slab surface.
  3. Where inserts are omitted, drill through from below and provide through bolts with recessed steel plate and nut flush with slab.
- B. PIPE HANGERS AND SUPPORTS
1. Support horizontal piping as follows:

a.	PIPE SIZE	MAX. SPACING	ROD DIA.
b.	2 to 1-1/4"	6'-6"	3/8"
c.	1-1/2 to 2"	10'-0"	3/8"
d.	2-1/2 to 3"	10'-0"	2"
e.	4 to 6"	10'-0"	5/8"
  2. Install hangers to provide minimum 2 inch space between finished covering and adjacent work.
  3. Place hanger within 12 inches of each horizontal elbow.
  4. Support vertical piping at every floor.
  5. Where several pipes can be installed in parallel and at same elevation, provide trapeze or multiple hangers.

### 3.15 INSTALLATION OF PIPE INSULATION

- A. GENERAL
1. Install materials after piping has been tested and approved.
  2. Install materials in accordance with manufacturer's instructions.
  3. Continue insulation with vapor barrier through penetrations.
  4. On insulated piping systems with vapor barrier, insulate fittings, valves, unions, flanges, strainers, PT plugs, drains, flexible connections and expansion joints. All cold piping surfaces shall be insulated. Balancing valves and PT plugs shall have insulation which is removable and reattachable.
  5. On insulated piping systems without vapor barriers and piping conveying fluids 140 deg. F. or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation at such locations.
  6. Provide an insert, not less than 6 inches long, of same thickness and contour as adjoining insulation, between support shield and piping, but under the finish jacket, on piping 2 inch diameter and larger, to prevent insulation from sagging at support points.

Inserts shall be cork or other heavy density insulating material suitable for the planned temperature range. Factory fabricated inserts may be used.

7. Neatly finish insulation at supports, protrusions, and interruptions.
8. Exterior Applications: Provide indicated jacket with seams located on the bottom of horizontal piping. Insulate fitting, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement.
9. INSULATION OMITTED: Omit insulation on hot piping within radiation enclosures or unit cabinets; on cold piping within unit cabinets providing piping is located over drain pan; on condensate piping between steam trap and union; and on unions, flanges, strainers flexible connections, and expansion joints.

**B. PIPE INSULATION APPLICATION**

1. Insulate the following piping systems with the type and thickness of insulation indicated as follows:

PIPING SYSTEM	1) F.G.=FIBERGLASS							
	INSUL TYPE	RUNOUT TO 2"	1" AND LESS	1.25" TO 2"	2.5" TO 4"	5" TO 6"	8" AND LARGER	
HOT/CH WATER SUP/RET	F.G.	1.0	1.5	1.5	1.5	1.5	1.5	
LP STEAM	F.G.	1.0	1.5	2.0	2.0	2.0	2.0	
MP STEAM	F.G.	1.5	1.5	2.5	3.0	3.0	3.0	
STEAM CONDENSATE	F.G.	1.0	1.0	1.0	1.5	1.5	2.0	
MAKEUP WATER	F.G.	0.5	0.5	1.0	1.0	1.0	1.0	
REFRIGERANT SUCTION	F.G.	0.5	0.5	0.5	0.5	0.5	0.5	
REFRIGERANT HOT GAS	F.G.	0.5	0.5	0.5	0.5	0.5	0.5	

**C. INDOOR, PIPE INSULATION JACKET APPLICATION**

1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. Piping, Concealed:
  - a. None.
3. Piping, Exposed:
  - a. PVC, Color-Coded by System.

**D. OUTDOOR, PIPE INSULATION APPLICATION**

1. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
2. Piping, Exposed:
  - a. Aluminum

**3.16 INSTALLATION OF MECHANICAL IDENTIFICATION**

**A. PREPARATION**

1. Degrease and clean surfaces to receive adhesive for identification materials.

**B. INSTALLATION**

1. Plastic Nameplates: Install with corrosive resistant mechanical fasteners, or adhesive.
2. Metal Tags: Install with corrosive resistant chains.
3. Plastic Pipe Markers: Install in accordance with manufacturer's instructions.
4. Plastic Tape Duct Markers: Install in accordance with manufacturer's instructions.
5. Underground Plastic Pipe Markers: Install 6 to 8 inches below finished grade, directly above buried pipe.

### C. APPLICATION

1. **EQUIPMENT NAMEPLATES:** Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:
  - a. Pumps, compressors, chillers, condensers, and similar motor-driven units.
  - b. Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
  - c. Fans, blowers, primary balancing dampers, and mixing boxes.
  - d. Packaged HVAC central-station and zone-type units.
  - e. Control components
2. **EQUIPMENT MARKERS:** Install equipment markers with permanent adhesive on or near each major item of mechanical equipment. Data required for markers may be included on signs, and markers may be omitted if both are indicated.
  - a. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - b. Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - c. Include markers for the following general categories of equipment:
    - 1) Meters, gages, thermometers, and similar units.
    - 2) Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - 3) Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
3. **EQUIPMENT SIGNS:** Install equipment signs with screws or permanent adhesive on or near each major item of mechanical equipment. Locate signs where accessible and visible.
  - a. Identify mechanical equipment with equipment markers in the following color codes:
  - b. Green: For cooling equipment and components.
  - c. Yellow: For heating equipment and components.
  - d. Green and Yellow: For combination cooling and heating equipment and components.
  - e. Brown: For energy-reclamation equipment and components.
  - f. Letter Size: Minimum 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
  - g. Distinguish among multiple units, indicate operational requirements, indicate safety and emergency precautions, warn of hazards and improper operations, and identify units.
  - h. Include signs for the following general categories of equipment:
    - 1) Pumps, compressors, chillers, condensers, and similar motor-driven units.
    - 2) Heat exchangers, coils, evaporators, cooling towers, heat recovery units, and similar equipment.
    - 3) Fans, blowers, primary balancing dampers, filters, mixing boxes.
    - 4) Packaged HVAC central-station and zone-type units.
    - 5) Tanks and pressure vessels.
    - 6) Strainers, filters, humidifiers, water-treatment systems, and similar equipment.
    - 7) Control Components



4. WARNING-TAG INSTALLATION: Print required message on, and attach warning tags to, equipment and other items where required.
  5. ACCESS PANELS: Identify all access doors and panels.
  6. VALVES: Identify valves, except valves within heating or cooling terminals, with metal tags.
  7. VALVE CHART AND SCHEDULE: Provide valve chart and schedule in aluminum frame with clear plastic shield. Install at location as directed.
  8. CONCEALED EQUIPMENT LOCATION INDICATORS: Provide markings for all concealed equipment and systems requiring routine maintenance to indicate location of access. Equipment to be indicated includes but is not limited to terminal boxes, terminal equipment, reheat coils, filters, control dampers, etc. Coordinate marking system methods and products with Owner and Architect.
- D. Locate Piping identification and flow arrows as follows:
1. Identify piping, concealed or exposed, with plastic pipe markers. Identify service and flow direction. Install in clear view and align with axis of piping. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and "T", at each side of penetration of structure or enclosure, and at each obstruction.
  2. On vertical pipes approximately seven feet above floor.
  3. Behind each access door and panel.
  4. At each change of direction of piping.
  5. On each piping branch close to point of connection to main piping.
  6. At valves.
  7. At no greater than intervals of 50 feet on straight runs of piping, and on both sides of walls.
- E. Locate Ductwork identification and flow arrows as follows:
1. Identify ductwork with plastic tape duct markers. Identify as to air handling unit number. Locate at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.
  2. On vertical ductwork approximately seven feet above floor.
  3. Behind each access door and panel.
  4. At each change of direction of ductwork.
  5. On each ductwork branch close to point of connection to main ductwork.
  6. At no greater than intervals of 25 feet on straight runs of ductwork, and on both sides of walls.
- F. Do color coding of pipes with two (2) inch wide bands according to color schedule to be issued by the Owner during the progress of the work.
- G. Labeling on all exposed piping in finished spaces shall be on top of the piping out of line of sight.
- H. Labeling on all exposed ductwork in finished spaces shall be on top of the ductwork out of line of sight.
- I. Identify all pumps, controls, remote switches, starters, disconnects, pushbuttons and similar equipment as to service with white lamacoid engraved name-plates with black letters. Firmly secure with self-tapping screws. Submit sample plates and lettering for review.
- J. Identify all fans (including air handler systems) with a label which shall be dated and be a minimum of 6" x 4". The label shall be made of (minimum) heavy-duty plastic laminate securely attached to the air handling devices. Submit a sample and a list of all equipment tags to be provided complete with all information included within the tag to Engineer for (shop drawing) approval. The label shall be provided with the following information:

1. Tag number.
2. Design airflows (CFM).
3. Design external static pressures (in. H<sub>2</sub>O).
4. Motor horsepowers.
5. Areas served by unit.

K. Install valve tags at each valve. Attach to valves with four (4) inch brass chains.

### 3.17 INSTALLATION OF DUCTWORK INSULATION

#### A. GENERAL

1. Install materials after ductwork has been tested and approved.
2. Install materials in accordance with manufacturer's instructions.
3. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
4. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
5. Keep insulation materials dry during application and finishing.
6. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
7. Apply insulation with the least number of joints practical.
8. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity.
9. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
10. Maintain integrity of vapor barrier and protect it to prevent puncture and other damage.
11. Interior Wall and Partition Penetrations: Extend ductwork insulation without interruption through walls, floors and similar ductwork penetrations, except fire-rated walls and partitions.
12. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.
13. Refer to DIVISION 7 Section "Through-Penetration Firestop Systems." for firestopping materials and requirements for penetrations through fire and smoke barriers.
14. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.
15. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.
  - a. Seal penetrations with vapor-retarder mastic.
  - b. Apply insulation for exterior applications tightly joined to interior insulation ends.
  - c. Seal insulation to roof flashing with vapor-retarder mastic.
16. Provide rigid removable insulated panels for duct access doors. Panel insulation value and materials shall match insulation requirements of duct system.

#### B. INSTALLATION

1. FLEXIBLE FIBERGLASS: Seal jacket joints with vapor barrier tape to match jacket. Staple seams 6" O.C. with outward cinching staples, then seal with pressure sensitive tape matching jacket. Install without sag on underside of ductwork. Use adhesive or mechanical fasteners where necessary to prevent sagging. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier tape. Stop and point insulation

around access doors and damper operators to allow operation without disturbing wrapping.

2. RIGID FIBERGLASS: Secure insulation to ductwork using mechanical fasteners with pin spacing no greater than 12 inch on center. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier tape. Tape joints and edges with 3 inch pressure sensitive vapor barrier tape to match jacket. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping. Duct Liner Not acceptable on Healthcare Projects. Duct Liner is not F&T standard delete unless specifically used on the project.

#### C. APPLICATION

1. Insulate all exposed fresh air intake, and hot and/or cold supply air ducts within finished spaces with 2 inch thick rigid fiberglass ductwork insulation or other such thickness that the installed R value accounting for compression is minimum R5. Cover with PVC jacket for field painting.
2. Insulate all concealed fresh air intake, and concealed hot and/or cold supply air ducts with 2 inch thick Flexible Fiberglass ductwork insulation or other such thickness that the installed R value accounting for compression is minimum R5.
3. Insulate all exposed exhaust air ductwork within 10 feet of exterior opening with 1 inch thick Rigid Fiberglass ductwork insulation. All rectangular exposed ductwork is to be covered by an aluminum jacket. All round exposed ductwork is to be covered by PVC jacket.
4. Insulate supply and return ductwork located out of doors with 2" rigid fiberglass insulation. Cover insulation with a Exterior Rubber Jacket System. Jacket system shall be installed using manufacturers adhesives and in strict accordance with manufacturer's instructions.

### 3.18 INSTALLATION OF EQUIPMENT INSULATION

#### A. GENERAL

1. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of equipment.
2. Do not insulate factory insulated equipment.
3. Apply insulation as close as possible to equipment by grooving, scoring, beveling insulation, if necessary. Secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
4. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
5. Cover Rigid Fiberglass and Calcium Silicate insulation with metal mesh finish and finish with heavy coat of insulating cement.
6. Do not insulate over nameplates or testing agency labels and stamps. Bevel and seal insulation around such.
7. When equipment with insulation requires periodical opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.
8. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either the wet or dry state.
9. Apply multiple layers of insulation with longitudinal and end seams staggered.
10. Keep insulation materials dry during application and finishing.
11. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.
12. Apply insulation with the least number of joints practical.

13. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
14. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.
15. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
16. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.
17. Install vapor-retarder mastic on equipment scheduled to receive vapor retarders. Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.

B. APPLICATION

1. Insulate the following equipment:
2. Insulate heat exchangers with 2" thick Rigid Fiberglass equipment insulation.
3. Insulate chilled water pump bodies with 1" thick Rubber Sheet equipment insulation.
4. Insulate Chilled-water compression and buffer tanks with 2" thick Rigid Fiberglass equipment insulation. Jacket all exterior systems.
5. Insulate air separators with 2" thick Rigid Fiberglass equipment insulation. Jacket all exterior systems.
6. Insulate steam flash tanks with 2" thick Rigid Fiberglass equipment insulation.

C. Omit insulation from the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Manholes.
5. Handholes.
6. Cleanouts.

3.19 INSTALLATION OF DUCTWORK

A. GENERAL

1. Align ductwork accurately at connections, within 1/8 inch misalignment tolerance and internal surfaces smooth.
2. Support ducts rigidly with suitable ties, braces, hangers and anchors of type which will hold ducts true to shape and to prevent buckling.
3. Limit clearance to 2 inch where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.
4. Locate insulated ductwork for 1 inch clearance outside of insulation.
5. Coordinate layout with suspended ceiling and lighting layouts and similar finish work.
6. Non-Fire-Rated Partition Penetrations: Where ducts pass through interior partitions and exterior walls and are exposed to view, conceal spaces between construction openings and ducts or duct insulation with sheet metal flanges of same metal thickness as ducts. Overlap openings on 4 sides by at least 1-1/2 inches.
7. Fire-Rated Partition Penetrations: Where ducts pass through walls, partitions, ceilings and floors, install appropriately rated fire dampers, sleeves, and fire-stopping materials.
8. Smoke Barrier Penetrations: Where ducts pass through walls, partitions, ceilings and floors, install appropriately rated smoke dampers, sleeves, and fire-stopping materials.

9. Maintain indicated fire/smoke rating of walls, partitions, ceilings, and floors at duct penetrations. Seal with fire-stop materials.
10. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.
11. Coordinate duct installation with installation of accessories, dampers, coils frames, equipment, controls and other associated work of the ductwork system.
12. Install in the ductwork system control dampers furnished by the Automatic Temperature Control Contractor, assemble such multiple section dampers and provide required blank off plates where dampers are smaller than the duct.
13. Provide openings in ductwork where required to accommodate thermometers, sensors, and controllers. Provide pilot tube openings where required for testing of systems.
14. Set plenum doors 6 to 12 inches above floor. Arrange door swing so that fan static pressure holds door in closed position.
15. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork.
16. Where allowed Install flexible supply ductwork so that full cross sectional area is maintained, take care not to crush collapse or crimp duct.
17. Flexible ductwork not allowed on return or exhaust air systems.
18. Install double wall insulated flexible ductwork so that full cross sectional area is maintained, take care not to crush, collapse or crimp duct.

**B. CLASS 2 DUCTWORK**

1. Assemble and install to achieve maximum leakage rate of 5 percent.
2. Seal ductwork, after installation, to seal class recommended, and method prescribed in SMACNA "Duct Standards".
3. Support ductwork in manner complying with SMACNA "Duct Standards", hanger and support section.
4. Connect register, grilles and diffusers or troffers (where connection is concealed) to ducts with 5 foot maximum length of flexible or insulated flexible duct as required by the application. Hold in place with strap or clamp. Connect to air terminal with 22 gauge draw bands.

**C. CLASS 3, 4, AND 6 DUCTWORK**

1. Assemble and install to achieve maximum leakage rate of 1 percent.
2. Seal ductwork, after installation, to seal class recommended, and method prescribed in SMACNA "Duct Standards".
3. Support ductwork in manner complying with SMACNA "Duct Standards", hanger and support section.
4. Connect Variable Air Volume Terminal inlets with 2 foot maximum length of double wall flexible insulated duct if required by the application. Hold in place with strap or clamp. Attach to duct and variable air volume air terminal inlet with 22 gauge metal draw band and sheet metal screws.
5. Provide duct leak testing.

**D. LEAK TESTING**

1. Perform tests and inspections.
2. Leakage Tests:
3. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual."
4. Test all Class 3, 4, 6 and 10 supply, return, and exhaust systems.
5. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
6. Test for leaks before insulation application.
7. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test entire system at maximum

system design pressure. Do not pressurize systems above maximum design operating pressure. Give seven days' advance notice for testing.

E. CLEANING

1. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances.
2. Duct System Cleanliness Tests:
  - a. Visually inspect duct system to ensure that no visible contaminants are present.
  - b. Test sections of metal duct system, chosen randomly by Owner/Engineer, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - 1) Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
3. Duct system will be considered defective if it does not pass tests and inspections. Clean entire system
4. Prepare test and inspection reports.

F. DUCTWORK APPLICATION SCHEDULE

	<u>System</u>	<u>Class</u>	<u>Material</u>
1.	Supply from fan to VAV terminal	6	Steel
2.	Supply from VAV terminal/Duct Coil to Diffusers	2	Steel
3.	Return & Relief – VAV systems	3	Steel
4.	General Exhaust	2	Steel

3.20 INSTALLATION OF DUCTWORK ACCESSORIES

- A. Install accessories in accordance with manufacturer's instructions and as indicated.
- B. Fire Dampers, Smoke Dampers and combination fire/smoke dampers
  1. Install fire dampers, smoke dampers and combination fire/smoke dampers with required perimeter mounting angles, sleeves, and breakaway duct connections. Install dampers in accordance with manufacturer's UL Installation Instructions, labeling, and NFPA 90A at locations indicated on the drawings. Any damper installation that is not in accordance with the manufacturer's UL Installation Instructions must be approved prior to installation.
  2. Dampers must be accessible to allow inspection, adjustment, and replacement of components. Provide duct access doors in ductwork or plenums required to provide this access. Provide access doors required in walls, ceilings, or other general building construction.
  3. Install dampers square and free from racking. Do not compress or stretch the damper frame into the duct or opening. Handle dampers using the frame or sleeve. Do not lift or move dampers using blades, actuator or jackshaft.
  4. Fire Damper Application:
    - a. Provide Curtain type Dynamic fire dampers on any system part of a smoke evacuation system with velocities less than or equal to 2000 fpm.
    - b. Provide Multi-blade type Dynamic fire dampers on any system part of a smoke evacuation system with velocities greater than 2000 fpm.
    - c. Provide Static Curtain type fire dampers on all systems that are not part of the smoke evacuation system.
- C. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment. Cover connections to medium and high pressure fans with leaded vinyl sheet, held in place with metal straps.

- D. Provide duct access doors for inspection and cleaning before and after filters, fans, automatic dampers, fire and or smoke dampers and elsewhere as indicated. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated.

### 3.21 INSTALLATION OF HYDRONIC PIPING SYSTEMS

- A. GENERAL: Unless otherwise indicated install hydronic piping as follows:
1. Install eccentric reducers where pipe is reduced in size in direction of flow, with tops of both pipes and reducer flush.
  2. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
  3. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
  4. Install drains, consisting of a tee fitting, NPS ¾ ball valve, and short NPS ¾ threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
  5. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
  6. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS ¾ nipple and ball valve in blow-down connection of strainers NPS 2 and larger. Match size of strainer blow-off connection for strainers smaller than NPS 2.
  7. Install manual air vents at the system high points to allow bleeding off air.
- B. VALVES: Unless otherwise indicated install valves as listed below and elsewhere as indicated.
1. Isolation: ball and butterfly valves.
  2. Throttling: ball and butterfly valves
  3. Combination balancing and shut-off: Refer to "HYDRONIC SPECIALTIES" elsewhere in these specifications.
  4. Provide isolation valves at each hydronic terminal, coil and equipment and elsewhere as indicated.
  5. Provide combination balancing and shut-off valves at each hydronic terminal, coil and equipment and elsewhere as indicated.
  6. Provide balance cock at the by-pass port of each 3-way control.
  7. Provide drain valves on each mechanical equipment item located to completely drain equipment; at base of each isolated riser and elsewhere as indicated or required to completely drain hydronic piping system.
- C. EQUIPMENT CONNECTIONS:
1. Connect hydronic terminal, coil and equipment to the hydronic piping system in accordance to equipment manufacturer's instructions. Installation shall allow easy repair, cleaning, removal and replacement of hydronic terminal, coil and equipment.
  2. Size for supply and return piping connections shall be same as for equipment connections.
  3. Install control valves in accessible locations close to connected equipment.
  4. For control valve 1 1/4" and greater install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.
  5. Install ports for pressure and temperature gages at terminal, coil and equipment inlet and outlet connections.
- D. CHEMICAL TREATMENT:
1. After cleaning and flushing, refill hydronic piping system, adding caustic soda to maintain pH of 8.0 to 8.5 and sodium sulfate in amount of 1/3 caustic soda or to maintain residual of 30 to 40 PPM in system. Add trisodium phosphate to make hardness of 0 PPM and residual of approximately 30 PPM in system. Repeat measurements daily with system

under full circulation and apply chemicals to adjust levels until no apparent change is apparent.

### 3.22 INSTALLATION OF HYDRONIC SPECIALTIES

- A. Install specialties in accordance with manufacturer's instructions.
- B. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- C. Install only automatic air vents in mechanical equipment rooms only. Install at high points of system piping, at heat-transfer equipment and coils, and elsewhere as required for system air venting. Provide vent tubing to nearest drain. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- D. Install in-line air separators in pump suction lines. Install piping to compression tank with a 2 percent upward slope toward tank. Install drain valve on units NPS 2 and larger.
- E. Install bypass chemical shot feeders in each hydronic system, in upright position with top of funnel not more than 36 inches above floor. Install feeder in bypass line, off main, using globe valves on each side of feeder and in the main between bypass connections. Pipe drain, with ball valve, to nearest equipment drain.
- F. Install diaphragm-type compression tanks on floor. Vent and purge air from hydronic system, and ensure tank is properly charged with air to suit system design requirements.
- G. Provide valved drain and hose connection on strainer blow down connection.
- H. Remove temporary strainers after cleaning systems.
- I. Support pump fittings with floor mounted pipe and flange supports.
- J. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.
- K. Pipe relief valve outlet to nearest floor drain.
- L. Where one line vents several relief valves, make cross sectional area equal to sum of individual vent areas.

### 3.23 INSTALLATION OF STEAM AND CONDENSATE SYSTEMS

- A. GENERAL: Unless otherwise indicated install steam and condensate piping as follows:
  - 1. Install steam and condensate piping with 1/4" per 10 foot downward slope in the direction of flow.
  - 2. Install branch piping and riser offsets with 1/8" per foot downward slope in the direction of condensate flow.
  - 3. Install branch and run-outs at top of main, either in the vertical or at 45 deg. from the vertical and perpendicular to main.
  - 4. Install run-out piping to terminals with 1/4" per foot downward slope in direction of condensate return.
  - 5. Install eccentric reducers where pipe is reduced in size, with bottoms of both pipes and reducer flush. Locate reducers 18" min. distance from branch connection.



6. Install condensate riser drips on all steam piping risers.
  7. Provide end of main drip at the end of each steam run.
- B. VALVES: Unless otherwise indicated install valves as listed below and elsewhere as indicated.
1. Provide isolation valves at each steam terminal each piece of mechanical equipment and elsewhere as indicated.
  2. Provide drain valves on each mechanical equipment item located to completely drain equipment; at base of each isolated riser and elsewhere as indicated or required to completely drain steam and condensate piping system.
- C. EQUIPMENT CONNECTIONS: Connect steam and condensate equipment to piping system in accordance to equipment manufacturer's instructions.
- D. LEAK TESTS
1. Prepare steam and condensate piping according to ASME B31.9, "Building Services Piping" and as follows
    - a. Leave joints, including welds, uninsulated and exposed for examination during test.
    - b. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
    - c. Flush system with clean water. Clean strainers.
    - d. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  2. Perform the following tests on steam and condensate piping:
    - a. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
    - b. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength.
    - c. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components and repeat hydrostatic test until there are no leaks.
  3. Prepare written report of testing.

### 3.24 INSTALLATION OF REFRIGERANT PIPING SYSTEMS

- A. GENERAL
1. Size refrigerant pipe and install valves and accessories as required and/or recommended by refrigerant equipment manufacturer.
  2. Install refrigerant piping, valves and equipment per the refrigerant equipment manufacturer's requirements.
  3. Connect refrigerant equipment to piping system in accordance to equipment manufacturer's requirements.
  4. Size refrigerant pipe and install valves and accessories as required and/or recommended by refrigerant equipment manufacturer.
- B. PIPING

1. Install refrigerant piping with 1/16" per foot downward slope in direction of oil return to the compressor. Provide oil traps and double risers where indicated, and where required to provide oil return

C. VALVES AND SPECIALTIES

1. Install refrigerant valves and specialties in accordance with manufacturer's instructions.

D. LEAK TESTS

1. Prior to initial operation perform leak test on piping system. Perform initial test with dry nitrogen, using soap solution to test all joints. Perform final test with 27" vacuum, and then 200 psi using halide torch. System must be entirely leak-free.

E. DEHYDRATION AND CHARGING

1. Install core in filter drier after leak test but before evacuation.
2. Evacuate with vacuum pump, until temperature of 35 deg. F. is indicated on vacuum dehydration indicator.
3. During evacuation, apply heat to pockets, elbows, and low spots in piping.
4. Maintain vacuum for 5 hours after closing valve between vacuum pump and system.
5. Break vacuum with refrigerant gas, allow pressure to build up to 2 psi.
6. Complete charging system, using new filter drier core in charging line. Provide full operating charge.

3.25 INSTALLATION OF ROOF FANS

- A. Install in accordance with manufacturer's installation instructions.
- B. Furnish roof curbs to roofing installer or general contractor for installation. Provide locations of penetrations to installer.
- C. Secure with corrosion resistant lag screws to roof mounting curbs

3.26 INSTALLATION OF RADIANT HEATING PANELS

- A. The mechanical contractor shall cooperate with other trades working in the ceiling area to achieve a neat and well coordinated installation.
- B. All support molding shall be the responsibility of Division 9 unless specialized application is required. All wall moldings shall be mitred with cross tees installed flush. Perimeter molding to be extruded aluminum - minimum 25 gauge. Ensure ceiling openings and wall moldings are installed as per radiant panel shop drawings.
- C. Radiant panels installed in psychiatric patient areas shall be secured to ceiling using backing angles and tamperproof hardware.
- D. Installed Manufacturer supplied fluted inter-connectors to connect panels installed in series. Soft copper or pigtail type connectors are not be acceptable.
- E. Connection to supply, return piping with 16 mm (5/8") O.D. soft copper.
- F. System piping shall be thoroughly cleaned and flushed before connecting to radiant panels.
- G. Wire employed to suspend the radiant ceiling panel from the existing structure. The standard material is 2.64 mm (12 gauge) galvanized, soft annealed steel wire, conforming to ASTM A

641M or A 641. Vertical suspension of 1 (one) wire per cross-brace for panels of a width equal to or less than 600mm (24"). Panels over 600mm (24") require a minimum of 2 wire hangers per cross-brace. Minimum of 2 wire hangers per panel. Wire hangers are to be suspended to a maximum of 1200mm (4') on centre. Refer to VIBRATION ISOLATION AND SEISMIC RESTRAINT paragraph of these specifications for additional requirements.

### 3.27 INSTALLATION OF PUMPS

- A. Install in accordance with manufacturer's instructions.
- B. Provide access space around pumps for service. Provide no less than minimum as recommended by manufacturer.
- C. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over
- D. Provide line sized shut-off valve and strainer pump suction fitting on pump suction, and line sized soft seat check valve and balancing valve or combination pump discharge valve] on pump discharge.
- E. Provide air cock and drain connection on horizontal pump casings.
- F. Provide drains for bases and seals, piped to and discharging into floor drains.
- G. Check, align, and certify alignment of base mounted pumps prior to start-up.
- H. Install base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to CONCRETE portions of these specifications.
- I. Lubricate pumps before start-up.
- J. Provide Type FC-1 flexible connectors.

### 3.28 INSTALLATION OF CHILLERS

- A. Install in accordance with manufacturer's instructions.
- B. Provide for connection to electrical service. Refer to DIVISION 26 – ELECTRICAL.
- C. Provide for connection of electrical wiring between starter and chiller control panel, oil pump, and purge unit. Refer to DIVISION 26 – ELECTRICAL.
- D. Align chiller on concrete foundations, sole plates, and sub-bases. Level, grout, and bolt in place.
- E. Install units on vibration isolation. Refer to VIBRATION ISOLATION AND SEISMIC RESTRAINT paragraph of these specifications.
- F. Provide evaporator connections to chilled water piping.
  - 1. On inlet, provide:

- a. Thermometer well for temperature controller.
  - b. Thermometer well and thermometer.
  - c. Strainer.
  - d. Nipple and flow switch.
  - e. Flexible pipe connector.
  - f. Pressure gage.
  - g. Shut-off valve.
2. On outlet, provide:
    - a. Thermometer well and thermometer.
    - b. Flexible pipe connector.
    - c. Pressure gage.
    - d. Shut-off and Balancing valve.
- G. Furnish and install necessary auxiliary water piping for oil cooling units and purge condensers.
- H. Insulate evaporator and cold surfaces.
- I. Provide condenser connection to condenser water piping.
1. On inlet, provide:
    - a. Thermometer well for temperature controller.
    - b. Thermometer well and thermometer.
    - c. Strainer.
    - d. Nipple and flow switch.
    - e. Flexible pipe connector.
    - f. Pressure gage.
    - g. Shut-off valve.
  2. On outlet, provide:
    - a. Thermometer well and thermometer.
    - b. Flexible pipe connector.
    - c. Pressure gage.
    - d. Shut-off and Balancing valve.
- J. Arrange piping for easy dismantling to permit tube cleaning.
- K. Provide piping from chiller rupture disc to outdoors. Size as recommended by manufacturer.
- L. Manufacturer's Field Services
1. Prepare and start systems.
  2. Provide services of factory trained representative for minimum one day to leak test, refrigerant pressure test, evacuate, dehydrate, charge, start-up, calibrate controls, and instruct Owner on operation and maintenance.
  3. Supply initial charge of refrigerant and oil.

### 3.29 INSTALLATION OF HUMIDIFIERS

- A. Install in accordance with manufacturer's instructions.
- B. Install to ARI 630.

### 3.30 INSTALLATION OF AIR HANDLING UNITS

- A. Install in accordance with ARI 435.

- B. Install flexible connections specified in "DUCTWORK ACCESSIORES" this SECTION between fan inlet and discharge ductwork. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.
- C. Install assembled unit on vibration isolator rail. Install isolated fans with resilient mountings and flexible electrical leads. Install restraining snubbers as required. Adjust snubbers to prevent tension in flexible connectors when fan is operating.
- D. Provide fixed sheaves required for final air balance.
- E. Make connections to coils with unions or flanges.
- F. Hydronic Coils:
  - 1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
  - 2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
  - 3. Locate water supply at bottom of supply header and return water connection at top.
  - 4. Provide manual float operated automatic air vents at high points complete with stop valve.
  - 5. Ensure water coils are drainable and provide drain connection at low points.
- G. Insulate coil headers located outside air flow as specified for piping.
- H. Manufacturer's Field Services
  - 1. Prepare and start systems.
  - 2. Supervise rigging, hoisting, and installation; include eight hour day per Air Handler.
  - 3. Start-up Air Handler in presence of and instruct Owners operating personnel.

### 3.31 INSTALLATION OF VARIABLE SPEED DRIVES

- A. Install in accordance with NEMA ICS 3.1.
- B. Tighten accessible connections and mechanical fasteners after placing controller.
- C. Provide fuses in fusible switches; refer to DIVISION 16 – ELECTRICAL for product requirements.
- D. Select and install overload heater elements in motor controllers to match installed motor characteristics.
- E. Provide engraved plastic nameplates
- F. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.
- G. Prepare and start systems.
- H. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.
- I. Manufacturer's Field Services
  - 1. Prepare, calibrate and start systems.

2. Start-up Variable Frequency Drive in presence of and instruct Owners operating personnel.

### 3.32 INSTALLATION OF REGISTERS, GRILLES AND DIFFUSERS

- A. Install diffusers, registers, and grilles level and plumb.
- B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated on architectural ceiling grids, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.
- C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.
- D. Adjusting: After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.
- E. Install safety chains on all diffusers, registers, and grilles install more than 15' above the floor. Refer to VIBRATION ISOLATION AND SEISMIC RESTRAINT paragraph of these specifications for additional requirements.

### 3.33 INSTALLATION OF VARIABLE AIR VOLUME TERMINAL BOXES

- A. Install in accordance with manufacturer's instructions.
- B. Provide ceiling access doors or locate units above easily removable ceiling components.
- C. Support units individually from structure. Do not support from adjacent ductwork.
- D. Connect to ductwork.
- E. Install heating coils.

### 3.34 WATER TREATMENT INITIALIZATION

- A. PREPARATION
  1. Systems shall be operational, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.
  2. Place terminal control valves in open position during cleaning.
  3. Verify that electric power is available and of the correct characteristics.
- B. CLEANING SEQUENCE
  1. Concentration:
    - a. As recommended by manufacturer.
    - b. One pound per 100 gallons of water contained in the system.
    - c. One pound per 100 gallons of water for hot systems and one pound per 50 gallons of water for cold systems.
  2. Hot Water Heating Systems:

- a. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
  - b. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
  - c. Circulate for 6 hours at design temperatures, then drain.
  - d. Refill with clean water and repeat until system cleaner is removed.
3. Chilled Water Systems:
- a. Circulate for 48 hours, then drain systems as quickly as possible.
  - b. Refill with clean water, circulate for 24 hours, then drain.
  - c. Refill with clean water and repeat until system cleaner is removed.
4. Use neutralizer agents on recommendation of system cleaner supplier and approval of Architect/Engineer.
5. Flush open systems with clean water for one hour minimum. Drain completely and refill.
6. Remove, clean, and replace strainer screens.
7. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

C. INSTALLATION

1. Install in accordance with manufacturer's instructions.

D. CLOSED SYSTEM TREATMENT

1. Provide one bypass feeder on each system. Install isolating and drain valves and necessary piping. Install around balancing valve downstream of circulating pumps unless indicated otherwise.
2. Introduce closed system treatment through bypass feeder when required or indicated by test.
3. Provide 3/4 inch water coupon rack around circulating pumps with space for 12 test specimens.

- E. Extra Materials: Furnish sufficient chemicals for initial system start-up and for preventative maintenance for one year from date of substantial completion.

F. Manufacturer's Field Services

1. Prepare, calibrate and start systems.
2. Start-up system in presence of and instruct Owners operating personnel.
3. Retest System at the completion of 1 year period. Submit test report.

3.35 INSTALLATION OF PIPE EXPANSION FITTINGS AND LOOPS

- A. Install in accordance with manufacturer's instructions.
- B. Construct spool pieces to exact size of flexible connection for future insertion.
- C. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Provide line size flexible connectors.
- D. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.
- E. Rigidly anchor pipe to building structure where necessary. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

- F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required or indicated.
- G. Provide expansion loops as indicated on drawings.
- H. EXPANSION-JOINT INSTALLATION
  - 1. Install manufactured, nonmetallic expansion joints according to FSA's "Technical Handbook: Non-Metallic Expansion Joints and Flexible Pipe Connectors."
  - 2. Install expansion joints of sizes matching size of piping in which they are installed.
  - 3. Install alignment guides to allow expansion and to avoid end-loading and torsional stress.
- I. PIPE BEND AND LOOP INSTALLATION
  - 1. Install pipe bends and loops cold-sprung in tension or compression as required to partly absorb tension or compression produced during anticipated change in temperature.
  - 2. Attach pipe bends and loops to anchors.
    - a. Steel Anchors: Attach by welding. Comply with ASME B31.9 and ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."
    - b. Concrete Anchors: Attach by fasteners. Follow fastener manufacturer's written instructions.
- J. SWING CONNECTIONS
  - 1. Connect risers and branch connections to mains with at least five pipe fittings, including tee in main.
  - 2. Connect risers and branch connections to terminal units with at least four pipe fittings, including tee in riser.
  - 3. Connect mains and branch connections to terminal units with at least four pipe fittings, including tee in main.
- K. ALIGNMENT-GUIDE INSTALLATION
  - 1. Install guides on piping adjoining pipe expansion joints and bends and loops.
  - 2. Coordinate below with structural Sections and Drawings if welding is included in structural work.
  - 3. Attach guides to pipe and secure to building structure.
- L. ANCHOR INSTALLATION
  - 1. Install anchors at locations to prevent stresses from exceeding those permitted by ASME B31.9 and to prevent transfer of loading and stresses to connected equipment.
  - 2. Fabricate and install steel anchors by welding steel shapes, plates, and bars to piping and to structure. Comply with ASME B31.9 and AWS D1.1.
  - 3. Construct concrete anchors of poured-in-place concrete of dimensions indicated and include embedded fasteners.
  - 4. Install pipe anchors according to expansion-joint manufacturer's written instructions if expansion joints or compensators are indicated.
  - 5. Use grout to form flat bearing surfaces for expansion fittings, guides, and anchors installed on or in concrete.

### 3.36 INSTALLATION OF VIBRATION ISOLATION AND SEISMIC RESTRAINT

- A. GENERAL
  - 1. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's submittal data.
  - 2. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.



**B. EQUIPMENT INSTALLATION**

1. Equipment shall be isolated as indicated in TABLE A at the end of this section.
2. Additional Requirements:
  - a. The minimum operating clearance under all bases shall be 1".
  - b. All bases shall be placed in position and supported temporarily by blocks or shims prior to the installation of the equipment, isolators and restraints.
  - c. Spring isolators shall be installed after all equipment is installed without changing equipment elevations.
  - d. After the entire installation is complete and under full operational load, the spring isolators shall be adjusted so that the load is transferred from the blocks to the isolators.
  - e. Remove all debris from beneath the equipment and verify that there are no short circuits of the isolation. The equipment shall be free in all directions.
  - f. Install equipment with flexibility in wiring.
  - g. Thrust restraints shall be installed on all cabinet fan heads, axial or centrifugal fans whose thrust exceeds 10% of unit weight.
  - h. Housekeeping pads for equipment in this section must be properly doweled or bolted, using wedge type expansion bolts to meet the acceleration criteria. Anchor equipment or isolators to housekeeping pads.

**C. PIPING and DUCTWORK ISOLATION**

1. Installation:
  - a. General
    - 1) Hanger isolators shall be installed with the hanger box hung as close as possible to the structure. (Without touching)
    - 2) Hanger rods shall not short-circuit the hanger box.
  - b. All piping in mechanical equipment room(s) attached to rotating or reciprocating equipment shall be isolated as follows:
    - 1) Water and steam piping.
      - a) Water piping 1-1/4" to 2" and all steam piping larger than 1" shall be hung with TYPE E isolators with 0.25" deflection.
      - b) Water pipe larger than 2" shall be hung with TYPE F isolators with 0.75" deflection.
      - c) Horizontal floor or roof mounted water piping 1-1/4" to 2" and all steam piping larger than 1" shall be supported by TYPE P isolators with 0.3" deflection.
      - d) Water pipe larger than 2" shall be supported by TYPE B isolators with 0.75" deflection.
    - 2) Control air piping and vacuum piping from compressor discharge to receiver shall be suspended by TYPE E isolators with 0.25" deflection or supported by TYPE P isolators with 0.3" deflection.
  - c. All ductwork over four square feet face area located within 50' from air moving equipment shall be hung with TYPE C hangers with 0.75" deflection.
  - d. Emergency generator exhaust shall be isolated with TYPE C isolators with 0.75" deflection (all neoprene components shall be omitted).
  - e. Vertical riser supports for water & steam pipe 4" diameter and larger shall be isolated from the structure using TYPE K guides and anchors.
  - f. Install TYPE FC-1 flexible connectors at all connections of pipe to externally isolated equipment.
  - g. Install FC-2 or 4 type connectors only at locations which exceed temperature limitations of FC-1 or service requires stainless steel or bronze construction flex. (Such as; spaces without floor drains, or pipes carrying gas, fuel oil, steam or Freon)

**D. SEISMIC RESTRAINTS**

1. Installation

- a. All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted or welded to the structure. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively attached to the structure.
- b. All suspended equipment including, but not limited to; air handling units, pumps, fans, tanks, stacks, VAV boxes, unit heaters, fan powered boxes, cabinet unit heaters, etc. shall be two or four point independently braced with TYPE III restraints. Install cable braces taught for non-isolated equipment and slack with ½" cable deflection for isolated equipment. VAV Boxes (without fans) attached directly to ductwork on the main supply side shall be considered as ductwork for seismic design purposes. Rod bracing shall be installed as per approved submittals and shop drawings. Equipment rigidly connected to ductwork weighing less than 75 lbs. is excluded.
- c. All horizontally suspended pipe and duct shall use RESTRAINT TYPE III. Spacing of seismic bracing shall be as per TABLE B at the end of this section.
- d. For all trapeze-supported piping, the individual pipes must be attached to the trapeze support at the designated restraint locations.
- e. For overhead supported equipment, over stress of the building structure must not occur. Bracing may occur from:
  - 1) Flanges of structural beams.
  - 2) Upper truss chords in bar joists.
  - 3) Cast in place inserts or drilled and shielded inserts in concrete structures.
- f. Pipe Risers
  - 1) Where pipe pass through cored holes, holes must be packed with resilient material or fire stop as specified in other sections of this specification and/or state and local codes. No additional horizontal seismic bracing is required at these locations.
  - 2) Non-isolated, constant temperature pipe risers through cored holes require a riser clamp at each floor level on top of the slab attached in a seismically approved manner for vertical restraint.
  - 3) Non-isolated, constant temperature pipe risers in pipe shafts require structural steel attached in a seismically approved manner at each floor level and a riser clamp at each floor level on top of, and fastened to the structural steel. The riser clamp and structural steel must be capable of withstanding all thermal, static and seismic loads.
  - 4) Isolated and/or variable temperature risers through cored holes require Type K riser resilient Guides and Anchors installed to meet both thermal expansion and seismic acceleration criteria.
  - 5) Isolated and/or variable temperature risers in pipe shafts require Type K resilient riser guides and anchors installed on structural steel to meet both thermal expansion and seismic acceleration criteria. Each floor level must have a riser clamp that does not interfere with the thermal expansion/contraction of the pipe.
- g. Chimneys, stacks and boiler breeching passing through floors are to be bolted at each floor level or secured above and below each floor with riser clamps.
- h. Diffusers shall be attached to lay-in ceilings with earthquake clips or other approved means of positive attachment to the T- bar ceiling structure.
- i. All non-isolated floor or wall mounted equipment and tanks shall use RESTRAINT TYPE III or V.
- j. Where base anchoring of equipment is insufficient to resist seismic forces, restraint TYPE III shall be located above the unit's center of gravity to suitably resist "G" forces specified.

- 1) Vertically mounted tanks and up-blast tubular centrifugal fans, tanks or similar equipment may require this additional restraint.
  - k. A rigid piping or duct system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and roof; solid concrete wall and a metal deck with lightweight concrete fill, pipes & duct that cross a building expansion joint.
  2. Exclusions from seismic requirements on non life safety equipment:
    - a. Curb mounted mushroom, exhaust and vent fans with curb area less than nine square feet are excluded unless specifically detailed in the schedules or drawings.
    - b. Duct exemptions
      - 1) Rectangular, Square and Oval ducts less than six square feet in cross sectional area.
      - 2) Round duct less than 33 inches in diameter.
      - 3) Individual ducts suspended by hangers positively attached to the structure that are less than 12 inches in length as measured to top of the duct to the point of attachment to the structure. Hangers must be attached within 2 inches of the top of the duct with a minimum of two #10 sheet metal screws. If any hanger in the run exceeds the 12" limit, seismic bracing is required for the run.
    - c. Piping exemptions
      - 1) All piping less than 2-1/2" diameter except in mechanical rooms where piping less than 1-1/4" is exempted.
      - 2) All clevis or single level trapeze supported piping suspended by hangers with positive attachment to the structure that are less than 12 inches in length as measured from the top of the pipe to the point of attachment to the structure. If any hanger in the run exceeds the 12" limit, seismic bracing is required for the run.
  3. Exclusions from seismic requirements on life safety equipment.
    - a. Duct exemptions
      - 1) Smoke evacuation duct or fresh air make-up air that has a cross sectional area less than 3 square feet.
- E. INSPECTION
1. If in the opinion of the project engineer the seismic restraint installation does not meet with the project requirements, an outside consultant will be retained to inspect, verify and submit corrective measures to be taken. The consultant's fees and all work associated with such a review shall be borne by the contractor.

TABLE A VIBRATION ISOLATION & SEISMIC RESTRAINT REQUIREMENTS FOR HVAC EQUIPMENT				EQUIPMENT INSTALLATION ATTACHMENT POINT								
EQUIPMENT				ON GRADE			ABOVE GRADE			ROOF		
		SIZE (5) (8)	MOUNTING	ISO L	DEFL	BASE	ISO L	DEFL	BASE	ISO L	DEFL	BASE
AIR HANDLING UNITS AIR CONDITIONING UNITS CABINET TYPE FANS HEAT RECOVERY UNITS		TO 10 H.P.	FLOOR	D	0.3	(1)	B	0.75	(1)	--	--	--
			CEILING	--	--	--	F			--	--	--
		OVER 10 H.P.	FLOOR	D	0.3	(1)	B	(2)		--	--	--
			CEILING	--	--	(1)	F	(2)		--	--	--
AIR OR REFRIGERANT COMPRESSORS	TANK	TO 10 H.P.	FLOOR	D	0.3	--	B	0.75	--	--	--	--
		OVER 10 H.P.		B	0.75	--		1.5	B-2	--	--	--
	UNITARY	TO 10 H.P.		D	0.3	--		0.75	B-2	--	--	--
		OVER 10 H.P.		B	0.75	--		1.5	(3)	--	--	--
AIR COOLED CONDENSERS & DRY COOLERS		TO 1 H.P.	ROOF	--	--	--	--	--	--	--	.75	B-4
		OVER 1 H.P.		--	--	--	--	--	--	--	1.5	B-4
AXIAL FANS		TO 15 H.P.	FLOOR/ROOF	D	0.3	B-1	B	(2)	B-1	--	(2)	B-3 OR 4
			CEILING	--	--	--	F		--	--		--
		OVER 15 H.P.	FLOOR/ROOF	B	0.75	B-1	B		B-1	--		B-3 OR 4
			CEILING	--	--	--	F		--	--		--
BOILERS & STEAM GENERATORS		OIL OR GAS	FLOOR	--	--	--	B	0.75 (1)	--	--	--	--
		ELECTRIC		--	--	--	G	0.1	--	--	--	--
CENTRIFUGAL FANS	ARRG'T 1 & 3	ALL	FLOOR/ROOF	B	0.75	B-1	B	(2)(6)	B-1 (4)	B	(2)(6)	B-1 (4)
			CEILING	--	--	--	F		--	--		--
	ARRG'T 4,9 & 10		FLOOR/ROOF	D	0.3	--	B		--	--		B-4
			CEILING	--	--	--	F		--	--		--
CHILLERS & CONDENSING UNITS	ABSORB. & CENTRIF.	ALL	FLOOR	G	0.1	--	B	0.75	--	--	1.5	B-4
		RECIPR. & ROTARY	To 5 TONS	D	0.25	--	D	.25	--	--	.75	B-4
	6-20 TONS		FLOOR / ROOF	B	1.0	--	B	1.5	--	--	1.5	B-4
	OVER 20 TONS			2.5	--	--	2.5					
COMPUTER ROOM UNITS		ALL	CEILING	--	--	--	F	0.75	--	--	--	--
			FLOOR	--	--	B-9	B	0.75	B-9	--	--	--
COOLING TOWERS		TO 200 TONS	FLOOR OR ROOF	G	0.10	--	B	1.5	--	B	1.5	B-1
		OVER 200	--	--	--	--	2.5	--	--	2.5		
CURB MOUNTED ROOF EXHAUSTERS		ALL (7)	ROOF	--	--	--	--	--	--	--	--	B-5
FAN COIL UNITS FAN POWERED BOXES CABINET UNIT HEATERS UNIT VENTILATORS HEAT PUMPS		ALL	CEILING	--	--	--	F	0.75	--	--	--	--
PUMPS	BASE MOUNTED	TO 15 H.P.	FLOOR	D	0.3	B-2	B	0.75	B-2	--	--	--
		15-30 H.P.		B	0.75			1.5		--	--	--
		OVER 30 H.P.		--	--			--		--	--	--
	INLINE	ALL	FLOOR	--	--	--	D	0.3	--	--	--	--
			CEILING	--	--	--	F	0.75	--	--	--	--
	CONDENSATE BOILER FEED	ALL	FLOOR	D	0.3	--	D	0.3	--	--	--	--
--			--	--	--	--	--	--	--			
DX ROOF TOP UNITS AIR HANDLING UNITS		TO 3,000 CFM	CURB MOUNT-	--	--	--	--	--	--	--	0.75	B-3

TABLE A VIBRATION ISOLATION & SEISMIC RESTRAINT REQUIREMENTS FOR HVAC EQUIPMENT			EQUIPMENT INSTALLATION ATTACHMENT POINT									
AIR CONDITIONING UNITS MAKE UP AIR UNITS HEAT RECOVERY UNITS H&V UNITS (10)	3,001 TO 10,000 CFM	ED	--	--	--	--	--	--	--	--	1.50	B-3
	OVER 10,000 CFM		--	--	--	--	--	--	--	2.50	B-3	
	TO 6000 CFM	POINT SUPPORT -ED	--	--	--	--	--	--	B	0.75	(1)	
	OVER 6000 CFM		--	--	--	--	--	--		2.5	(1)	
UNIT HEATERS	ALL	CEILING	--	--	--	E	0.3	--	--	--	--	

**TABLE A NOTES:**

GENERAL: **ISOL** = Isolator, **DEFL.** = Deflection, All deflections indicated are in inches.

- (1) Units may not be capable of point support. Refer to separate equipment specification section, if base is not provided by that section and external isolation is required, provide Type B-1 base by this section for entire unit.
- (2) Static deflection shall be determined on the deflection guide. Deflections indicated are minimums at actual load and shall be selected from manufacturer's nominal 4", 3", 2" and 1" deflection spring series. **R.P.M. is defined as the slowest operating speed of the equipment.**
- (3) Single stroke compressors may require inertia bases with thickness greater than 12" max. As described for base B-2. Inertia base mass shall be sufficient to maintain double amplitude of 1/8".
- (4) For floor mounted fans substitute base TYPE B-2 for class 2 or 3 or any class fan with static pressure over 5".
- (5) Equipment with less than 1/3 H.P. is excluded from vibration requirements. (Seismic requirements still apply)
- (6) Utility sets with wheel diameters less than 15" need not have deflections greater than 0.75".
- (7) Curb mounted fans with curb area less than nine (9) square feet are excluded.
- (8) For equipment with multiple motors, H.P. Classification applies to largest single motor.
- (9) Exclude B-2 base for skid mounted pump sets.
- (10) Based on Supply Air CFM.

DEFLECTION GUIDE	
R.P.M.	DEFLECTION
LESS THAN 400	3.50"
401 TO 600	2.50"
601 TO 900	1.50"
OVER 900	0.75"

TABLE B SEISMIC BRACING TABLE		
EQUIPMENT	ON CENTER SPACING	
	TRANSVERSE	LONGITUDINAL
DUCT	30 Feet	60 Feet
PIPE	40 Feet	80 Feet
BOILER BREECHING	30 Feet	60 Feet
CHIMNEYS & STACKS	30 Feet	60 Feet

**NOTE WELL**

Projects that contain large pipe may require that the allowable spacing shown in this Table be reduced to minimize structural loading. All associated costs shall be the responsibility of the contractor. Close coordination and approval by the structural engineer is mandatory for all seismic point loads exceeding 2,000 lbs.

### 3.37 TESTING, ADJUSTING AND BALANCING

#### A. ACCEPTABLE BALANCERS

1. Provide the services of an independent AABC or NEBC certified air balancing contractor. Submit contractor qualifications for approval prior to commencement of testing, adjusting, and balancing.

#### B. EXAMINATION

1. Verify that systems are complete and operable before 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. Registers, Grilles and Diffusers are installed and connected.
  - k. Duct system leakage is minimized.
  - l. Hydronic systems are flushed, filled, and vented.
  - m. Pumps are rotating correctly.
  - n. Proper strainer baskets are clean and in place.
  - o. Service and balance valves are open.

- C. Submit field reports. Report defects and deficiencies noted during performance of services which prevent system balance.

- D. Beginning of work means acceptance of existing conditions.

#### E. PREPARATION

1. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect/Engineer to facilitate spot checks during testing.
2. Provide additional balancing devices as required.

#### F. INSTALLATION TOLERANCES

1. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.
2. Registers, Grilles and Diffusers: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.
3. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

#### G. ADJUSTING

1. Ensure recorded data represents actual measured or observed conditions.
2. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
3. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

4. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.
5. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.
6. Check and adjust systems approximately six months after final acceptance and submit report.

#### H. RENOVATION PRE-CONSTRUCTION TESTING

1. Measure and prepare a balancing report prior to demolition and/or new construction.
2. The report is intended to record all air and water flows within the spaces being renovated and all associated equipment supplying, exhausting, or returning air or water from the spaces being renovated. Test all associated heating and cooling generation and transfer equipment serving the renovated spaces.
3. Testing technician shall record the physical condition of all equipment being tested. Note condition, maintenance or repairs required.
4. Prior to commencing testing coordinate with owner to ensure the all equipment is operational and spaces are accessible.
5. Submit pre-construction testing report for review and approval prior to commencement of demolition.
6. Record sound and vibration within spaces being renovated.
7. Measure and record all main supply, return and exhaust air ducts at limit of demolition.

#### I. PHASED CONSTRUCTION

1. Where project is intended to be constructed in multiple phases perform testing, balancing and submit balancing reports at the completion of each phase.
2. At the completion of the project submit a complete balancing report of all phases.
3. Test and adjust systems making provisions for .Measure and prepare a balancing report prior to demolition and/or new construction.
4. Make provisions for temporary balancing or reduce flows as required.

#### J. AIR SYSTEM PROCEDURE

1. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities [at site altitude].
2. Make air quantity measurements in ducts by Pivot tube traverse of entire cross sectional area of duct.
3. Measure air quantities at registers, grilles and diffusers.
4. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.
5. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters. Use of diffuser and register dampers shall be for small adjustment only and dampers shall not be closed more than 15%.
6. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.
7. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.
8. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.
9. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.
10. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

11. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.
12. Variable Volume Systems. Work with ATC contractor to determine optimal duct static pressure sensor setpoint: Demand-based Static pressure reset:
  - a. Static Pressure shall be determined within the range of 0.5" to MaxP by a continuously polling direct-acting control loop whose control point is the damper position of the most open VAV damper and whose setpoint is 90% open.
  - b. MaxP shall be determined by the air balancing contractor in conjunction with the control contractor as required to provide design airflow in all boxes downstream of the duct static pressure sensor.

K. WATER SYSTEM PROCEDURE

1. Adjust water systems to provide required or design quantities.
2. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gauges to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
3. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
4. Effect system balance with automatic control valves fully open to heat transfer elements.
5. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.
6. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

L. SCHEDULES

1. Equipment requiring sound level, Air, Water, and vibration - testing, Adjusting, and Balancing:
  - a. HVAC Pumps
  - b. Water Chillers
  - c. Air Coils
  - d. Terminal Heat Transfer Units
  - e. Air Handling Units
  - f. Fans
  - g. Air Filters
  - h. Air Terminal Units
  - i. Registers, Grilles and Diffusers
  - j. Duct Mains
2. Sound levels shall be taken at all motor driven equipment greater than 3/4 motor horsepower. Test sound levels at the equipment and in spaces above, below and/or adjacent to the equipment.

M. REPORT FORMS: Provide sound level, water, air, and vibration - testing, balancing and adjustment. Submit reports in the following format:

1. Title Page:
  - a. Name of Testing, Adjusting, and Balancing Agency
  - b. Address of Testing, Adjusting, and Balancing Agency
  - c. Telephone number of Testing, Adjusting, and Balancing Agency
  - d. Project name
  - e. Project location
  - f. Project Architect
  - g. Project Engineer



- h. Project Contractor
- i. Project altitude
- j. Report date
- 2. Summary Comments:
  - a. Design versus final performance
  - b. Notable characteristics of system
  - c. Description of systems operation sequence
  - d. Summary of outdoor and exhaust flows to indicate amount of building pressurization
  - e. Nomenclature used throughout report
  - f. Test conditions
- 3. Instrument List:
  - a. Instrument
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Range
  - f. Calibration date
- 4. Electric Motors:
  - a. Manufacturer
  - b. Model/Frame
  - c. HP/BHP
  - d. Phase, voltage, amperage; nameplate, actual, no load
  - e. RPM
  - f. Service factor
  - g. Starter size, rating, heater elements
  - h. Sheave Make/Size/Bore
- 5. V-Belt Drive:
  - a. Identification/location
  - b. Required driven RPM
  - c. Driven sheave, diameter and RPM
  - d. Belt, size and quantity
  - e. Motor sheave diameter and RPM
  - f. Center to center distance, maximum, minimum, and actual
- 6. Pump Data:
  - a. Identification/number
  - b. Manufacturer
  - c. Size/model
  - d. Impeller
  - e. Service
  - f. Design flow rate, pressure drop, BHP
  - g. Actual flow rate, pressure drop, BHP
  - h. Discharge pressure
  - i. Suction pressure
  - j. Total operating head pressure
  - k. Shut off, discharge and suction pressures
  - l. Shut off, total head pressure
- 7. Chillers:
  - a. Identification/number
  - b. Manufacturer
  - c. Capacity
  - d. Model number
  - e. Serial number
  - f. Evaporator entering water temperature, design and actual
  - g. Evaporator leaving water temperature, design and actual

- h. Evaporator pressure drop, design and actual
- i. Evaporator water flow rate, design and actual
- j. Condenser entering water temperature, design and actual
- k. Condenser pressure drop, design and actual
- l. Condenser water flow rate, design and actual
- 8. Cooling Coil Data:
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Entering air DB temperature, design and actual
  - g. Entering air WB temperature, design and actual
  - h. Leaving air DB temperature, design and actual
  - i. Leaving air WB temperature, design and actual
  - j. Water flow, design and actual
  - k. Water pressure drop, design and actual
  - l. Entering water temperature, design and actual
  - m. Leaving water temperature, design and actual
  - n. Saturated suction temperature, design and actual
  - o. Air pressure drop, design and actual
- 9. Heating Coil Data:
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Air flow, design and actual
  - f. Water flow, design and actual
  - g. Water pressure drop, design and actual
  - h. Entering water temperature, design and actual
  - i. Leaving water temperature, design and actual
  - j. Entering air temperature, design and actual
  - k. Leaving air temperature, design and actual
  - l. Air pressure drop, design and actual
- 10. Air Moving Equipment
  - a. Location
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Arrangement/Class/Discharge
  - f. Air flow, specified and actual
  - g. Return air flow, specified and actual
  - h. Outside air flow, specified and actual
  - i. Total static pressure (total external), specified and actual
  - j. Inlet pressure
  - k. Discharge pressure
  - l. Duct static pressure setpoint: Max, Minimum and Optimized.
  - m. Sheave Make/Size/Bore
  - n. Number of Belts/Make/Size
  - o. Fan RPM
- 11. Return Air/Outside Air Data:
  - a. Identification/location
  - b. Design air flow
  - c. Actual air flow
  - d. Design return air flow

- e. Actual return air flow
  - f. Design outside air flow
  - g. Actual outside air flow
  - h. Return air temperature
  - i. Outside air temperature
  - j. Required mixed air temperature
  - k. Actual mixed air temperature
  - l. Design outside/return air ratio
  - m. Actual outside/return air ratio
12. Exhaust Fan Data:
- a. Location
  - b. Manufacturer
  - c. Model number
  - d. Serial number
  - e. Air flow, specified and actual
  - f. Total static pressure (total external), specified and actual
  - g. Inlet pressure
  - h. Discharge pressure
  - i. Sheave Make/Size/Bore
  - j. Number of Belts/Make/Size
  - k. Fan RPM
13. Duct Traverse:
- a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air temperature
  - j. Air correction factor
14. Duct Leak Test:
- a. Description of ductwork under test
  - b. Duct design operating pressure
  - c. Duct design test static pressure
  - d. Duct capacity, air flow
  - e. Maximum allowable leakage duct capacity times leak factor
  - f. Test apparatus
  - g. Blower
  - h. Orifice, tube size
  - i. Orifice size
  - j. Calibrated
  - k. Test static pressure
  - l. Test orifice differential pressure
  - m. Leakage
15. Air Monitoring Station Data:
- a. Identification/location
  - b. System
  - c. Size
  - d. Area
  - e. Design velocity
  - f. Design air flow
  - g. Test velocity
  - h. Test air flow

16. Flow Measuring Station:
  - a. Identification/number
  - b. Location
  - c. Size
  - d. Manufacturer
  - e. Model number
  - f. Serial number
  - g. Design Flow rate
  - h. Design pressure drop
  - i. Actual/final pressure drop
  - j. Actual/final flow rate
  - k. Station calibrated setting
17. Terminal Unit Data:
  - a. Manufacturer
  - b. Type, constant, variable, single, dual duct
  - c. Identification/number
  - d. Location
  - e. Model number
  - f. Size
  - g. Minimum static pressure
  - h. Minimum design air flow
  - i. Maximum design air flow
  - j. Maximum actual air flow
  - k. Inlet static pressure
18. Air Distribution Test Sheet:
  - a. Air terminal number
  - b. Room number/location
  - c. Terminal type
  - d. Terminal size
  - e. Area factor
  - f. Design velocity
  - g. Design air flow
  - h. Test (final) velocity
  - i. Test (final) air flow
  - j. Percent of design air flow
19. Sound Level Report:
  - a. Location
  - b. Octave bands - equipment off
  - c. Octave bands - equipment on
20. Vibration Test:
  - a. Location of points:
  - b. Fan bearing, drive end
  - c. Fan bearing, opposite end
  - d. Motor bearing, center (if applicable)
  - e. Motor bearing, drive end
  - f. Motor bearing, opposite end
  - g. Casing (bottom or top)
  - h. Casing (side)
  - i. Duct after flexible connection (discharge)
  - j. Duct after flexible connection (suction)
  - k. Horizontal, velocity and displacement
  - l. Vertical, velocity and displacement
  - m. Axial, velocity and displacement
  - n. Normally acceptable readings, velocity and acceleration
  - o. Unusual conditions at time of test

p. Vibration source (if non-complying)

### 3.38 AIR DUCT AND SYSTEM CLEANING

- A. Engage a certified Air system cleaning specialist (ASCS) to clean the following systems:
  - 1. Supply system.
  - 2. Return system.
  - 3. Exhaust system.
- B. ASCS Qualifications: A certified member of National Air Duct Cleaners Association (NADCA).
  - 1. Certification: Employ an ASCS certified by NADCA on a full-time basis
  - 2. Supervisor Qualifications: Certified as an ASCS by NADCA
- C. Experience: Submit records of experience in the field of HVAC systems cleaning.
- D. Examination:
  - 1. Examine systems to determine appropriate methods, tools, and equipment required for performance of work.
  - 2. Prepare written report listing conditions detrimental to performance of work.
  - 3. Proceed with work only after unsatisfactory conditions have been corrected.
- E. Perform cleaning and testing before air balancing. Upon completion of air cleaning and prior to air balancing replace Air filters.
- F. Use duct-mounted access doors, as required, for physical and mechanical entry and for inspection.
  - 1. Install additional duct-mounting access doors to comply with duct cleaning standards.
  - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection. Replace damaged and deteriorated flexible ducts.
  - 3. Disconnect and reconnect flexible connectors as needed for cleaning and inspection. Replace damaged and deteriorated flexible connectors
  - 4. Reseal rigid-fiberglass-duct systems according to NAIMA recommended practices.
  - 5. Replace damaged fusible links on fire and smoke dampers. Replacement fusible links shall be same rating as those being replaced.
  - 6. Remove and reinstall ceiling components to gain access for duct cleaning. Clean ceiling components after they have been removed and replaced.
- G. Mark position of dampers and air-directional mechanical devices before cleaning, and restore to their marked position on completion.
- H. Particulate Collection and Odor Control:
  - 1. Where venting vacuuming system inside building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron size (or greater) particles.
  - 2. When venting vacuuming system outside building, use filtration to contain debris removed from the HVAC system and locate exhaust down wind and away from air intakes and other points of entry into building.
- I. Clean the following metal-duct system components by removing visible surface contaminants and deposits:
  - 1. Air outlets and inlets (registers, grilles, and diffusers).
  - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.

3. Air-handling-unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
  4. Coils and related components.
  5. Return-air ducts, dampers, and actuators, except in ceiling plenums and mechanical room.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
  7. Dedicated exhaust and ventilation components.
- J. Mechanical Cleaning Methodology:
1. Clean metal-duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
  2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of ducts so areas being cleaned are under negative pressure.
  3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts or duct liner.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment, and do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.
  5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
  6. Provide operative drainage system for washdown procedures.
  7. Biocidal Agents and Coatings: Apply biocidal agents if fungus is present; use according to manufacturer's written instructions after removal of surface deposits and debris.
- K. Cleanliness Verification:
1. Verify cleanliness after mechanical cleaning and before application of treatment, including biocidal agents and protective coatings.
  2. Visually inspect metal-duct systems for contaminants.
  3. Where contaminants are discovered, reclean and reinspect duct systems.
- L. Duct Access
1. Install duct-mounting access doors where access doors do not currently exist to allow for the cleaning of ducts, accessories, and terminal units as follows:
    - a. On both sides of duct coils.
    - b. Downstream from volume dampers, turning vanes, and equipment.
    - c. Adjacent to fire or smoke dampers; reset or install new fusible links.
    - d. Before and after each change in direction, at maximum 50-footspacing.
    - e. On sides of ducts where adequate clearance is available.
- M. Connections
1. Reconnect ducts to fans and air-handling units with existing flexible connectors after cleaning ducts and flexible connectors. Replace existing damaged and deteriorated flexible connectors.
  2. For fans developing static pressures of 5-inch wgand higher, cover replacement flexible connectors with loaded vinyl sheet held in place with metal straps.
  3. Reconnect terminal units to supply ducts with existing flexible ducts or replace damaged and deteriorated existing flexible ducts with maximum 12-inchlengths of new flexible duct.
  4. Reconnect diffusers or light troffer boots to low-pressure ducts with existing flexible ducts or replace damaged and deteriorated existing flexible ducts with maximum 60-inch lengths of flexible duct clamped or strapped in place.
  5. Reconnect existing and new flexible ducts to metal ducts with adhesive plus sheetmetal screws.

N. Testing/Reporting

1. Gravimetric Analysis: Sections of metal-duct system, chosen randomly by Owner, Architect, or Engineer shall be tested for cleanliness according to NADCA vacuum test gravimetric analysis. Test a minimum of 1 location for each 1000 square foot of project area.
  - a. If analysis determines that levels of debris are equal to or lower than suitable levels, system shall have passed cleanliness verification.
  - b. If analysis determines that levels of debris exceed suitable levels, system cleanliness verification will have failed and metal-duct system shall be re-cleaned and re-verified.
2. Verification of Coil Cleaning: Cleaning shall restore coil pressure drop to within 10 percent of pressure drop measured when coil was first installed. If original pressure drop is not known, coil will be considered clean only if it is free of foreign matter and chemical residue, based on thorough visual inspection.
3. Report results of tests in writing.

3.39 SELECTIVE DEMOLITION

- A. The extent of the demolition work is shown on the drawings or described in this specification.
- B. Refer to DIVISION 1 Sections "CUTTING AND PATCHING" and "SELECTIVE DEMOLITION" for general demolition requirements and procedures.
- C. Disconnect, demolish, and remove mechanical systems, equipment, and components indicated to be removed.
  1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
  2. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
  3. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
  4. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.
  5. Equipment to Be Removed: Disconnect and cap services and remove equipment.
  6. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
  7. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
  8. If pipe, insulation, or equipment to remain is damaged in appearance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality.
- D. RELATED WORK
  1. GENERAL CONTRACTOR
    - a. Cuts wall and surfaces to provide access to elements to be removed or disconnected.
  2. ELECTRICAL CONTRACTOR
    - a. Disconnects live wiring to all equipment or systems to be removed.
  3. PLUMBING CONTRACTOR
    - a. Disconnects live plumbing and domestic water to all equipment to be removed.
- E. CODES, ORDINANCES AND REGULATORY REQUIREMENTS

1. Comply with all state and local codes as to removal and disposal of equipment removed from the site.
2. Comply with governing EPA notification regulations before beginning selective demolition.
3. Comply with hauling and disposal regulations of authorities having jurisdiction.
4. Comply with ANSI A10.6 and NFPA 241.

F. PERMITS

1. Give all required notices, file all required plans and Specifications relating to the work of this Section with the proper authorities and pay for any required permits.

G. SITE EXAMINATION

1. Visit site prior to submitting bid to become familiar with the existing conditions which may affect the removal of systems or products provided as part of the work of this Section.
2. Extra payment or compensation for work required by this Section due to existing conditions that would have been observed during the site examination will not be made.

H. REFRIGERANT RECOVERY

1. All Air-conditioning equipment and systems shall be removed demolished without releasing refrigerants.
2. Refrigerant recovery is to be performed by a Refrigerant Recovery Technician Certified by an EPA-approved certification program.

I. REMOVAL AND DISPOSAL

1. All equipment and systems to be removed or demolished under this Section shall become the property of the contractor. The contractor shall remove all such equipment from the site promptly after detachment from building structure.
2. Storage or sale of removed items or materials on-site is not permitted.

J. COORDINATION

1. Coordinate the work of this Section with all other project contractors.
2. Provide any special information or requirements needed for the proper and safe removal of equipment.

K. HAZARDOUS MATERIALS

1. It is unknown whether hazardous materials will be encountered in the Work.
2. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner.

L. UTILITY SERVICE

1. Maintain existing Mechanical/Electrical utilities/services indicated to remain in service and protect them against damage during selective demolition operations.
2. Maintain fire-protection facilities in service during selective demolition operations.
3. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.

M. EXISTING WARRANTIES

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

3.40 TRIAL USAGE



- A. The owner shall be permitted trial usage of systems or parts of systems for the purpose of testing and learning operational procedures.
- B. Trial usage shall not be construed as acceptance.
- C. Trial usage shall be carried out with the express knowledge and under supervision of the HVAC Subcontractor, who shall not waive any responsibility because of trial usage.

#### 3.41 INSTRUCTIONS TO OWNER

- A. Submit to the Owner, lists for each system or piece of equipment indicating that all components have been checked and are complete prior to the instruction period.
- B. Thoroughly instruct the Owner's authorized representative in the safe operation of the systems and equipment. This instructional procedure shall be videoed by this contractor and three copies of the tape submitted to the Architect.
- C. Arrange and pay for the services of qualified manufacturer's representatives to instruct Owner on specialized portions of the installation. This shall include 2 hours of instruction in the operation of the water treatment system, and 8 hours of operation of the automatic temperature control system. Instruction shall take place on-site at time agreed to by Owner.
- D. Submit a complete record of instructions given to the Owner. For each instruction period, supply the following data:
  - 1. Date.
  - 2. Duration.
  - 3. System or equipment involved.
  - 4. Names of persons giving instructions.
  - 5. Other people present.
- E. Instructional period shall be carried out during a continuous period of five days.

END OF SECTION 23 00 00

Maine Medical Center  
Pavilion 6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health  
28034

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## SECTION 26 00 00 – ELECTRICAL

### PART 1 - GENERAL

#### 1.1 GENERAL REQUIREMENTS

- A. Conditions of the Contract and DIVISION 1, General Requirements, shall be made part of this Section.
- B. Refer to the drawings for further definition of location, extent, and details of the work described herein.
- C. Cooperate and coordinate with all trades in execution of the work described in this Section, so as to provide coordination with all trades for items such as - clearance for equipment maintenance & operation, proper voltages, correct receptacle types, etc.
- D. Where referred to, standard specifications of technical Societies, Manufacturer's Associations, and Federal Agencies shall include all amendments current as the date of issue of these Specifications.
- E. It is intended, for the guidance of the bidders, that the Manufacturer's name used first throughout this Section of the Specification, is that used in the design of the Electrical system. All material submitted shall be equal in all respects to that used in the design.
- F. The Subcontractor for work of this Section shall become familiar with other Sections of the Specifications to determine the type and extent of work there under which affects the work of this trade, whether or not such work is specifically mentioned in this Section.

#### 1.2 WORK INCLUDED

- A. Examine all Drawings and other Sections of Specifications for requirements that affect work of this Section.
- B. Perform work and provide materials and equipment as shown on the Drawings and as specified herein. Work shall include, but not be limited to, all labor, materials, tools, equipment, insurance, transportation, temporary protection, supervision, and incidental items required for a complete installation. Drawings and specifications form complimentary requirements; provide work specified and not shown on drawings and work shown on drawings and not specified as though explicitly shown on both. Completely coordinate work of this Section with work of other Sections and Trades to provide a complete and functional installation.
- C. Provide all labor, equipment, material, implements and materials required to furnish and install all Electrical work, complete as shown on the drawings and noted herein. The following are major items of WORK INCLUDED:
  - 1. Hoisting and rigging for equipment and materials specified herein.
  - 2. Core drilling, cutting and channeling for holes five (5) inches and less in diameter.
  - 3. Furnish and maintain in safe and adequate condition, all staging and scaffolding that is required for work of this section.
  - 4. Multiple Phase Project: The project is intended for multiple phases. The contractor shall treat each phase as a separate project requiring equipment start-up; testing, adjusting

- and balancing, reports; system flushing and testing; submittals; coordination drawings; punch lists; etc.
5. Maintain temporary electrical system throughout building during construction.
  6. Distribution panels.
  7. Panelboards.
  8. Dry-type transformers.
  9. Disconnect switches (not supplied with equipment).
  10. Circuit breakers (not supplied with equipment).
  11. Fuses.
  12. Motor controllers (not supplied with equipment).
  13. Variable frequency drives (not supplied with equipment).
  14. Grounding.
  15. Lightning protection system.
  16. Raceways and boxes.
  17. Raceway support system.
  18. Conductors and cables.
  19. Control / signal conductors.
  20. Wiring devices, including but not limited to, receptacles, switches, occupancy sensors, time switches, etc.
  21. Lighting control system.
  22. Interior lighting.
  23. Electrical Supporting devices.
  24. Pull boxes.
  25. Junction boxes.
  26. Electrical identification, including but not limited to, nameplates, device markings, cable and conduit identification, etc.
  27. Seismic restraints.
  28. Fire and Smoke Stopping. Coordinate materials and methods with DIVISION 7.
  29. Electrical identification, including but not limited to, nameplates, device markings, cable and conduit identification, etc.
  30. Modifications to existing fire alarm system.
  31. Tone-visual nurse call system.
  32. Electric heating cables.
  33. Submittals.
  34. Short Circuit and Coordination Study.
  35. Coordination Drawings.
  36. Record Documents.
  37. Electrical acceptance tests.
  38. Operation and Maintenance (O&M) Manuals.
  39. System startup, demonstration and training.
  40. Psych – Safe devices, fire alarm and remote controlled devices including solenoids.

### 1.3 INTENT

- A. Description in the Specifications, or the indication on the Drawings of equipment, materials, operation and methods, required that such items shall be of the quantity required, and the systems complete in every respect.
- B. The Specifications shall be considered an integral part of the accompanying Drawings. Any item or subject omitted from one or the other, but which is either mentioned or reasonably implied, shall be considered as properly and sufficiently specified. In the case of a conflict, the more demanding item shall apply.

- C. The Electrical Contractor shall be completely responsible for the acceptable condition and operation of all systems, equipment and components forming part of the installation or directly associated with it. The Electrical Contractor shall provide fully qualified personnel to fulfill this requirement. The Electrical Contractor shall be responsible for prompt replacement of defective materials, equipment and parts of equipment and related damages.

#### 1.4 RELATED WORK

- A. Examine all other sections of the Specifications and all drawings for the relationship of the work under this Section and the work of other trades. Cooperate with all trades and coordinate all work under this section therewith.
- B. The following related items are included under Sections listed below:
1. Except as specified herein, cutting shall be the responsibility of the General Contractor and patching shall be performed by the respective trades. Refer to the respective Sections.
  2. The Electrical Contractor shall provide all hoisting and rigging for equipment and materials specified herein.
  3. The Electrical Contractor shall provide all core-drilling, cutting and channeling for electrical equipment requiring holes five (5) inches and less in diameter.
  4. The Electrical Contractor shall furnish and maintain in safe and adequate condition, all staging and scaffolding that is required for work of this Section.
  5. Temporary light and power for use during construction and testing. DIVISION 1 – CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS.
  6. Flashing of roof for electrical equipment and electrical power provided by equipment. DIVISION 7 – ASPHALT SHINGLE ROOFING.
  7. Painting of all exposed electrical equipment not having enameled surfaces, stainless steel or chromed finishes. DIVISION 9 - PAINTING
  8. In general, all wiring required for equipment provided by the HVAC Contractor that requires Automatic Controls and all interlock wiring for this HVAC equipment that is not shown or indicated on the Electrical Drawings of DIVISION 26 - ELECTRICAL, shall be provided under DIVISION 23 – HEATING VENTILATION AND AIR CONDITIONING.
  9. The Electrical Contractor shall provide all fire stopping related to Division 16 work in accordance with DIVISION 7 – FIRE-STOPPING.
  10. The Electrical Contractor shall seal all penetrations through non-rated walls, ceilings, floors, etc related to DIVISION 26 work in accordance with DIVISION 7 – JOINT SEALERS.
  11. The Electrical Contractor shall provide all electrical power, fire alarm and line-voltage control wiring connections to power operated doors, hardware, emergency call buttons, etc. in accordance with and in coordination with DIVISION 8 – DOORS AND WINDOWS with particular attention to DIVISION 8 – FINISH HARDWARE and DIVISION 28 – INTRUSION DETECTION SYSTEM.
  12. The Electrical Contractor shall coordinate all floor box installations with Division 9 – FINISHES with particular attention to DIVISION 9 – CERAMIC TILE, DIVISION 9 – PREFINISHED HARDWOOD FLOORING, DIVISION 9 – RESILIENT FLOORING, DIVISION 9 – CARPET.
  13. The Electrical Contractor shall provide all electrical power, fire alarm and line-voltage control wiring connections to display boards, illuminated signage, etc. in accordance with and in coordination with DIVISION 10 – SPECIALTIES. Furnish the following materials to be installed under other SECTIONS.
  14. The Electrical Contractor shall provide all electrical power, fire alarm and line-voltage control wiring connections to power operated projection screens, loading dock equipment, hardware, food service equipment, etc. in accordance with and in coordination with DIVISION 11 – EQUIPMENT.

15. The Electrical Contractor shall provide a plan indicating the location and size of each access panel to the General Contractor for review and coordination. Access panels required for electrical system shall be furnished and installed by the electrical contractor in accordance with DIVISION 8 – ACCESSDOORS AND FRAMES.
  16. The Electrical Contractor shall review in detail DIVISION 1 – ALTERNATES and include alternate pricing in the bid as required by BIDDING REQUIREMENTS, CONTRACTING REQUIREMENTS, and applicable parts of DIVISION 1 – GENERAL REQUIREMENTS. Any exclusions shall be clearly outlined in the bid otherwise all related work and costs shall be included.
  17. Fire and Smoke stopping at penetrations through fire-rated assemblies. Fire-stop materials and methods are specified in DIVISION 7.
- C. Furnish the following materials to be installed under other SECTIONS.
1. The Electrical Contractor shall furnish and wire duct smoke detectors installed under DIVISION 23 - HEATING VENTILATION AND AIR-CONDITIONING.
- D. Wire the following materials furnished and installed under other SECTIONS.
1. Sprinkler flow, tamper, pressure and alarm switches furnished and installed under DIVISION 21 - FIRE PROTECTION.
  2. Air compressors and excess pressure pumps switches furnished and installed under DIVISION 21 - FIRE PROTECTION.
  3. Aqua-stat furnished and installed under DIVISION 22 - PLUMBING.
  4. Heating, ventilating and air-conditioning equipment furnished and installed under DIVISION 23 – HEATING VENTILATION AND AIR-CONDITIONING.
- E. Wire and install the following materials furnished under other SECTIONS.
1. VFDs furnished under DIVISION 23 – HEATING VENTILATION AND AIR-CONDITIONING.
- 1.5 STANDARD OF MATERIALS AND WORKMANSHIP
- A. Conditions of the Contract and DIVISION 1, General Requirements, shall be made part of this Section:
1. Workmanship and installation methods shall conform to the highest standard practice. Work shall be performed by skilled tradesmen under the direct supervision of fully qualified personnel.
  2. Install equipment in strict accordance with manufacturer's published recommendations.
  3. When requested, submit samples of materials proposed for review before proceeding with the work.
  4. Install equipment and materials to present a neat appearance. Install ducts and conduit parallel with or perpendicular to building planes.
  5. Conceal conduit and cables in finished areas. Install work so as to require a minimum amount of furring.
  6. Equipment, materials and work shall comply with the requirements of generally recognized agencies, including, but not limited to, agencies listed under DIVISION 26 Article CODES, STANDARDS AND REGULATIONS and shall conform to and be installed in strict accordance with Federal, State and Town requirements and shall meet all of the requirements of all authorities having jurisdiction.
- 1.6 ABBREVIATIONS AND DEFINITIONS
- A. "EC" as mentioned herein means specifically "Electrical Contractor" when used in conjunction with contractor, equipment, work or articles within this specification.



- B. "HVAC" or "HV" or "AC" as mentioned herein means specifically "Heating, Ventilating and Air Conditioning" or "Heating and Ventilating" or "Air Conditioning" respectively, when used in conjunction with contractor, equipment, work or articles within this specification.
- C. A.T.C. as mentioned herein means specifically Automatic Temperature Control as it refers to the manufacturer or description of work and equipment
- D. "Provide" may be used in place of "furnish and install" and where used shall mean to deliver, furnish, erect, and connect up complete in readiness for regular operation, the particular work or equipment referred to, unless otherwise specified.
- E. The term "Applicable Section Contractor" or "A.S.C." shall be understood to refer to a contractor or contractors other than the E or any Electrical Subcontractor.
- F. "Shown on drawings" as used in the specifications shall mean "noted", "indicated", "scheduled", "detailed", or any other diagrammatic or written reference made on the drawings.
- G. "Provide" as used in the specifications and on the drawings shall mean "furnish" and "install", "connect", "apply", "erect", "construct", or similar terms, unless otherwise indicated.
- H. "Material" as used in the specifications shall mean any "product", "equipment", "device", "assembly", or "item" required under the Contract, as indicated by trade or brand name, manufacturer's name, standard specification reference or other description.
- I. "Approved" or "Approval" shall mean the written approval of the Architect.
- J. "Contract Documents" shall mean the entire set of Drawings and Specifications as listed in the Table of Contents of the General Conditions including all bound and unbound material and all items officially issued to date such as addenda, bulletins, job modifications, sketches, etc.
- K. "Specification" shall mean all information contained in the bound or unbound volume, including all "Contract Documents" defined therein, except for the drawings.
- L. "Accessible" shall indicate ease of access with or without the use of ladders and without requiring extensive removal of other equipment, such as ductwork, piping, etc. to gain access. "Accessible Ceiling" indicates acoustic tile type hung ceilings. Concealed spline or sheetrock ceilings with access panels shall not be considered accessible ceilings.
- M. "Concealed" shall mean hidden from sight in chases, furred spaces, shafts, hung ceilings, embedded in construction or in crawl spaces.
- N. "Exposed" shall mean not installed underground or "Concealed" as defined above.
- O. "Electrical Subcontractor" shall refer to the Subcontractor responsible for furnishing and installation of all work indicated on the Electrical Drawings and in the Electrical Specifications.
- P. "Owner" shall refer to the Owner or his designated representative.

#### 1.7 EXAMINATION

- A. Examine the Specifications and Drawings, including the Specifications and Drawings of other DIVISIONS before bid.

- B. Before submitting bid, visit and examine the site where work is to be carried out and become familiar with all features and characteristics that affect the work of this SECTION.
- C. Report in writing, any discrepancies or deficiencies which may adversely affect the work, at least six days prior to close of bid.
- D. No allowance will be made for any difficulties encountered due to any features of the building, site or surrounding public and private property that existed up to the time of bid.

## 1.8 CODES, STANDARDS, AND REGULATIONS

- A. Electrical work shall comply with the latest editions of the following codes, including State amendments, which have been accepted by local authorities:
  - 1. BOCA – Building Officials Code Association
  - 2. IBC – International Building Code
  - 3. UBC – Uniform Building Code
  - 4. State of Maine Building Code
  - 5. State of Maine Energy Code
  - 6. NFPA 13 – Sprinkler Systems
  - 7. NFPA 70 - National Electrical Code with State Amendments
  - 8. NFPA 72 - National Fire Alarm Code with State Amendments
  - 9. NFPA 101 - Life Safety Code
  - 10. ANSI C2 - National Electrical Safety Code
  - 11. NFPA 99 - Health Care Facilities
  - 12. NFPA 110 – Emergency and Standby Power Systems
- B. Electrical work shall comply with the current standards of the following organizations:
  - 1. ADA - Americans with Disabilities Act
  - 2. IEEE - Institute of Electrical and Electronics Engineers
  - 3. IES - Illuminating Engineering Society
  - 4. EIA/TIA - Electronic Industries Association/Telecommunications Industry Association
    - a. EIA/TIA-568 Commercial Building Wiring Standard.
    - b. EIA/TIA-569 Commercial Building Standard for Telecommunication Pathways and Spaces.
  - 5. OSHA - Occupational Safety and Health Act
  - 6. FM - Factory Mutual Association
  - 7. UL - Underwriters' Laboratories
  - 8. ANSI - American National Standards Institute
  - 9. NEMA - National Electric Manufacturers Association
  - 10. ASTM - American Society for Testing and Materials
  - 11. Owner's Insurance Underwriter
  - 12. U.S. Department of Health and Human Services - Guidelines for Construction and Equipment of Hospital and Medical Facilities
  - 13. NECA 1-2006 – Standard practices for Good Workmanship in Electrical Contracting.
  - 14. NETA 2007 Acceptance Testing Specifications, InterNational Electrical Testing Association.
- C. When requirements listed in this Section conflict with each other, with the contract documents or with the requirements of applicable Codes, Standards or Regulations, the most stringent requirements shall apply.
- D. In addition to complying with the specified requirements, comply with pertinent regulations of governmental agencies and Authorities Having Jurisdiction (AHJ) including local and state building, plumbing, mechanical, electrical, fire, and health department codes and standards.

## 1.9 DRAWINGS

- A. The Drawings are schematic in nature and are intended to show approximate locations of apparatus, luminaires, devices conduit run, etc. in diagrammatic form. The Drawings are not intended to show Architectural and Structural details.
- B. Do not scale drawings. Obtain any information requiring accurate dimensions from Architectural and Structural Drawings or from site measurements. Check locations and elevations before proceeding with work.
- C. At no additional cost to the Owner, make all changes or additions to materials and/or equipment necessary to accommodate structural and architectural conditions.
- D. Leave areas clear and unobstructed where space is indicated as reserved for future equipment.
- E. Whether shown on the Drawings or not, provide adequate code required clearances, space and provision for servicing of equipment, removal and reinstallation.
- F. Provide all ceiling mounted components, including light luminaires, smoke detectors, remote test/reset stations, occupancy sensors, access doors, panels, etc., in strict accordance with reflected ceiling plans.

## 1.10 FABRICATION OF MATERIALS

- A. Before prefabricating equipment for installation, make certain that such items can be installed as shown on the Drawings without interfering with the structure or the work of other trades. Any problems that cannot be solved in agreement with other trades affected, shall be submitted for decision.
- B. If equipment is prefabricated prior to the investigation and reaching of a solution to possible interference problems, necessary changes in such prefabricated items shall be made at not extra cost to the Owner.
- C. In case of any discrepancies between the Specifications and Drawings, or where the Specifications or Drawings are not clear or definite, the subject shall be referred to or decided by the Architect whose decision shall be final. Otherwise, make adjustments at no expense to the Owner.

## 1.11 PERMITTING AND UTILITY COMPANY CHARGES

- A. Apply for, obtain and pay for all permits, inspections and fees required.
- B. Be fully acquainted with and obey all Federal, State, and Municipal laws, by-laws, codes and regulations, and all authorities having jurisdiction.
- C. Before starting any work, submit the required specifications and Drawings to the Governing Authorities for their approval. Comply with any requested changes as part of the Contract, and give any notification immediately of such changes.
- D. Where the Specifications, Instructions, or the Governing Authorities require any work to be tested, inspected or approved, give sufficient notice of its readiness for inspection, and, if the inspection is by a Governing Authority, of the date and time set for such inspection.

- E. Inspection will be made promptly. If any work is covered up without consent, it shall, if required, be uncovered for examination and the required corrections made at not extra cost to the Owner.
- F. Furnish any certificates necessary as evidence that the work conforms to the requirements of all authorities having jurisdiction.
- G. Make changes, if required, to make the work conform to all laws, bylaws, codes, and regulations, as part of DIVISION 26 work.
- H. Electrical Contractor shall assist the owner in applications for and to the local utility company energy rebate programs, including pricing information. The application and pricing information shall be submitted prior to the luminaire, lamp and ballast shop drawing submittal.

#### 1.12 SUBMITTALS

- A. Refer to DIVISION 1 - Submittals and specifications for shop drawing requirements. Without limiting the generality thereof, the Electrical Subcontractor shall also submit the additional information noted herein.
- B. General: Follow the procedures specified in DIVISION 1. Unless otherwise noted in DIVISION 1 the required shop drawing submittals shall be reviewed and returned for two full or partial submissions as part of the base Engineering scope of services. All additional submittal reviews shall be billed to the general contractor at \$750.00 per submittal.
- C. Substitutions: The DIVISION 26 contractor shall submit on the system, components, materials, manufacture, etc. utilized by the Engineer as the "Basis of Design." The contractor shall be allowed to utilize one of the listed manufacturers for items that are not listed with a "Basis of Design." When a substitution is allowed by the Architect and/or Engineer it shall be the full responsibility of the DIVISION 26 contractor to coordinate all differences with field conditions, owner, owners representatives, commissioning agent, other trades, etc. Any costs and schedule delays due to changes, modifications, redesigns, removal and replacement created by the contractors substitution or failure to coordinate substitution shall be the responsibility of the contractor.
- D. Present, not later than three (3) weeks after award of the Contract, a list of Shop Drawings shall be submitted with the name of each manufacturer and supplier. Failure to submit this list will result in the necessity for the Contractor to use that equipment which is scheduled.
- E. Do not manufacture, deliver or install equipment and materials until final review of Shop Drawings has been completed.
- F. Prior to submission of Shop Drawings, the Electrical Subcontractor shall thoroughly check each shop drawing to ascertain that it complies with the Contract requirements; that the electrical characteristics are correct; and that the dimensions of work submitted fit the available space. Any deviations from the Contract requirements shall be clearly noted on the Shop Drawings. The Electrical Subcontractor shall stamp each submittal with his firm's name, date and approval, thereby representing that the above has been complied with. Shop Drawings not so checked and stamped, shall be returned without being examined by the Architect. Review of the Shop Drawings shall not relieve the Electrical Subcontractor from the responsibility for departures from the Contract Documents. Errors in shop drawings shall be the sole responsibility of the Electrical Subcontractor whether the drawings are reviewed or not.
- G. Shop drawings shall be submitted in groups by systems. For example, all luminaires, lamps, ballasts and accessories shall be submitted simultaneously in one package.

- H. Submit for review, two transparency and (2) blue- or black-line reproductions of each Shop Drawing larger than 8 ½" x 11". Submit seven (7) copies of smaller certified Shop Drawings of all equipment, materials, equipment wiring, diagrams, motors, starters, controls and schedules. Ensure that shop drawings have adequate clear space for all stamps. When requested, resubmit drawings promptly.
- I. Submit certified Shop Drawings and distribute prints to all trades and manufacturers affected.
- J. Be responsible for presenting the processing of shop drawings to suit manufacturing schedule of equipment and construction schedule of building.
- K. Be responsible for the accuracy of equipment dimensions relative to available space, the performance and the electrical characteristics. When required, submit a complete comparison between accepted alternative equipment and materials, and that which is specified.
- L. Each Shop Drawing shall indicate clearly the correct name and address of the project, the intended use and location of the equipment, and the specified designated number.
- M. Upon receipt of approved Shop Drawings, distribute prints to all trades and manufacturers affected.
- N. Keep one set of reviewed Shop Drawings on the site at all times.
- O. Bind one set of the corrected "Reviewed" Shop Drawings in each Operation and Maintenance Instructions Manual. Refer to DIVISION 1 - SUBMITTALS, DIVISION 1 - PROJECT CLOSEOUT.
- P. Provide information to other Contractors as required of concrete equipment bases and for any other work to be performed by other trades.
- Q. The Electrical Subcontractor shall submit to the General Contractor, for transmittal to the Owner, any samples requested by the Owner. Submittal, review, and approval of samples shall be in accordance with the Conditions of the Contract.

#### 1.13 COORDINATION DRAWINGS

- A. Prepare Coordination Drawings according to the requirements outlined in DIVISION 1. Before work progresses, in addition to the shop drawings listed herein, Coordination Drawings shall be prepared by the HVAC and Sheetmetal Subcontractors, at a suitable scale not less than 3/8 inch equals one foot, showing structure, sheetmetal layout and other information as needed for coordination. (Where the HVAC and Sheetmetal Contractors are not part of the scope or do not create the Coordination Drawings, the Electrical Subcontractor shall create the Coordination Drawings as required to include all pertinent information.) The Electrical Subcontractor shall add major electrical equipment, components, and feeders to these Coordination Drawings indicating locations and space requirements for installation, access, and working clearance. The Electrical Subcontractor shall show where sequence and coordination of installations are important to the efficient flow of the Work. Coordinate drawing preparation with effort specified in other Specification Sections. Include the following electrical information on the Coordination Drawings:
  - 1. Provisions for scheduling, sequencing, moving, and positioning large equipment in the building during construction.
  - 2. Floor plans, elevations, and details, including the following:

- a. Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
  - b. Electric Coordination drawings shall include, as a minimum, all light luminaires, all switchboards, panelboards, transformers, motor control centers, feeder junction and pull boxes, feeder conduits sized 1 ¼" and greater, busways, MI cable, cable trays, all floor standing equipment, all fire alarm panels and terminal cabinets, generators, transfer switches, UPS', and control panels.
  - c. Electrical Room Layouts indicating all equipment and Code required clearances.
  - d. Equipment support details.
  - e. Exterior wall, roof, and foundation penetrations of cable and raceway; and their relation to other penetrations and installations.
  - f. Fire-rated interior wall and floor penetrations by electrical installations.
  - g. Sizes and locations of required concrete pads and bases.
3. Reflected ceiling plans to coordinate and integrate installing air supply diffusers and returns, light luminaires, alarm and communication systems components, sprinklers, and other ceiling-mounted items.
  4. All costs associated with all aspects of the Coordination Drawings, regardless of how many times they are required to be redrawn and how long it is required to produce a complete coordinated set of drawings, shall be borne by the Electrical Subcontractor.

#### 1.14 REQUESTS FOR INTERPRETATION (RFIs)

- A. Prepare Requests for Interpretation (RFIs) in accordance to Division 1 and, in addition, adhere to the following:
- B. RFIs shall originate with the Contractor. RFIs submitted directly by sub-contractors will be returned with no response. RFIs sent directly to engineer will be returned with no response. Incomplete RFIs will not be reviewed and will be returned for additional information.
- C. If email RFI submissions are allowed by DIVISION 1 then the RFI and Attachment(s) shall be in Adobe Acrobat PDF format.
- D. Submit RFIs in format specified and in addition include:
  1. Specification Section number and title and related paragraphs, as appropriate.
  2. Drawing number, room name, structural grid coordinates and detail references, as appropriate.
  3. Field dimensions and conditions, as appropriate.
  4. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
  5. Attachments: Include 8 ½" x 11" copies of construction documents highlighting areas requiring interpretation. Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation and suggested solution(s).
    - a. Supplementary drawings prepared by Contractor shall be to scale and shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

#### 1.15 RECORD DOCUMENTS

- A. Prepare record documents in accordance with the requirements in DIVISION 1. In addition to the requirements specified in DIVISION 1, indicate installed conditions for:

1. Major raceway systems, size and location, for both exterior and interior; locations of control devices; distribution and branch electrical circuitry; and fuse and circuit breaker size and arrangements.
2. Equipment locations (exposed and concealed), dimensioned from prominent building lines.
3. Approved substitutions, Contract Modifications, and actual equipment and materials installed.

#### 1.16 OPERATION AND MAINTENANCE DATA

- A. Prepare maintenance manuals in accordance with DIVISION 1 Section "PROJECT CLOSEOUT." In addition to the requirements specified in DIVISION 1, include the following information for equipment items:
  1. Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
  2. Manufacturer's printed operating procedures to include start-up, break-in, and routine and normal operating instructions; regulation, control, stopping, shutdown, and emergency instructions; and summer and winter operating instructions.
  3. Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; aligning and adjusting instructions.
  4. Servicing instructions and lubrication charts and schedules.
- B. The minimum information that shall be furnished in the maintenance manual shall include the following:
  1. Individual characteristics for trouble shooting sequences for each item of each:
    - a. Distribution panels.
    - b. Panelboards.
    - c. Dry-type transformers.
    - d. Motor controllers.
    - e. Variable frequency drives.
  2. Catalog cut sheets for every item for which a shop drawing is required.
  3. Schedule of loads served from each:
    - a. Distribution panels.
    - b. Panelboards.
    - c. Dry-type transformers.
    - d. Motor controllers.
    - e. Variable frequency drives.
  4. On-hand spare parts list and complete parts list for each:
    - a. Distribution panels.
    - b. Panelboards.
    - c. Dry-type transformers.
    - d. Disconnect switches and circuit breakers.
    - e. Motor controllers.
    - f. Variable frequency drives.
    - g. Lightning protection system.
    - h. Lighting control system.
    - i. Fire alarm system.
    - j. Nurse call system.
  5. Tap setting schedule for each:
    - a. Dry-type transformers.
  6. Overload element schedule for each motor starter.
  7. Bolt tightening torques and inspection intervals on each:
    - a. Bolted bus connection.

- b. Cable connection.
- c. Miscellaneous bolted electrical connections.
8. Manufacturers' recommended cleaning intervals and special procedures for each:
  - a. Dry-type transformer coil assembly.
  - b. Electrical equipment interior.
  - c. Electrical equipment ventilation opening.
  - d. Luminaire lenses and reflectors.
9. Main and arcing contact adjustment and replacement for each:
  - a. Contactor.
  - b. Circuit breaker.
  - c. Motor starter.
10. Calibration and exercise procedures and intervals for each:
  - a. Lighting control system.
  - b. Molded case breaker.
11. "As designed" and "as left" adjustable circuit breaker settings.
12. Testing interval and target values for ground fault protection circuit relays.
13. Testing and trouble shooting procedures unique to special systems.
14. Approved special construction details that differ from the details shown on Drawings.

#### 1.17 SHORT CIRCUIT, COORDINATION AND ARC FLASH STUDIES

- A. Fault impedance diagram, a load flow analysis or study, a short-circuit analysis or study, and a power system coordination study shall be prepared to demonstrate the protective system after devices have been properly calibrated, adjusted, set and tested. These data, including complete descriptive and technical data of all protective devices, diagrams, and studies as required to ensure complete coordination, shall be prepared in conformance with industry practices, standards, or with other technical data approved by the Engineer and shall be submitted for approval. The entire short circuit, arc flash hazard analysis, and the coordination study shall be performed using ESA or SKM Systems Analysis with both hard and soft copies submitted to the engineer for review prior to the results being implemented. The entire study described in this section of the specifications shall be performed by a registered professional engineer in accordance with ANSI/IEEE Standard 242-1986, "Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems."
- B. Determination of Facts
  1. The Contractor shall coordinate with the commercial power company for short circuit current availability at the site.
- C. Fault Impedance Diagram
  1. The diagram shall be prepared to reflect the system impedance of power sources available to supply the building or facility, and the impedance of the new power system components for the facility.
- D. Fault Locations and Short-Circuit Current Availability (SCCA)
  1. The fault impedance diagram shall, as a minimum, show fault locations for each voltage transformation and at each power distribution bus. The SCCA available at each fault location shall be shown in tabular form on the diagram for a bolted line-to-line fault and a line-to-ground fault.
  2. An Arc Flash Hazard Analysis study utilizing the SCCA study results, shall be prepared and performed by a registered professional engineer in accordance with NETA ATS section 6.3. adhesive Labels shall be printed for each piece of equipment reviewed in the study. A submittal shall be prepared for review by the engineer and owner of the labels prior to application of the labels to the equipment in the study.



- E. Power System Coordination Study
  - 1. The study shall include all data related to protective devices proposed as such data relates to the nameplate data, time-current characteristics, and the fixed or adjustable features of the protective devices. These data shall include:
    - a. The time-current characteristic curves published by the manufacturer of the protective devices or equipment having adjustable time-current characteristics.
    - b. Data published by the manufacturer of circuit breakers or protective relays which contain installation, operation and maintenance instructions for calibration, adjustment, setting, and testing of the specific protective device.
    - c. Composite time-current characteristic curves for primary, secondary and other related devices, as required to ensure coordinated power system protection between protective devices or equipment.
    - d. Provide all device settings (delays, trips, etc.) for all devices both upstream and downstream.
  
- F. Multiple Level Ground Fault Coordination Study (NEC 517.17)
  - 1. Similar to the coordination study but focused on coordinating ground fault trip settings so as to contain a ground fault to not opening more than one device upstream of the fault.
  
- G. The above studies shall be calculated by means of an industry standard, Windows computer software package such as ESA EasyPower or SKM PowerTools.
  - 1. All requirements of the current National Electrical Code shall be adhered to.
  - 2. The coordination study shall include the closest upstream utility protective device down to the panelboard main, branch, or feeder circuit breakers. Prepare the coordination curves to determine the required settings of protective devices to assure selective coordination.
  - 3. The phase and ground overcurrent protection shall be included, as well as settings for all other adjustable protective devices.
  - 4. Graphically illustrate on log-log paper that adequate time separation exists between devices. Sufficient curves shall be used to clearly indicate the coordination achieved between devices. Reasonable coordination intervals and separation of characteristic curves shall be maintained. Plot the specific time-current characteristics of each protective device in such a manner that the upstream devices will be clearly depicted on the sheet.
  - 5. The plots shall include complete titles, representative one-line diagram and legends, associated power company's relays or fuse characteristics, and complete parameters of transformers. There shall be a maximum of eight protective devices per sheet.
  - 6. The following specific information shall also be shown on the coordination curves:
    - a. Device identifications.
    - b. Time and current ratio for curves.
    - c. Fuse, circuit breaker, and relay curves, showing complete operating bands of low-voltage circuit breaker trip curves.
    - d. Cable damage curves.
    - e. ANSI transformer magnetizing inrush and withstand curves per ANSI C37.91 and transformer damage curves.
    - f. Motor starting curves
    - g. Significant maximum symmetrical or asymmetrical short circuit cutoff point.
    - h. Electric utility's relays and/or fuses including manufacturer's minimum melt, total clearing, tolerance.

- i. Medium voltage equipment relays.
  - j. Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
  - k. Low voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
  - l. Pertinent transformer full-load currents at 100 and 600 percent.
  - m. Ground fault protective device settings.
  - n. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center and panelboard.
7. Develop a table to summarize the settings selected for the protective devices. Include in the table the following:
- a. Device identification
  - b. Current transformer ratio, relay tap, time delay, and instantaneous pickup
  - c. Circuit breaker sensor rating, long-time, short-time, and instantaneous settings, and time bands.
  - d. Fuse rating and type.

#### 1.18 ELECTRICAL BASIS OF DESIGN

- A. For major pieces of electrical equipment, including but not limited to medium-voltage switchgear, medium-voltage transformers, secondary unit substations, switchgear, switchboards, transfer switches, generators, fire alarm, etc., the engineer's basis of design is the unit shown on the plans, listed in the schedules and outlined in the specification. The contractor may submit an alternate unit from the list of approved manufacturers in this specification IF he ensures that such unit has thermal and acoustical performance equal to or better than the scheduled unit and IF he ensures that the unit fits within the allotted electrical space.
- B. For equipment supported by the buildings structure or an architectural element the contractor must ensure that the submitted unit either weighs less than the scheduled unit or can be supported by the roof structure.
- C. For all outdoor mounted equipment, which differs from that shown on the schedules, the contractor must ensure that his submitted equipment does not violate any local ordinances.
- D. Electrical characteristics of submitted equipment must match those of scheduled equipment. This means that voltages, phases and hertz of submitted equipment must be the same as scheduled equipment.

#### 1.19 CONNECTIONS TO EQUIPMENT

- A. The Electrical Contractor shall provide all electrical and control connections to equipment provided under other sections of the specifications as shown on the contract documents and herein specified including final connections to equipment to result in a complete system, fully operational. Coordinate the locations of all equipment with Architect. Obtain installation diagrams and methods of installation of all equipment from manufacturers. Follow instructions strictly.

1.20 COORDINATION

- A. Fully coordinate with other trades to ensure that work is carried out in the best interests of all concerned. Install work in proper sequence to conserve headroom and space.
- B. Coordinate work with other trades to provide maximum accessibility for maintenance and operation of all equipment installed by all trades.
- C. Give notices of requirements for holes, recessed openings, pits and chases.
- D. Set all necessary sleeves and inserts before concrete is scheduled to be poured.
- E. Furnish all items to be built-in, in ample time to allow scheduled progress of work.
- F. Refer to the Coordination Drawing Section of the Specification for Coordination drawing process.
- G. Coordinate electrical power, control and interlock wiring requirements with the HVAC, Plumbing and Fire Protection Contractors two (2) weeks after receipt of signed contract to allow proper coordination between trades.
- H. Verify with the electrical characteristics of mechanical equipment with the DIVISION 23 contractors before ordering any equipment and/or installation of any electrical equipment.
- I. Verify the electrical characteristics of the elevator with the elevator contractor and general contractor to ensure complete coordination of power, control, fire alarm, signal and interlock wiring required by the contractor of this section. Examples are transfer switch interlock wiring, fire alarm interface with recall system, elevator hoist-way motorized damper fire alarm and power interface, disconnect location, elevator machine room receptacle location, sump pump, etc..
- J. Verify with the electrical characteristics of appliances and laundry equipment with the general contractor before ordering any equipment and/or installation of any electrical equipment.
- K. Verify smoke and damper actuator requirements with the general contractor and DIVISION 23 contractors before ordering any equipment and/or installation of any electrical equipment.
- L. Coordinate Duct Smoke detector sampling tube lengths and requirements with HVAC contractor.
- M. Coordinate sprinkler flow switch and tamper switch locations and requirements with fire protection contractor.
- N. Verify duct smoke detector and fire alarm interface requirements with HVAC contractor.
- O. Wire all motor starters, control devices, relays, pilot lights, accessories, contactors, wiring diagrams, and the like required for proper operation, connection and control of motorized equipment, provided by the HVAC. Plumbing and Fire Protection Contractor as specified and/or shown on the drawings.
- P. Electrical Contractor shall be responsible for the following:
  - 1. Mount and connect motor starters, VFD, controllers and disconnects, except where specified to be factory wired and mounted on the equipment.
  - 2. Provide all required power connections for all motor driven equipment.
  - 3. Provide power wiring to control transformers and control panels.

- Q. HVAC contractor provides low and line voltage control wiring to all equipment requiring control unless specifically called for on the Electrical drawings or specifications.
- R. General contractor shall provide all roof openings. Roof openings shall be the minimum size required for conduit penetrations.

#### 1.21 TEMPORARY SERVICES

- A. Temporary Fire Alarm System: Electrical Contractor shall be responsible to provide temporary fire alarm service and system as outlined in specification DIVISION 1 - TEMPORARY FACILITIES AND CONTROLS. The Electrical Contractor shall be responsible for all negotiations and coordination with the Portland Fire Department. The temporary fire alarm service shall be disconnected and reconnected during the hours of construction, in full coordination with the Portland Fire Department and General Contractor, to avoid false alarms from construction debris, dust, etc. The temporary fire alarm system shall include heat detectors, cabling, pull stations and horn/strobe units.
- B. Permanent electrical service and systems shall not be used as a temporary, except with written permission of the Architect, Owner and Engineer.

#### 1.22 COMMUNICATIONS SERVICE

- A. The Electrical Contractor shall provide duct banks, manholes, etc. to support new voice, data and video systems in the facility.

#### 1.23 IDENTIFICATION OF ELECTRICAL SYSTEMS

- A. After finish painting is complete, identify all electrical system. Use terminology consistent with the Drawings and Specifications. Refer to DIVISION 1. A line item on the schedule of values for equipment identification shall be included.
- B. Labeling of new systems added to existing systems shall be consistent with the existing numbering system and terminology. Do not use numbers that have already been used.
- C. Labeling on all exposed conduit shall be on top of the conduit out of line of sight.
- D. Submit sample labels for review.
- E. Provide typewritten master lists in Operating and Maintenance Instruction Manuals; and shop equipment numbers on Record Prints and sepias.
- F. Identification shall be consistent with Owner's standard methods of identification.

#### 1.24 PROTECTION

- A. Protect all electrical equipment, system and work from damage. Keep all equipment dry and clean at all times.
- B. Cover openings in equipment, and conduits, with caps or heavy gauge plastic sheeting until final connections are made.

- C. Correct at no cost to the Owner, any damage caused by improper storage, handling, or installation of equipment and materials.
- D. Protect equipment, conduit and temporary services installed within Section 16000 from weather damage.

#### 1.25 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Three of each type.
  - 2. Lamps: - Ten percent of the total amount furnished, three minimum.
  - 3. Ballasts - Ten percent of the total amount furnished, three minimum.
  - 4. Emergency Battery Units - Ten percent of the total amount furnished, three minimum.
  - 5. Fire Alarm Smoke Detectors – Ten percent of the total amount furnished, three minimum.
  - 6. Fire Alarm Pull Stations – Ten percent of the total amount furnished, three minimum.
  - 7. Fire Alarm Duct Smoke Detectors – One unit.
  - 8. Fire Alarm Audible / Visual Device – Ten percent of the total amount furnished, three minimum.

#### 1.26 SEISMIC DESIGN

- A. This project is located within a seismic zone requiring special provisions for the support and restraint of equipment and piping. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to the Office of Statewide Health Planning & Development for the State of California (OSHPD) and shall bear anchorage pre-approval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
  - 1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
  - 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
  - 3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
  - 4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
  - 5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

- C. Where applicable and for high rise buildings, the seismic restraint design and construction requirements for equipment and piping incorporated as part of Life Safety Systems shall be such that these systems will remain in place and be functional following a major earthquake, and that the design shall consider lateral drifts between stories as specified by code.

#### 1.27 GUARANTEE

- A. Conform to the requirements of DIVISION 1 - Project Close-out.
- B. All equipment, material and workmanship shall be unconditionally guaranteed, as set forth in the Contract, or for longer periods when stated in the Specifications. Extensions to the standard equipment warranty periods shall be arranged by the Electrical contractor to enable the period to commence upon beneficial usage by the Owner.
- C. If any equipment or material does not match the manufacturer's published data or specifically supplied rating schedules during performance tests, replace without delay the defective equipment or materials. Bear all associated costs and adjust all components at no charge to the Owner and adjust all components to achieve the proper rating.
- D. Correct defects and deficiencies, and pay for resulting damage to Mechanical or other work, and to property and person, which appear or originate during the guaranteed period
- E. The Owner shall give notice of observed defects promptly in writing.

#### 1.28 DEMOLITION

- A. The following systems shall be included for demolition as part of this project:
  - 1. Panelboards.
  - 2. Disconnect switches and circuit breakers.
  - 3. Fuses.
  - 4. Motor controllers.
  - 5. Grounding.
  - 6. Lightning protection system.
  - 7. Raceways and boxes.
  - 8. Raceway support system.
  - 9. Conductors and cables.
  - 10. Control / signal conductors.
  - 11. Wiring devices, including but not limited to, receptacles, switches, occupancy sensors, time switches, etc.
  - 12. Lighting control system.
  - 13. Interior lighting.
  - 14. Electrical Supporting devices.
  - 15. Pull boxes.
  - 16. Junction boxes.
  - 17. Electrical identification, including but not limited to, nameplates, device markings, cable and conduit identification, etc.
  - 18. Seismic restraints.
  - 19. Fire-stopping.
  - 20. Electrical identification, including but not limited to, nameplates, device markings, cable and conduit identification, etc.
  - 21. Fire alarm system.
  - 22. Nurse call system.

- B. The Electrical Contractor shall work with the demolition contractor to de-energize, cut and make safe all electrical systems to be completely demolished. The scope of work shall include coordination with existing electrical, fire alarm, public address, master clock and bell systems to insure any and all systems passing through are temporarily rerouted, reconnected and in working order for continuous operation. The Electrical Contractor shall also be responsible to coordinate the disconnection of any system connecting to a utility company service or municipal system prior to building demolition.
- C. The Electrical Contractor shall de-energize and make safe all electrical systems required to be demolished. Electrical equipment scheduled to be maintained or relocated shall be removed, stored, cleaned, and repaired prior to re-installation – this is the responsibility of the Electrical Contractor.
- D. The Electrical Contractor shall be responsible to understand the wiring and continuity of all systems and system wiring prior to demolition or removal. System wiring providing service to areas outside the area of construction shall maintained in such a manner that will not impact the full operation of the facility.
- E. The Electrical Contractor shall coordinate with DIVISION 1 – GENERAL REQUIREMENTS, DIVISION 1 – Demolition.

## PART 2 - PRODUCTS

### 2.1 SUPPORTING DEVICES

- A. Channel and angle support systems, hangers, anchors, sleeves, brackets, fabricated items, and fasteners are designed to provide secure support from the building structure for electrical components.
  - 1. Material: Steel, except as otherwise indicated, protected from corrosion with zinc coating or with treatment of equivalent corrosion resistance using approved alternative finish or inherent material characteristics.
  - 2. Metal Items for Use in Damp Locations: Hot-dip galvanized steel, except as otherwise indicated.
- B. Steel channel supports have 9/16-inch (14-mm) diameter holes at a maximum of 8 inches (203 mm) o.c., in at least 1 surface.
  - 1. Fittings and accessories mate and match with channels and are from the same manufacturer.
- C. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps or "click"-type hangers.

### 2.2 CONDUCTORS AND CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Wires and Cables:
    - a. American Insulated Wire Corp.; Leviton Manufacturing Co.
    - b. BICC Brand-Rex Company.
    - c. Carol Cable Co., Inc.
    - d. Senator Wire & Cable Company.

- e. Southwire Company.
2. Connectors for Wires and Cables:
  - a. AMP Incorporated.
  - b. General Signal; O-Z/Gedney Unit.
  - c. Monogram Co.; AFC.
  - d. Square D Co.; Anderson.
  - e. 3M Company; Electrical Products Division.
- B. Building Wires and Cables
  1. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "INSTALLATION OF CONDUCTORS AND CABLES", "Wire and Insulation Applications" paragraph.
  2. Rubber Insulation Material: Comply with NEMA WC 3.
  3. Thermoplastic Insulation Material: Comply with NEMA WC 5.
  4. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
  5. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
  6. Conductor Material: Copper.
  7. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.
- C. Connectors and Splices
  1. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "INSTALLATION OF CONDUCTORS AND CABLES", "Wire and Insulation Applications" paragraph.

## 2.3 RACEWAYS AND BOXES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Metal Conduit and Tubing:
    - a. Alfex Corp.
    - b. Anamet, Inc.; Anaconda Metal Hose.
    - c. Anixter Brothers, Inc.
    - d. Carol Cable Co., Inc.
    - e. Cole-Flex Corp.
    - f. Electri-Flex Co.
    - g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    - h. Grinnell Co.; Allied Tube and Conduit Div.
    - i. Monogram Co.; AFC.
    - j. Spiraduct, Inc.
    - k. Triangle PWC, Inc.
    - l. Wheatland Tube Co.
  2. Nonmetallic Conduit and Tubing:
    - a. Anamet, Inc.; Anaconda Metal Hose.
    - b. Arco Corp.
    - c. Breeze-Illinois, Inc.
    - d. Cantex Industries; Harsco Corp.
    - e. Certainteed Corp.; Pipe & Plastics Group.
    - f. Cole-Flex Corp.
    - g. Condux International; Electrical Products.
    - h. Electri-Flex Co.
    - i. George-Ingraham Corp.
    - j. Hubbell, Inc.; Raco, Inc.



- k. Lamson & Sessions; Carlon Electrical Products.
  - l. R&G Sloan Manufacturing Co., Inc.
  - m. Spiraduct, Inc.
  - n. Thomas & Betts Corp.
  - 3. Conduit Bodies and Fittings:
    - a. American Electric; Construction Materials Group.
    - b. Crouse-Hinds; Div. of Cooper Industries.
    - c. Emerson Electric Co.; Appleton Electric Co.
    - d. Hubbell, Inc.; Killark Electric Manufacturing Co.
    - e. Lamson & Sessions; Carlon Electrical Products.
    - f. O-Z/Gedney; Unit of General Signal.
    - g. Scott Fetzer Co.; Adalet-PLM.
    - h. Spring City Electrical Manufacturing Co.
  - 4. Metal Wireways:
    - a. Hoffman Engineering Co.
    - b. Keystone/Rees, Inc.
    - c. Square D Co.
  - 5. Nonmetallic Wireways:
    - a. Hoffman Engineering Co.
    - b. Lamson & Sessions; Carlon Electrical Products.
  - 6. Surface Metal Raceways:
    - a. Airey-Thompson Co., Inc.; A-T Power Systems.
    - b. American Electric; Construction Materials Group.
    - c. Butler Manufacturing Co.; Walker Division.
    - d. Wiremold Co. (The); Electrical Sales Division.
  - 7. Surface Nonmetallic Raceways:
    - a. Anixter Brothers, Inc.
    - b. Butler Manufacturing Co.; Walker Division.
    - c. Hubbell, Inc.; Wiring Device Division.
    - d. JBC Enterprises, Inc.; Enduro Fiberglass Systems.
    - e. Lamson & Sessions; Carlon Electrical Products.
    - f. Panduit Corp.
    - g. Thermotools Co.
    - h. United Telecom; Premier Telecom Products, Inc.
    - i. Wiremold Co. (The); Electrical Sales Division.
  - 8. Boxes, Enclosures, and Cabinets:
    - a. American Electric; FL Industries.
    - b. Butler Manufacturing Co.; Walker Division.
    - c. Crouse-Hinds; Div. of Cooper Industries.
    - d. Electric Panelboard Co., Inc.
    - e. Erickson Electrical Equipment Co.
    - f. Hoffman Engineering Co.; Federal-Hoffman, Inc.
    - g. Hubbell Inc.; Killark Electric Manufacturing Co.
    - h. Hubbell Inc.; Raco, Inc.
    - i. Lamson & Sessions; Carlon Electrical Products.
    - j. O-Z/Gedney; Unit of General Signal.
    - k. Parker Electrical Manufacturing Co.
    - l. Robroy Industries, Inc.; Electrical Division.
    - m. Scott Fetzer Co.; Adalet-PLM.
    - n. Spring City Electrical Manufacturing Co.
    - o. Thomas & Betts Corp.
    - p. Woodhead Industries, Inc.; Daniel Woodhead Co.
- B. Metal Conduit And Tubing
- 1. Rigid Steel Conduit: ANSI C80.1.

2. Rigid Aluminum Conduit: ANSI C80.5.
  3. IMC: ANSI C80.6.
  4. Plastic-Coated Steel Conduit and Fittings: NEMA RN 1.
  5. Plastic-Coated IMC and Fittings: NEMA RN 1.
  6. EMT and Fittings ANSI C80.3.
    - a. Fittings: Set-screw type.
  7. FMC: Zinc-coated steel.
  8. LFMC: Flexible steel conduit with PVC jacket.
  9. Fittings: NEMA FB 1; compatible with conduit/tubing materials.
- C. Nonmetallic Conduit And Tubing
1. ENT: NEMA TC 13.
  2. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
  3. ENT and RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
  4. LFNC: UL 1660.
- D. Metal Wireways
1. Material: Sheet metal sized and shaped as indicated.
  2. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
  3. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
  4. Wireway Covers: Screw-cover type.
  5. Finish: Manufacturer's standard enamel finish.
- E. Nonmetallic Wireways
1. Description: Fiberglass polyester, extruded and fabricated to size and shape indicated, with no holes or knockouts. Cover is gasketed with oil-resistant gasket material and fastened with captivated screws treated for corrosion resistance. Connections are flanged, with stainless-steel screws and oil-resistant gaskets.
  2. Description: PVC plastic, extruded and fabricated to size and shape indicated, with snap-on cover and mechanically coupled connections using plastic fasteners.
  3. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
  4. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
- F. Surface Raceways
1. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
  2. Surface Nonmetallic Raceways: 2-piece construction, manufactured of rigid PVC compound with matte texture and manufacturer's standard color.
  3. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.
- G. Outlet And Device Boxes
1. Sheet Metal Boxes: NEMA OS 1.
  2. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.
  3. Nonmetallic Boxes: NEMA OS 2.
- H. Pull and Junction Boxes
1. Small Sheet Metal Boxes: NEMA OS 1.

2. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

I. Enclosures And Cabinets

1. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
  - a. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
  - b. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.
2. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

2.4 WIRING DEVICES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Wiring Devices:
  - a. Hubbell Inc.
  - b. Pass & Seymour/Legrand.
  - c. Leviton Mfg. Co., Inc.
2. Multi-Outlet Assemblies:
  - a. Wiremold Co.
  - b. Hubbell, Inc.
3. Poke-Through, Floor Service Outlets, and Telephone/Power Poles:
  - a. Hubbell, Inc.
  - b. Pass & Seymour/LeGrand.
  - c. Square D Co.
  - d. Wiremold Co.

B. Wiring Devices

1. Comply with NEMA Standard WD 1, "General Purpose Wiring Devices."
2. Enclosures: NEMA 1 equivalent, except as otherwise indicated.
3. Color: As determined by Architect, except as otherwise indicated or required by Code.
4. Receptacles connected to emergency power: Red with red plate.
5. Receptacles, Straight-Blade, Hospital Grade: Listed and labeled for compliance with Hospital Grade of UL Standard 498, "Electrical Attachment Plug and Receptacle," and Federal Specification W-C-598.
6. Receptacles, Straight-Blade, Special Features: Comply with the basic requirements specified above for straight-blade receptacles of the class and type indicated, and with the following additional requirements:
  - a. Ground-Fault Circuit Interrupter (GFCI) Receptacles:
    - 1) UL Standard 943, "Ground Fault Circuit Interrupters," feed-through type, with integral NEMA 5-20R duplex receptacle arranged to protect connected downstream receptacles on the same circuit. Design units for installation in a 2-3/4-inch (70-mm) deep outlet box without an adapter.
    - 2) Self-testing with internal diagnostics.
    - 3) Red and green LED's on face. Steady green indicates power on condition. Steady red indicates presence of ground fault condition, flashing red indicates loss of capability to protect against ground fault.
    - 4) "Hubbell #GFR8300H\_ \_ ST" or approved equal.

- b. Weather resistant (WR) Receptacles: "Hubbell #HBL8300SGxxx", "Pass & Seymour #WR63Hxxx" or "Leviton #WR8300xxx"
- c. Tamper Resistant (TP) Receptacles: "Hubbell #GFR8300SGxxx", "Pass & Seymour #TR63Hxxx" or "Leviton #TR8300xxx"
- 7. Psych – Safe Applications:
  - a. Tamper – resistant blade slots.
  - b. Tamper – resistant screws on coverplate
  - c. Ground Fault Circuit Interrupter
- 8. Pendant Cord/Connector Devices: Matching, locking type, plug and plug receptacle body connector, NEMA L5-20P and L5-20R, heavy-duty grade.
  - a. Bodies: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
  - b. External Cable Grip: Woven wire mesh type made of high-strength galvanized-steel wire strand and matched to cable diameter and with attachment provision designed for the corresponding connector.
- 9. Cord and Plug Sets: Match voltage and current ratings and number of conductors to requirements of the equipment being connected.
  - a. Cord: Rubber-insulated, stranded copper conductors, with type SOW-A jacket. Grounding conductor has green insulation. Ampacity is equipment rating plus 30 percent minimum.
  - b. Plug: Male configuration with nylon body and integral cable-clamping jaws. Match to cord and to receptacle type intended for connection.
- 10. Snap Switches: Quiet-type a.c. switches, NRTL listed and labeled as complying with UL Standard 20 "General Use Snap Switches," and with Federal Specification W-S-896.
- 11. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permits separate or common feed connection.
  - a. Switch: 20 ampere, 120-277 V a.c.
  - b. Receptacle: NEMA configuration 5-15R.
- 12. Snap Switches in Hazardous (Classified) Locations: Comply with UL Standard 894, "Switches for Use in Hazardous (Classified) Locations."
- 13. Dimmer Switches: Modular full-wave solid-state units with integral, quiet on-off switches, and audible and electromagnetic noise filters.
  - a. Wattage rating exceeds connected load by 30 percent minimum, except as otherwise indicated.
  - b. Control: Continuously adjustable slide, toggle or rotary knob. Single-pole or 3-way switch to suit connections.
  - c. Incandescent Lamp Dimmers: Modular dimmer switches for incandescent luminaires; switch poles and wattage as otherwise indicated, 120 V, 60 Hz with continuously adjustable rotary knob, toggle, or slide, single-pole with soft tap or other quiet switch. Equip with electromagnetic filter to eliminate noise, RF and TV interference, and 5-inch (127-mm) wire connecting leads.
  - d. Fluorescent Lamp Dimmers: Modular dimmer switches compatible with dimmer ballasts. Trim potentiometer adjusts low-end dimming. Dimmer-ballast combination is capable of consistent dimming to a maximum of 10 percent of full brightness.
- 14. Wall Plates: Single and combination types that mate and match with corresponding wiring devices. Features include the following:
  - a. Color: Matches wiring device except as otherwise indicated. For receptacles connected to emergency circuits: Red
  - b. Plate-Securing Screws (tamperproof): Metal with heads colored to match plate finish.
  - c. Material: 0.04-inch-thick, type 302, satin-finished stainless steel, except as otherwise indicated.

### C. Multi-Outlet Assemblies

1. Comply with Standard UL 5, "Surface Metal Raceways and Fittings."
2. Components of Assemblies: Products of a single manufacturer designed to be used together to provide a complete matching assembly of raceways and receptacles.
3. Raceway Material: Metal, with manufacturer's standard corrosion-resistant finish.
4. Raceway Material: Nonmetallic.
5. Wire: No. 12 AWG.

D. Telephone/Power Service Poles

1. Description: Factory-assembled and -wired units designed to extend power, telephone, and data service from distribution wiring concealed in the ceiling to devices or outlets in the pole near the floor. Features include the following:
  - a. Poles: Nominal 2.5-inch- (65-mm-) square cross section, with height adequate to extend from floor to at least 6 inches (150 mm) above ceiling. Separate channels for power and signal wiring.
  - b. Mounting Provisions: Ceiling trim flange with concealed bracing arranged for positive connection to ceiling support members. Pole foot with carpet pad attachment.
  - c. Finishes: Manufacturer offers a minimum of 6 finish and trim combinations, including painted and satin anodized aluminum finishes and wood grain type trim. Furnish with final finish as selected from samples.
  - d. Wiring: Three No. 12 AWG power and ground conductors, one 75-ohm coaxial telephone/data cable, and one 4-pair 75-ohm telephone/data cable except as otherwise indicated.
  - e. Power Receptacles: Two single, 20-ampere, heavy-duty NEMA 5-20R units except as otherwise indicated.
  - f. Signal Outlets: Blank insert with bushed cable opening except as otherwise indicated.

## 2.5 ELECTRICAL IDENTIFICATION

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
1. Brother P-Touch
  2. American Labelmark Co.; Labelmaster Subsidiary.
  3. Brady USA, Inc.; Industrial Products Div.
  4. Calpico, Inc.
  5. Carlton Industries, Inc.
  6. Champion American, Inc.
  7. Cole-Flex Corp.
  8. D&G Sign and Label.
  9. EMED Co., Inc.
  10. George-Ingraham Corp. (The).
  11. Grimco, Inc.
  12. Ideal Industries, Inc.
  13. Kraftbilt.
  14. LEM Products, Inc.
  15. Markal Corp.
  16. National Band & Tag Co.
  17. Panduit Corp.
  18. Radar Engineers.
  19. Ready Made Sign Co.; Cornerstone Direct Corp. Div.
  20. Seton Name Plate Co.
  21. Standard Signs, Inc.

B. Receptacles

1. Each receptacle wall plate shall have a label as described in section 3. Label shall be "Brother P-Touch" using "TZS211" heavy duty ¼" white tape with black letters or approved equal.

C. Raceway and Cable Labels

1. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
2. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.
  - a. Color: Black legend on orange field.
  - b. Legend: Indicates voltage and service (ie, normal, critical, life safety, equipment branch).
3. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.
4. Pretensioned, Wraparound Plastic Sleeves: Flexible, preprinted, color-coded, acrylic bands sized to suit the diameter of the line it identifies and arranged to stay in place by pretensioned gripping action when placed in position.
5. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3 mils thick by 1 to 2 inches wide (0.08 mm thick by 25 to 51 mm wide).
6. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:
  - a. Size: Not less than 6 inches wide by 4 mils thick (152 mm wide by 0.102 mm thick).
  - b. Compounded for permanent direct-burial service.
  - c. Embedded continuous metallic strip or core.
  - d. Printed Legend: Indicates type of underground line.
7. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.
8. Aluminum, Wraparound Marker Bands: Bands cut from 0.014-inch- (0.4-mm-) thick aluminum sheet, with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.
9. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.
10. Aluminum-Faced Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002 inch (0.05 mm) thick, laminated with moisture-resistant acrylic adhesive, and punched for the fastener. Preprinted legends suit each application.
11. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2 inches (51 by 51 mm) by 0.05 inch (1.3 mm).

D. Engraved Nameplates And Signs

1. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.
2. Engraving stock, melamine plastic laminate, 1/16-inch (1.6-mm) minimum thick for signs up to 20 sq. in. (129 sq. cm), 1/8 inch (3.2 mm) thick for larger sizes.
  - a. Engraved Legend: Black letters on white face.
  - b. Punched for mechanical fasteners.
3. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for the application. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396-inch (1-mm), galvanized steel backing, with

colors, legend, and size appropriate to the application. 1/4-inch (6.4-mm) grommets in corners for mounting.

5. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

E. Miscellaneous Identification Products

1. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties with the following features:
  - a. Minimum Width: 3/16 inch (5 mm).
  - b. Tensile Strength: 50 lb (22.3 kg) minimum.
  - c. Temperature Range: Minus 40 to 185 deg F (Minus 4 to 85 deg C).
  - d. Color: As indicated where used for color coding.
2. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

## 2.6 GROUNDING

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

1. Apache Grounding; Nashville Wire Products.
2. Boggs: H. L. Boggs & Co.
3. Chance: A. B. Chance Co.
4. Dossert Corp.
5. Erico Inc.; Electrical Products Group.
6. Galvan Industries, Inc.
7. Hastings Fiber Glass Products, Inc.
8. Heary Brothers Lightning Protection Co.
9. Ideal Industries, Inc.
10. ILSCO.
11. Kearney.
12. Korn: C. C. Korn Co.
13. Lightning Master Corp.
14. Lyncole XIT Grounding.
15. O-Z/Gedney Co.
16. Raco, Inc.
17. Salisbury: W.H. Salisbury & Co., Utility.
18. Thomas & Betts, Electrical.
19. Utilco Co.

B. Grounding and Bonding Products

1. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

C. Wire and Cable Grounding Conductors

1. Comply with DIVISION 26 Section "Wires and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.
  - a. Material: Copper Only.
2. Equipment Grounding Conductors: Insulated with green color insulation.
3. Grounding-Electrode Conductors: Stranded cable.
4. Underground Conductors: Bare, tinned, stranded, except as otherwise indicated.
5. Bare Copper Conductors: Conform to the following:
  - a. Solid Conductors: ASTM B 3.
  - b. Assembly of Stranded Conductors: ASTM B 8.
  - c. Tinned Conductors: ASTM B 33.

6. Miscellaneous Conductors
  - a. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.
  - b. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.
  - c. Bonding Straps: Soft copper, 0.05 inch (1 mm) thick and 2 inches (50 mm) wide, except as indicated.
7. Connector Products
  - a. Pressure Connectors: High-conductivity-plated units.
  - b. Bolted Clamps: Heavy-duty type.
  - c. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

## 2.7 DRY-TYPE TRANSFORMERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering transformers that may be incorporated into the Work include, but are not limited to, the following:
  1. Acme Electric Corp.; Transformer Division.
  2. Bryant Electric.
  3. Cutler-Hammer/Eaton Corp.
  4. Federal Pacific Co.; Line Power Mfg. Corp. Subsidiary.
  5. GE Electrical Distribution & Control.
  6. Siemens Energy & Automation, Inc.
  7. Square D; Groupe Schneider.
- B. Transformers, General
  1. Description: Factory-assembled and -tested, air-cooled units of types specified, designed for 60-Hz service.
  2. Cores: Grain-oriented, non-aging silicon steel.
  3. Coils: Continuous Copper windings without splices, except for taps.
  4. Internal Coil Connections: Brazed or pressure type.
  5. Enclosure: Class complies with NEMA 250 for the environment in which installed.
  6. Sound levels shall be warranted by the manufacturer not to exceed the following: 15 to 50KVA - 45dB; 51 to 150kVA - 50dB; 151 to 300kVA - 55dB; 301 to 500kVA - 60dB; 501 to 700kVA - 62dB; 701 to 1000kVA - 64dB.
  7. Low-Sound-Level Units: Minimum of 3 dBA less than NEMA ST 20 standard sound levels when factory tested according to IEEE C57.12.91.
- C. General-Purpose Distribution And Power Transformers
  1. Comply with NEMA ST 20 and list and label as complying with UL 1561.
  2. Comply with NEMA TP-1-1996 Energy Efficient Standards.
    - a. NEMA TP-1-1996 Efficiency Levels for Low Voltage Dry-Type Transformers:

<b>TRANSFORMER EFFICIENCY TABLE</b>			
<b>SINGLE PHASE</b>		<b>THREE PHASE</b>	
<b>kVA</b>	<b>MIN. EFFICIENCY</b>	<b>kVA</b>	<b>MIN. EFFICIENCY</b>
15	97.7%	15	97.0%
25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%



75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%
250	98.8%	300	98.6%
333	98.9%	500	98.7%
		750	98.8%

3. Cores: One leg per phase.
  4. Windings: One coil per phase in primary and secondary.
  5. Enclosure: Indoor, ventilated, drip proof.
  6. Insulation Class: 105 or 130 deg C class for transformers 15 kVA or smaller; 180 deg C class for transformers larger than 15 kVA. All transformers larger than 15kVA shall have minimum class 155 insulation, be fully enclosed except for ventilating ports.
    - a. Rated Temperature Rise: Class 130: 80 deg C maximum rise above 40 deg C.
    - b. Rated Temperature Rise: Class 180: 115 deg C maximum rise above 40 deg C.
    - c. Rated Temperature Rise: Class 220: 150 deg C maximum rise above 40 deg C.
  7. Taps: For transformers 3 kVA and larger, full-capacity taps in high-voltage windings are as follows:
    - a. Taps, 3 through 10 kVA: Two 5-percent taps below rated high voltage.
    - b. Taps, 15 through 500 kVA: Six 2.5-percent taps, 2 above and 4 below rated high voltage.
  8. K-Factor Rating: Transformers indicated to be K-factor rated are listed to comply with UL 1561 requirements for non-sinusoidal load current handling capability to the degree defined by the designated K-factor.
    - a. Transformer design prevents overheating when carrying full load with harmonic content corresponding to the designated K-factor.
    - b. Nameplate states the designated K-factor of the transformer.
    - c. Refer to drawings for specific K-Rating required for transformer.
  9. Electrostatic Shielding: Each winding is independently single shielded with a full-width copper electrostatic shield arranged to minimize inter-winding capacitance.
    - a. Coil leads and terminal strips are arranged to minimize capacitive coupling between input and output connections.
    - b. Shield Terminal: Separate; marked "Shield" for grounding connection.
    - c. Capacitance: Shield limits capacitance between primary and secondary to a maximum of 33 Pico farads over a frequency range of 20 Hz to 1 MHz.
    - d. Common-Mode Noise Attenuation: Minus 120 dB minimum, 0.5 to 1.5 kHz; minus 65 dB minimum, 1.5 to 100 kHz.
    - e. Normal-Mode Noise Attenuation: Minus 52 dB minimum, 1.5 to 10 kHz.
  10. Wall-Mounting Brackets: Manufacturer's standard brackets for transformers up to 45 kVA.
  11. Fungus Proofing: Permanent fungicidal treatment for coil and core.
- D. Control And Signal Transformers
1. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
  2. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.
  3. Description: Self-cooled, 2 windings.
- E. Finishes
1. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.
  2. Outdoor Units: Comply with ANSI C57.12.28.

- F. Source Quality Control
  - 1. Factory Tests: Design and routine tests comply with referenced standards.
  - 2. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project if specified sound levels are below standard ratings.

## 2.8 PANELBOARDS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
  - 1. Square D Co.
  - 2. Eaton /Cutler-Hammer.
  - 3. General Electric Co.
  
- B. Panelboard Fabrication
  - 1. Enclosures: Flush- or surface-mounted cabinets as indicated. NEMA PB 1, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R.
    - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
    - d. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
  - 2. Panels shall be fully rated. Series ratings not acceptable.
  - 3. Front: Entire front trim hinged to box with piano hinge and standard door within hinged trim cover. Front for surface-mounted panelboards shall be same dimensions as box. Front trim shall be Eaton "DD" style – front piano-hinged to box, GE option "D" - front piano-hinged to box, Square D "Hinged trim" - front piano-hinged to box. Fronts for flush panelboards shall overlap box, unless otherwise indicated.
  - 4. Directory Frame: Metal, mounted inside each panelboard door.
  - 5. Bus: Hard drawn copper of 98 percent conductivity.
  - 6. Main and Neutral Lugs: Compression type.
  - 7. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors. Bonded to box.
  - 8. Service Equipment Approval: Listed for use as service equipment for panelboards with main service disconnect.
  - 9. Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances, for the overcurrent protective device ampere ratings indicated for future installation of devices.
  - 10. Extra Gutter Space: Dimensions and arrangement as indicated.
    - a. Gutter Barrier: Arranged to isolate section of gutter as indicated.
    - b. Column-Type Panelboard Configuration: Narrow cabinet extended as wireway to overhead junction box equipped with ground and neutral terminal buses.
    - c. Subfeed: Overcurrent protective device or lug provision as indicated.
  - 11. Feed-through Lugs: Sized to accommodate feeders indicated.
  
- C. Lighting and Appliance Branch-Circuit Panelboards
  - 1. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
  - 2. Doors: In panelboard front, with concealed hinges. Secure with flush catch and tumbler lock, all keyed alike.
  - 3. Populate panelboards with circuit breakers as defined on the drawings. Balance of space in all panelboards shall be filled with 1P20A spares. Spaces in panelboards not acceptable.
  - 4. Provide trim as described above.
  - 5. Provide locks for circuit breakers serving exit sign circuits, fire alarm system and emergency call and nurse call systems.

D. Distribution Panelboards

1. Doors: In panelboard front, except omit in fusible-switch panelboard, unless otherwise indicated. Secure door with vault-type latch with tumbler lock, all keyed alike.
2. Branch-Circuit Breakers: Where overcurrent protective devices are indicated to be circuit breakers, use bolt-on circuit breakers, except circuit breakers 225-A frame size and greater may be plug-in type where individual positive-locking device requires mechanical release for removal.

E. Overcurrent Protective Devices

1. Molded-Case Circuit Breaker: NEMA AB 1, handle lockable.
  - a. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting capacity rating to meet available fault current.
  - b. Application Listing: Appropriate for application, including Type SWD for switching fluorescent lighting loads and Type HACR for motors and for heating, air-conditioning, and refrigerating equipment.
  - c. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
  - d. Circuit Breakers, 400 A and Larger: Field-adjustable short-time and continuous current settings.
  - e. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
  - f. Shunt Trip: Where indicated.
  - g. Ground fault circuit interrupter: Where indicated.
2. Fusible Switch: NEMA KS 1, Type HD, clips to accommodate specified fuses, handle lockable.

## 2.9 FUSES

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuses that may be incorporated into the Work include, but are not limited to, the following:

1. Cooper Industries, Inc.; Bussmann Div.
2. Eagle Electric Mfg. Co., Inc.
3. Ferraz Corp.
4. General Electric Co.; Wiring Devices Div.
5. Gould Shawmut.
6. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

B. Cartridge Fuses

1. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class as specified or indicated; current rating as indicated; voltage rating consistent with circuit voltage.

C. Spare Fuse Cabinet

1. Cabinet: Wall-mounted, 0.05-inch- (1.27-mm-) thick steel unit with full-length, recessed piano-hinged door with key-coded cam lock and pull.
  - a. Size: Adequate for orderly storage of spare fuses specified with 15 percent spare capacity minimum.
  - b. Finish: Gray, baked enamel.
  - c. Identification: Stencil legend "SPARE FUSES" in 1-1/2-inch (40-mm) letters on door.
  - d. Fuse Pullers: For each size fuse.

## 2.10 DISCONNECT SWITCHES AND CIRCUIT BREAKERS (Not provided with equipment)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:
1. Fusible Switches:
    - a. Eaton /Cutler-Hammer.
    - b. General Electric Co.
    - c. Square D Co.
  2. Molded-Case Circuit Breakers:
    - a. Eaton /Cutler-Hammer.
    - b. General Electric Co.
    - c. Square D Co.
- B. Elevator Disconnecting Means
1. Elevator disconnecting means(disconnect switch or circuit breaker) shall contain auxiliary contacts for connection to external control elements (battery lowering device, etc.).
- C. Disconnect Switches
1. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.
  2. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.
  3. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
    - a. Outdoor Locations: Type 3R.
- D. Enclosed Circuit Breakers
1. Final circuit breaker AIC shall be based on coordination study, specification Part 1.
  2. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.
  3. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current.
  4. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.
  5. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.
  6. Circuit Breakers, 400 A and Larger: Field-adjustable, short-time and continuous-current settings.
  7. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.
  8. Shunt Trip: Where indicated.
  9. Ground fault circuit interrupter: Where indicated.
  10. Accessories: As indicated.
  11. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
    - a. Outdoor Locations: Type 3R.
    - b. Other Wet or Damp Indoor Locations: Type 4.

## 2.11 MOTOR CONTROLLERS (Not provided with equipment)

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Eaton /Cutler-Hammer.
  2. General Electric Co.
  3. Square D Co.

- B. Manual Motor Controllers
  - 1. Description: NEMA ICS 2, general purpose, Class A with toggle action and overload element.
  
- C. Magnetic Motor Controllers
  - 1. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.
  - 2. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include a control power transformer with adequate capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.
  - 3. Combination Controller: Factory-assembled combination controller and disconnect switch with or without overcurrent protection as indicated.
    - a. Fusible Disconnecting Means: NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses indicated. Select and size fuses to provide Type 2 protection according to IEC 947-4-1, as certified by a Nationally Recognized Testing Laboratory.
    - b. Nonfusible Disconnect: NEMA KS 1, heavy-duty, nonfusible switch.
    - c. Circuit-Breaker Disconnect: NEMA AB 1, motor-circuit protector with field-adjustable short-circuit trip coordinated with motor locked-rotor amperes.
  - 4. Overload Relay: Ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect, and with appropriate adjustment for duty cycle.
  - 5. Overload Relay: NEMA ICS 2, Class 10 tripping characteristics selected to protect motor against voltage unbalance and single phasing.
  
- D. Variable-Frequency Controllers (not supplied with equipment)
  - 1. Description: NEMA ICS 2, variable-frequency controller, listed and labeled as a complete unit and arranged to provide variable speed of a standard NEMA MG 1, Design B, 3-phase, induction motor by adjusting output voltage and frequency.
  - 2. Design and Rating: Match load type such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
  - 3. Isolation Transformer: Match transformer voltage ratings and capacity to system and motor voltages; and controller, motor, drive, and load characteristics.
  - 4. Output Rating: 3-phase, 6 to 60 Hz, with voltage proportional to frequency throughout voltage range.
  - 5. Output Rating: 3-phase, 6 to 66 Hz, with torque constant as speed changes.
  - 6. Output Rating: 3-phase, 6 to 120 Hz, with horsepower constant throughout speed range.
  - 7. Starting Torque: 100 percent of rated torque or as indicated.
  - 8. Speed Regulation: Plus or minus one percent.
  - 9. Ambient Temperature: 0 to 40 deg C.
  - 10. Efficiency: 95 percent minimum at full load and 60 Hz.
  - 11. Isolated control interface allows controller to follow 1 of the following over an 11:1 speed range:
    - a. Electrical Signal: 4 to 20 mA at 24 V.
    - b. Pneumatic Signal: 3 to 15 psig (20 to 100 kPa).
  - 12. Internal Adjustability: Include the following internal adjustment capabilities:
    - a. Minimum Speed: 5 to 25 percent of maximum rpm.
    - b. Maximum Speed: 80 to 100 percent of maximum rpm.
    - c. Acceleration: 2 to 22 seconds.
    - d. Deceleration: 2 to 22 seconds.
    - e. Current Limit: 50 to 110 percent of maximum rating.
  - 13. Multiple-Motor Capability: Controller suitable for service to multiple motors and furnished with a separate overload relay and protection for each controlled motor. Shut off the controller and motors served by it when an overload relay is tripped.

14. Self-protection and reliability features include the following:
    - a. Input transient protection by means of surge suppressors.
    - b. Snubber networks to protect against malfunction due to system voltage transients.
    - c. Motor Overload Relay: Adjustable and capable of NEMA 250, Class 10 performance.
    - d. Notch filter to prevent operation of the controller-motor-load combination at a natural frequency of the combination.
    - e. Instantaneous overcurrent trip.
    - f. Loss of phase protection.
    - g. Reverse phase protection.
    - h. Under- and overvoltage trips.
    - i. Overtemperature trip.
    - j. Short-circuit protection.
  15. Automatic Reset/Restart: Attempt 3 restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction. Restarting during deceleration will not damage controller, motor, or load.
  16. Power-Interruption Protection: Prevents motor from reenergizing after a power interruption until motor has stopped.
  17. Status Lights: Door-mounted LED indicators to indicate the following conditions:
    - a. Power on.
    - b. Run.
    - c. Overvoltage.
    - d. Line fault.
    - e. Overcurrent.
    - f. External fault.
  18. Panel-Mounted Operator Station: Start-stop and auto-manual selector switches with manual speed control potentiometer and elapsed time meter.
  19. Indicating Devices: Meters or digital readout devices and selector switch, mounted flush in controller door and connected to indicate controller output current, voltage, and frequency.
  20. Manual Bypass: Magnetic contactor arranged to safely transfer motor between controller output and bypass controller circuit when motor is at zero speed. Controller-off-bypass selector switch indicator lights set and indicate mode selection.
  21. Integral fused disconnect.
  22. Bypass Controller: NEMA ICS 2, full-voltage, nonreversing motor controller, provides across-the-line starting capability in manual-bypass mode. Provide motor overload protection under both modes of operation with control logic that allows common start-stop capability in either mode.
  23. Isolating Switch: Non-load-break switch arranged to isolate variable-frequency controller and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode.
  24. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- E. Enclosures
1. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.
    - a. Outdoor Locations: NEMA 250, Type 3R.
    - b. Kitchen Areas: NEMA 250, Type 4X, stainless steel.
    - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
    - d. Hazardous Areas Indicated on Drawings: NEMA 250, Type 7C.
- F. Accessories
1. Devices are factory installed in controller enclosure, unless otherwise indicated.

2. Push-Button Stations, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type.
3. Stop and Lockout Push-Button Station: Momentary-break push-button station with a factory-applied hasp arranged so a padlock can be used to lock push button in depressed position with control circuit open.
4. Control Relays: Auxiliary and adjustable time-delay relays.
5. Elapsed Time Meters: Heavy duty with digital readout in hours.
6. Meters: Panel type, 2-1/2-inch (60-mm) minimum size with 90- or 120-degree scale and plus or minus 2 percent accuracy. Where indicated, provide transfer device with an off position. Meters indicate the following:
  - a. Ammeter: To indicate output current, with current sensors rated to suit application.
  - b. Voltmeter: To indicate output voltage.
  - c. Frequency Meter: To indicate output frequency.
7. Phase-Failure and Undervoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection. Provide adjustable undervoltage setting.
8. Current-Sensing, Phase-Failure Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connection; arranged to operate on phase failure, phase reversal, current unbalance of from 30 to 40 percent, or loss of supply voltage. Provide adjustable response delay.
9. Transient Voltage Surge Suppressors: IEEE C62.41, selected to meet requirements for a medium-exposure category.
10. Impulse sparkover voltage coordinated with system circuit voltage.
11. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

## 2.12 INTERIOR LIGHTING

- A. Products: Subject to compliance with requirements, provide one of the products specified in the Luminaire Schedule on the Drawings.
- B. Luminaires and Luminaire Components, General
  1. Metal Parts: Free from burrs, sharp corners, and edges.
  2. Sheet Metal Components: Steel, except as indicated. Form and support to prevent warping and sagging.
  3. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.
  4. Reflecting Surfaces: Minimum reflectance as follows, except as otherwise indicated:
    - a. White Surfaces: 85 percent.
    - b. Specular Surfaces: 83 percent.
    - c. Diffusing Specular Surfaces: 75 percent.
    - d. Laminated Silver Metallized Film: 90 percent.
  5. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or water white, annealed crystal glass, except as otherwise indicated.
    - a. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
    - b. Lens Thickness: 0.125 inch (3 mm) minimum; except where greater thickness is indicated.
  6. Luminaire Support Components: Comply with DIVISION 26 Section "Basic Electrical Materials and Methods."
    - a. Single-Stem Hangers: 1/2-inch (12-mm) steel tubing with swivel ball fitting and ceiling canopy. Finish same as luminaire.

- b. Twin-Stem Hangers: Two, 1/2-inch (12-mm) steel tubes with single canopy arranged to mount a single luminaire. Finish same as luminaire.
  - c. Rod Hangers: 3/16-inch- (5-mm-) minimum diameter, cadmium-plated, threaded steel rod.
  - d. Hook Hanger: Integrated assembly matched to luminaire and line voltage and equipped with threaded attachment, cord, and locking-type plug.
7. Fluorescent Luminaires: Conform to UL 1570.
8. Fluorescent Ballasts: Electronic integrated circuit, solid-state, full-light-output, energy-efficient type compatible with lamps and lamp combinations to which connected.
- a. Certification by Electrical Testing Laboratory (ETL).
  - b. Labeling by Certified Ballast Manufacturers Association (CBM).
  - c. Type: Class P, high power factor, except as otherwise indicated.
  - d. Integral lamp end-of-life protection.
  - e. Sound Rating: "A" rating, except as otherwise indicated.
  - f. Voltage: Match connected circuits.
  - g. Lamp Flicker: Less than 5 percent.
  - h. Minimum Power Factor: 90 percent.
  - i. Total Harmonic Distortion (THD) of Ballast Current: Less than 10 percent.
  - j. Conform to FCC Regulations Part 15, Subpart J for electromagnetic interference.
  - k. Conform to IEEE C62.41, Category A, for resistance to voltage surges for normal and common modes.
  - l. Multilamp Ballasts: Use 2, 3, or 4 lamp ballasts for multilamp luminaires where possible.
  - m. Luminaires in multiple light level and multiple switching applications:
    - 1) Provide additional ballasts as required in order to accommodate light level and multiple switching requirements as detailed on the plans. Utilize "master-satellite" pairs with factory modular wiring or tandem-wire luminaires to minimize ballast count.
  - n. Lamp-ballast connection method does not reduce normal rated life of lamps.
  - o. Low-Temperature Fluorescent Ballasts: Comply with above requirements, except ballast may be Class P electromagnetic type. Starting temperature is minus 20 deg C or colder.
  - p. Dimming Ballasts: Electronic type providing smooth dimming over a minimum range from 100 to 5 percent light output. Listed for use with specific fluorescent dimming system provided. Dimming systems are specified in DIVISION 26 Section "Lighting Control Equipment." Fluorescent wall dimmers are specified in DIVISION 26 Section "Wiring Devices."
  - q. Ballast disconnect: Provide UL listed disconnecting means between ballast and line per NEC 410.136.
9. Electromagnetic Interference (EMI) Filters: Integral to luminaire assembly. Provide one filter for each ballast. Suppress EMI as required by MIL-STD-461.
10. Radio Interference Filter: Provide a Radio Interference Filter (RFI) for each luminaire in CT, Xray and MRI rooms.
11. Air-Handling Luminaires: Arranged for use with plenum ceiling for air return and heat extraction and for attachment of an air-diffuser boot assembly specified in DIVISION 23 Section "Air Outlets and Inlets."
- a. Sound Transmission Class (STC): Conform to ADC Standard AD 63
  - b. Supply Units: Equip with slots in one or both side trims and join with air-diffuser boot assemblies.
  - c. Heat Removal Units: Provide an air path through lamp cavity.
  - d. Dampers: Operable from outside luminaire for control of return air volume.
  - e. Static Luminaires: Slots blanked, with luminaire appearance matching active units.
12. High-Intensity-Discharge (HID) Luminaires: Conform to UL 1572.
13. HID Ballasts: Conform to UL 1029 and ANSI C82.4. Include the following features, except as otherwise indicated.



- a. Constant wattage autotransformer (CWA) or regulating high-power-factor type, unless otherwise indicated.
  - b. Operating Voltage: Match system voltage.
  - c. Single-Lamp Ballasts: Minimum starting temperature of minus 30 deg C.
  - d. Normal Ambient Operating Temperature: 40 deg C.
  - e. Open circuit operation will not reduce average life.
  - f. High-Pressure Sodium (HPS) Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.
  - g. Encapsulation: Manufacturer's standard epoxy-encapsulated model designed to minimize audible luminaire noise.
14. Instant Restrike Device: Solid-state, potted module, mounted inside HPS luminaire and compatible with HPS lamps, ballasts, and sockets up to 150 W.
    - a. Restrike Range: 105 to 130 VAC.
    - b. Maximum Voltage: 250 V peak or 150 VAC RMS.
  15. Auxiliary, Instant-On, Quartz System: Automatically switches quartz lamp when luminaire is initially energized and when momentary power outages occur. Turns quartz lamp off automatically when HID lamp reaches approximately 60 percent light output.
  16. Incandescent Luminaires: Conform to UL 1571.
  17. Track-Lighting Systems: Conform to UL 1574. Provide components, including track, fittings, and luminaires, from same manufacturer and as recommended by manufacturer for intended use.
  18. Stage- or Studio-Type Lighting Equipment: Conform to UL 1573.
  19. Exit Signs: Conform to UL 924 and the following:
    - a. Sign Colors: Conform to local code.
    - b. Minimum Height of Letters: Conform to local code.
    - c. Arrows: Include as indicated.
    - d. Lamps for AC Operation: Light-emitting diodes (LED), 70,000 hours minimum rated life.
  20. Self-Powered Exit Signs (Battery Type): Integral automatic high/low trickle charger in a self-contained power pack.
    - a. Battery: Sealed, maintenance-free, nickel-cadmium type with special warranty.
  21. Emergency Lighting Units: Conform to UL 924. Provide self-contained units with the following features:
    - a. Battery: Sealed, maintenance-free, lead-acid type with minimum 10-year nominal life and special warranty.
    - b. Charger: Minimum 2-rate, fully automatic, solid-state type, with sealed transfer relay.
    - c. Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. Relay disconnects lamps and battery and automatically recharges and floats on trickle charger when normal voltage is restored.
    - d. Wire Guard: Where indicated, provide heavy-chrome-plated wire guard arranged to protect lamp heads or luminaires.
    - e. Time-Delay Relay: Provide time-delay relay in emergency lighting unit control circuit arranged to hold unit ON for fixed interval after restoration of power after an outage. Provide adequate time delay to permit HID lamps to restrike and develop adequate output.
  22. Emergency Fluorescent Power Supply Unit: Conform to UL 924.
    - a. Internal Type: Self-contained, modular, battery-inverter unit factory mounted within luminaire body.
      - 1) Test Switch and LED Indicator Light: Visible and accessible without opening luminaire or entering ceiling space.

- 2) Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
  - 3) Charger: Fully automatic, solid-state, constant-current type.
  - 4) Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Relay disconnects lamp and battery and automatically recharges when normal voltage is restored.
  - 5) Provide constant-on conductor to each unit in addition to switch leg, per manufacturer's wiring diagram.
- b. External Type: Self-contained, modular, battery-inverter unit.
- 1) Test Switch and LED Indicator Light: Visible and accessible without entering ceiling space.
  - 2) Battery: Sealed, maintenance-free, nickel-cadmium type with minimum 10-year nominal life.
  - 3) Charger: Fully automatic, solid-state, constant-current type.
  - 4) Operation: Relay automatically turns lamp on when supply circuit voltage drops to 80 percent of nominal voltage or below. Battery automatically recharges when normal voltage is restored.

C. Lamps

1. Comply with ANSI C78 series that is applicable to each type of lamp.
2. Fluorescent Color Temperature and Minimum Color-Rendering Index (CRI):
  - a. Linear fluorescent: 3500 K and 85 CRI, except as otherwise indicated.
  - b. Compact fluorescent: 3500 K and 82 CRI, except as otherwise indicated
3. Compact fluorescent lamps: Integral lamp end-of-life protection.
4. Non-compact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid start circuits.
5. Metal Halide Color Temperature and Minimum Color-Rendering Index (CRI): 3600 K and 70 CRI, except as otherwise indicated.
6. Lamps to be used on dimming circuits shall be "seasoned" a minimum of 100 hours at full output prior to installation on dimming ballast.

D. Finishes

1. Manufacturer's standard, except as otherwise indicated, applied over corrosion-resistant treatment or primer, free of streaks, runs, holidays, stains, blisters, and similar defects.

2.13 LIGHTNING PROTECTION SYSTEM

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- B. Manufacturers: Subject to compliance with requirements, provide products by of one of the following:

1. A-C Lightning Security, Inc.
2. Approved Lightning Protection Co., Inc.
3. Harger Lightning Protection, Inc.
4. Heary Bros. Lightning Protection Co.
5. Independent Protection Co., Inc.
6. Robbins Lightning, Inc.
7. Thompson Lightning Protection Co.
8. West Dodd Lightning Conductor Corp.

C. Lightning Protection System Components

1. Comply with UL 96.
2. System Materials: Copper, with solid air terminals, except as otherwise indicated.

3. System Materials: Aluminum, with solid air terminals, except as otherwise indicated.
4. Air Terminals for Single-Ply Membrane Roof Mounting: Units with bases especially designed for single-ply membrane roof materials.
5. Air Terminal Decorations: Decorative ball, direction vane, and compass set where indicated.
6. Air Terminals for Main Stack: Stainless steel.
7. Air Terminals for Main Stack: Lead-covered copper.
8. Ground Rods: Copper-clad steel with a minimum of 27 percent of rod weight in copper cladding.
  - a. Diameter: 3/4 inch (19 mm).
  - b. Length: 10 feet (3 m).

#### 2.14 RACEWAY SUPPORT SYSTEM

- A. Outlet Boxes
  1. Flush wall mounted 4-11/16 inches square pressed galvanized steel.
  2. Center vertical barrier for combination receptacle/device.
- B. Plaster Cover
  1. Single gang for single device.
  2. Two gang for combination receptacle/device.
- C. Cover Plates
  1. Same material, finish, and color as for wiring devices.
  2. Single gang for single device with appropriate opening, split plate, etc. for device to be installed.
  3. Two gang for combination receptacle/device with appropriate opening for receptacle and opening, split plate, etc. for device to be installed.
  4. Device opening shall be bushed one-inch when used for wire pull or device type cannot be verified.
  5. Blank as shown on Drawings or when single device type not used.
- D. Raceways
  1. Per appropriate section with insulated throat bushings on all conduit runs and rubber grommets holes between boxes or box sections.
- E. Telephone Backboards
  1. 3/4 inch plywood of size shown on Drawings.
- F. Cabinets
  1. Same as for panelboard enclosures.
  2. 3/4 inch plywood shall cover interior back of the enclosure.

#### 2.15 FIRE ALARM SYSTEMS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
  1. Match existing system devices and functionality. Provide re-programming of fire alarm control panel and satellite/extender panels.
- B. Psych – Safe Applications:
  1. Manual pull stations – provide locking Lexan cover.
  2. Visual devices (strobe only) – Wheelock RSS + Cover or approved equal.

3. Audio/Visual devices (horns or speakers based existing system components) – Wheelock ET80 or approved equal.
4. Detectors (smoke, heat) – Provide perforated cover.

C. Functional Description of System

1. The following descriptions are for general functionality and conformance with code to be used as guidelines.
2. Include the following system functions and operating features plus those additional functions and features required by the authorities having jurisdiction:
  - a. Priority of Signals: Accomplish automatic response functions by the first zone initiated. Alarm functions resulting from initiation by the first zone are not altered by subsequent alarms. The highest priority is an alarm signal. Supervisory and trouble signals have second- and third-level priority. Higher-priority signals take precedence over signals of lower priority, even though the lower-priority condition occurred first. Annunciate all alarm signals regardless of priority or order received.
  - b. Noninterfering: Zone, power, wire, and supervise the system so a signal on one zone does not prevent the receipt of signals from any other zone. All zones are manually resettable from the FACP after the initiating device or devices are restored to normal. Systems that require batteries or battery back-up for the programming function are unacceptable.
  - c. Fire Alarm Control Panel (FACP) Response: The manual or automatic operation of an alarm-initiating or supervisory-operating device causes the FACP to transmit an appropriate signal including the following:
    - 1) General alarm.
    - 2) Fire-suppression system operation alarm.
    - 3) Smoke or heat detector alarm.
    - 4) Valve tamper supervisory.
    - 5) Door release.
    - 6) Elevator recall.
    - 7) Elevator shutdown.
    - 8) System trouble.
    - 9) Fan shutdown.
    - 10) Smoke-control initiation.
  - d. Transmission to Remote Central Station: Automatically route alarm, supervisory, and trouble signals to a remote central station service.
  - e. Silencing at the FACP: Switches provide capability for acknowledgment of alarm, supervisory, trouble, and other specified signals at the FACP; and capability to silence the local audible signal and light a light-emitting diode (LED). Subsequent zone alarms cause the audible signal to sound again until silenced by switch operation. Restoring alarm, supervisory, and trouble conditions to normal extinguishes the associated LED and causes the audible signal to sound again until restoration is acknowledged by switch operation.
  - f. Loss of primary power sounds a trouble signal at the FACP. The FACP indicates when the fire alarm system is operating on an alternate power supply.
  - g. Loss of primary power at the FACP sounds a trouble signal at the FACP and the annunciator. An emergency power light is illuminated at both locations when the system is operating on an alternate power supply.
  - h. Annunciation: Manual and automatic operation of alarm- and supervisory-initiating devices is annunciated both on the FACP and on the annunciator, indicating location and type of device.
  - i. FACP Alphanumeric Display: Displays plain-English-language descriptions and addresses of initiating devices, alarms, trouble signals, supervisory signals, monitoring actions, system and component status, and system commands.
  - j. General Alarm: A system general alarm includes the following:
    - 1) Indicating the general alarm condition at the FACP and the annunciator.

- 2) Identifying the device that is the source of the alarm (or its zone) at the FACP and the annunciator.
  - 3) Initiating audible and visible alarm signals throughout the building.
  - 4) Initiating voice alarms on the fire floor and the floors immediately above and below.
  - 5) Initiating elevators' automatic recall operation.
  - 6) Closing fire and smoke doors normally held open by magnetic door holders.
  - 7) Stopping supply and return fans serving zone where alarm is initiated.
  - 8) Closing smoke dampers on system serving zone where alarm is initiated.
  - 9) Initiating smoke-control sequence through a signal to the building's automatic temperature-control system.
  - 10) Unlocking designated doors.
  - 11) Recording the event on the system printer.
  - 12) Initiating transmission of alarm signal to remote central station.
  - k. Manual station alarm operation initiates a general alarm.
  - l. Water-flow alarm switch operation:
    - 1) Initiates a general alarm.
    - 2) Causes flashing of the device location-indicating lamp for the device that has operated.
  - m. Smoke detection initiates a general alarm.
  - n. Smoke detection for zones without alarm verification initiates a general alarm.
  - o. Smoke detection for zones with alarm verification causes the following:
    - 1) Audible and visible indication of an "alarm verification" signal at the FACP.
    - 2) Activation of a listed and approved "alarm verification" sequence at the FACP and the detector.
    - 3) Recording of the event on the system printer.
    - 4) General alarm initiation if the alarm is verified.
    - 5) FACP indication cancellation and system reset if the alarm is not verified.
  - p. Sprinkler valve tamper switch operation causes or initiates the following:
    - 1) A supervisory, audible, and visible "valve tamper" signal indication at the FACP and the annunciator.
    - 2) The location-indicating light to flash for the device that has operated.
    - 3) A printed record of the event on the system printer.
    - 4) Transmission of supervisory signal to remote central station.
  - q. Low-air-pressure switch operation on a dry pipe or preaction sprinkler system causes or initiates the following:
    - 1) A supervisory, audible, and visible "sprinkler trouble" signal indication at the FACP and the annunciator.
    - 2) The location-indicating light to flash for the device that has operated.
    - 3) A printed record of the event on the system printer.
    - 4) Transmission of trouble signal to remote central station.
  - r. Remote Detector Sensitivity Adjustment: Manipulation of controls at the FACP causes the selection of specific addressable smoke detectors for adjustment, display of their current status and sensitivity settings, and control of changes in those settings. The same controls can be used to program repetitive, scheduled, automated changes in sensitivity of specific detectors. Sensitivity adjustments and sensitivity adjustment schedule changes are recorded by the system printer.
3. Recording of Events: Print a record all alarm, supervisory, and trouble events on the system printer. Printouts are by zone, device, and function. When the FACP receives a signal, the alarm, supervisory, and trouble conditions are printed. The printout includes the type of signal (alarm, supervisory, or trouble) the zone identification, date, and the time of the occurrence. The printout differentiates alarm signals from all other printed indications. When the system is reset, this event is also printed, including the same information for device, location, date, and time. A command initiates the printout of a list of existing alarm, supervisory, and trouble conditions in the system.

- a. Permissible Signal Time Elapse: The maximum permissible elapsed time between the actuation of any fire alarm or fire-detection system alarm-initiating device and its indication at the FACP is 2 seconds.
  - b. Independent System Monitoring: Supervise each independent smoke- or heat-detection system, duct detector, and elevator smoke-detection system for both normal operation and trouble.
  - c. Circuit Supervision: Indicate circuit faults by both a zone and a trouble signal at the FACP. Provide a distinctive indicating audible tone and LED-indicating light. The maximum permissible elapsed time between the occurrence of the trouble condition and its indication at the FACP is 200 seconds.
- D. Addressable Devices
1. Alarm-Initiating Devices: Classified as addressable devices according to NFPA 72.
    - a. Communication Transmitter and Receiver: Integral to device. Provides each device with a unique identification and capability for status reporting to the FACP.
    - b. External Addressable Interface Unit: May be used where specified devices are not manufactured and labeled with integral multiplex transmitter and receiver. Arrange to monitor status of each device individually.
- E. Manual Pull Stations
1. Description: Double-action type, fabricated of metal or plastic, and finished in red with molded, raised-letter operating instructions of contrasting color.
    - a. Break-Glass Feature: Stations requiring the breaking of a glass panel are unacceptable. Stations requiring the breaking of a concealed glass rod are acceptable.
    - b. Station Reset: Key or wrench operated, double pole, double throw, switch rated for the voltage and current at which it operates. Stations have screw terminals for connections.
- F. Smoke Detectors
1. General: Comply with UL 268. Include the following features:
    - a. Factory Nameplate: Serial number and type identification.
    - b. Operating Voltage: 24-V dc, nominal.
    - c. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
    - d. Plug-in Arrangement: Detector and associated encapsulated electronic components are mounted in a module that connects to a fixed base with a twist-locking plug connection. The plug connection requires no springs for secure mounting and contact maintenance. Terminals in the fixed base accept building wiring.
    - e. Integral Visual Indicating Light: Connect to indicate detector has operated.
    - f. Remote Controllability: Individually monitor detectors at the FACP for calibration, sensitivity, and alarm condition, and individually adjust for sensitivity from the FACP.
  2. Photoelectric Smoke Detectors: Include the following features:
    - a. Detector Sensitivity: Between 2.5- and 3.5-percent-per-foot (0.008- and 0.011-percent-per-mm) smoke obscuration when tested according to UL 268.
    - b. Sensor: An infrared detector light source with matching silicon-cell receiver.
  3. Beam-Type Smoke Detector: Each detector consists of a separate transmitter and receiver with the following features:
    - a. Adjustable sensitivity over a 6-level range, minimum.
    - b. Linear Range of Coverage: 600 feet (183 m), minimum.
      - 1) Tamper switch initiates trouble signal at the central FACP when either transmitter or receiver is disturbed.

- 2) Separate color-coded LEDs indicate normal, alarm, and trouble status. Any detector trouble, including power loss, is reported to the central FACP as a composite "trouble" signal.
  4. Ionization-Type Smoke Detector: Multiple-chamber type operating on the ionization principle and actuated by the presence of invisible products of combustion.
  5. Remote Air-Sampling Detector System: Includes air-sampling pipe network, a laser-based photoelectric detector, a sample transport fan, and a control unit.
    - a. Pipe Network: Electrical metallic tubing connects control unit with designated sampling holes.
    - b. Smoke Detector: Particle-counting type with continuous laser beam. Sensitivity adjustable to a minimum of 3 preset values.
    - c. Sample Transport Fan: Centrifugal type, creating a minimum static of 0.05 inches (1.3 mm) of water at all sampling ports.
    - d. Control Unit: Single or multizone unit as indicated. Provides the same system power supply, supervision, and alarm features as specified for the central FACP plus separate trouble indication for airflow and detector problems.
    - e. Signals to Central FACP: Any type of local system trouble is reported to the central FACP as a composite "trouble" signal. Alarms on each system zone are individually reported to the central FACP as separately identified zones.
  6. Duct Smoke Detector: Ionization type.
    - a. Sampling Tube: Design and dimensions as recommended by the manufacturer for the specific duct size and installation conditions where applied.
    - b. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
- G. Other Detectors
1. Thermal Detector: Combination fixed-temperature and rate-of-rise unit with mounting plate arranged for outlet box mounting; 135 deg F (57 deg C) fixed-temperature setting, except as indicated.
  2. Continuous Linear Thermal Detector System: Consists of detector cable and control unit.
    - a. Detector Cable: Comply with UL 521. Rated detection temperature 155 deg F (68 deg C). Listed for "regular" service and a standard environment. Cable includes 2 steel actuator wires twisted together with spring pressure, wrapped with protective tape, and finished with PVC outer sheath. Each actuator wire is insulated with heat-sensitive material that reacts with heat to allow the cable twist pressure to short circuit the wires at the location of elevated temperature.
    - b. Control Panel: 2-zone or multizone unit as indicated. Provides the same system power supply, supervision, and alarm features as specified for the central FACP.
    - c. Signals to Central FACP: Any type of local system trouble is reported to the central FACP as a composite "trouble" signal. Alarms on each detection zone are individually reported to the central FACP as separately identified zones.
  3. Flame Detector: Ultraviolet type with plug-in base and solid-state amplifier-switching circuit set for 10-second delay, unless otherwise indicated.
- H. Alarm-Indicating Devices
1. General: Equip alarm-indicating devices for mounting as indicated. Provide terminal blocks for system connections.
  2. Horns: Electric-vibrating-polarized type, operating on 24-V dc, with provision for housing the operating mechanism behind a grille. Horns produce a sound-pressure level of 90 dB, measured 10 feet (3 m) from the source.
  3. Visual Alarm Devices: Xenon strobe lights with clear or nominal white polycarbonate lens. Mount lenses on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch (25-mm) high letters on the lens.
    - a. Devices have a minimum light output of 115 candela adjustable down to 15 candela.
    - b. Devices have a minimum light output as indicated on the Drawings.

- c. Strobe Leads: Factory connected to screw terminals.
    - d. Combination devices consist of factory-combined, audible and visual alarm units in a single mounting assembly.
  4. Remote Alarm Indicator: LED type, mounted flush in a single gang wall plate.
    - a. Connected to indicate the alarm operation of a single detector or other device.
    - b. Legend: "Alarm."
  5. Voice/Tone Speakers & speaker/strobes (equal to Wheelock): Comply with UL 1480.
    - a. Matching Transformers: Tap range matched to the acoustical environment of the speaker location.
    - b. High-Range Speaker Units: Rated 2 to 15 W.
    - c. Low-Range Speaker Units: Rated 1 to 2 W.
    - d. Speaker Mounting: Flush, semirecessed, surface, or surface-mounted bidirectional as indicated.
- I. Firefighters' Telephones
  1. Telephone Handsets: High-impact plastic handset, heavy-duty coil cord, and hook switch; connected to the FACP by dedicated, supervised communication lines. Handsets have a dynamic receiver and a carbon transmitter, operating on 24-V dc.
  2. Cabinet: Flush or surface mounted as indicated, 0.0500-inch (1.3-mm) minimum stainless steel with a latched hinged door with red trim labeled "Firefighters' Phone." Size to accommodate handset and cord.
- J. Remote Device Location-Indicating Lights and Identification Plates
  1. Description: An LED-indicating light in the vicinity of each sprinkler water-flow switch and valve tamper switch denotes the associated device is in an abnormal or trouble mode. Lamp is flush mounted in a single gang wall plate. A red, laminated, phenolic-resin identification plate at the indicating light identifies, in engraved white letters, the room where the valve is located or the protected spaces downstream from the water-flow switch.
- K. Magnetic Door Holders
  1. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching door plate. Electromagnet operates from a 120-V ac source and requires no more than 3 W to develop 25-lbf (111-N) holding force.
  2. Material and Finish: Match door hardware.
- L. Central Fire Alarm Control Panel (FACP)
  1. General: Comply with UL 864.
  2. Cabinet: Lockable steel enclosure. Arrange panel so all operations required for testing or for normal care and maintenance of the system are performed from the front of the enclosure. If more than a single unit is required to form a complete control panel, provide exactly matching modular unit enclosures. Accommodate all components and allow ample gutter space for interconnection of panels and field wiring. Identify each enclosure by an engraved, red, laminated, phenolic-resin nameplate. Lettering on the enclosure's nameplate shall not be less than 1 inch (25 mm) high. Identify individual components and modules within the cabinets with permanent labels.
  3. Systems: Alarm and supervisory systems are separate and independent in the FACP. The alarm-initiating zone boards in the FACP consist of plug-in cards. Construction requiring removal of field wiring for module replacement is unacceptable.
  4. Control Modules: Types and capacities required to perform all functions of the fire alarm systems. Local, visible, and audible signals announce alarm, supervisory, and trouble conditions. Each type of audible alarm has a different sound.
  5. Zones: Provide for all alarm and supervisory zones indicated.
  6. Indicating Lights: Provide individual LED devices for each zone. An LED test switch for each FACP section illuminates all LED devices on that section of the control panel.



- Manual toggle test switches or push test-buttons do not require a key to operate. Alarm and supervisory signals light a red LED of the associated zone. Trouble signals light an amber LED for the associated zone.
7. Resetting: Provide the necessary controls to prevent the resetting of any alarm, supervisory, or trouble signal while the alarm or trouble condition still exists.
  8. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at the FACP and addressable system components, including annunciation and supervision. A display with a minimum of 32 characters shows alarm, supervisory, and component status messages. Arrange keypad for use in entering and executing control commands.
  9. Alphanumeric Display and System Controls: Arrange to provide the basic interface between human operator at the FACP and addressable system components, including annunciation, supervision, and control. A display with a minimum of 32 characters shows alarm, supervisory, and component status messages and indicates control commands to be entered into the system for control of smoke detector sensitivity and other parameters. Arrange keypad for use in entering and executing control commands.
  10. Voice Alarm: An emergency communication system, integral with the FACP, includes central voice alarm system components complete with microphones, preamplifiers, amplifiers, and tone generators. Features include the following:
    - a. Amplifiers comply with UL 1711.
    - b. Two alarm channels permit simultaneous transmission of different announcements to different zones or floors automatically or by using the central control microphone. All announcements are made over dedicated, supervised communication lines.
    - c. Status annunciator indicates the status of the various voice alarm speaker zones and the status of firefighter telephone 2-way communication zones.
  11. Firefighters' Telephone Control Module: Controls a 2-way firefighters' communication system. Arrange system to use dedicated, 2-way, supervised voice communication links between the FACP and remote firefighters' telephone stations throughout the building. The supervised telephone lines are capable of being connected to the talk circuits by controls in this module. Controls provide the ability to disconnect phones from the talk circuits if too many phones are in use simultaneously. The module includes the following:
    - a. Audible Pulse and Tone Generator, and High-Intensity Lamp: When a remote phone is activated, it causes the audible signal to sound and the high-intensity lamp to flash.
    - b. Selector panel controls simultaneous operation of telephones in selected zones and permits up to 6 phones to be operated simultaneously. Ground faults and open or shorted telephone lines are indicated on the panel front by individual LEDs. Zone selector switches with associated LED indicators permit the fire officer to activate selected telephone zones.
  12. Instructions: Printed or typewritten instruction card mounted behind a lexan plastic or glass cover in a stainless-steel or aluminum frame. Install the frame in a location observable from the FACP. Include interpretation and appropriate response for displays and signals, and briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

M. Graphic Annunciator

1. Annunciator Panel: Indicate the building floor plan with a "You Are Here" designation. Provide an LED-indicating light on the floor plan in each zone. Mark zone boundaries on the annunciator floor plan. Provide lights that indicate the floor on which a signal was actuated if this differs from the zone. Engrave zone and floor designations on the face of the annunciator.
2. Indicating lights include individual LED indicators for each type of alarm and supervisory device and an LED to indicate trouble. The actuation of any alarm or supervisory signal causes the illumination of a zone light, floor light, and device light. System trouble

causes the illumination of all of these lights and also the trouble light. Additional LEDs indicate normal and emergency power modes for the system. A toggle or push-button switch tests the LEDs mounted on the panel. The test switch does not require key operation.

3. Faceplate: Satin-finished stainless steel or brushed aluminum. Floor plan and zone boundary lines are engraved in the faceplate and filled with colored paint. Floor plan lines are 1/4-inch- (6-mm-) wide black, and zone boundaries are 1/8-inch- (3-mm-) wide red. Engraved legends for the LEDs and switches are 1/4-inch- (6-mm-) high minimum, in letters filled with red paint.

N. System Printer

1. General: Printer is dot-matrix type, listed and labeled as an integral part of the fire alarm system.

O. Emergency Power Supply

1. General: Components include valve-regulated, recombinant lead acid battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 10 years, minimum.
2. General: Components include nickel-cadmium-type battery, charger, and an automatic transfer switch. Battery nominal life expectancy is 20 years, minimum.
3. Battery capacity is adequate to operate the complete alarm system in normal or supervisory (nonalarm) mode for a period of 24 hours. At the end of this period, the battery has sufficient capacity to operate the system, including alarm-indicating devices in either alarm or supervisory mode, for a period of 15 minutes.
  - a. Magnetic door holders are not served by emergency power. Magnetic door holders are released when normal power fails.
4. Battery Charger: Solid-state, fully automatic, variable-charging-rate type. Provide capacity for 150 percent of the connected system load while maintaining the batteries at full charge. In the event batteries are fully discharged, the charger recharges them completely within 4 hours. Charger output is supervised as part of system power supply supervision.
5. Integral Automatic Transfer Switch: Transfers the load to the battery without loss of signals or status indications when normal power fails.

P. WIRE

1. Wire: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation.
  - a. Low-Voltage Circuits: No. 16 AWG, minimum.
  - b. Line-Voltage Circuits: No. 12 AWG, minimum.

## 2.16 TONE-VISUAL NURSE CALL SYSTEMS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Rauland-Borg Corp.

B. System Requirements

1. Coordinate the features of materials and equipment to form an integrated system. Match components and interconnections for optimum performance of specified functions.
2. Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities are adequate to increase the number of stations in the future by 25 percent above those indicated without adding any internal or external components or main trunk cable conductors.
3. Existing System Compatibility: System is compatible functionally and electrically with existing system so components and wiring operate as an extension of the existing system and all functional performance of the existing system applies to the final system. Colors,

tones, types, and durations of signal manifestation are common between the new and existing systems.

4. Resistance to Electrostatic Discharge: The design of the system and its components and cabling, including selecting, arranging, and connecting materials and circuits, shall provide complete protection against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.
5. Consistency of Products with System: Where more than one version of an indicated component is available, provide the one consistent with the system type, specified functional performance, indicated location, and installation conditions.
6. Equipment: Solid-state, modular.
7. Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-prewired plug connectors.
8. Functional Performance: System functions include, but are not limited to, the following:
  - a. Call initiation at a patient station lights a steady call-placed lamp on the station, a steady lamp in the zone light and corridor dome light associated with the patient's room, and steady lights at the central annunciator and staff/duty stations. At the same time, a distinctive tone is sounded at intervals at the central annunciator and staff/duty stations. A legend at the central annunciator identifies the calling station.
  - b. Call initiation at a pull-cord call station flashes a call-placed lamp on the station, a distinctive color lamp on the room corridor dome light and zone light and at the central annunciator and staff/duty stations. At the same time, a distinctive tone is sounded at intervals at the master and staff/duty stations. A legend at the master station identifies the calling station.
  - c. Call initiation at emergency call stations produces the same responses as above except flashing rate and tone repetition rates are greater, tone frequency is higher, and the room corridor dome and zone lamps are a different, distinctive color. Indicator lamps may be extinguished and the system reset only at the calling station.
  - d. System Reset: Operating a reset button at the originating station cancels all signals associated with the call.
  - e. Cord-Set Removal: When the cord set is removed from the jack in the patient station faceplate, a patient station call is initiated as described above. Reset is accomplished by reinserting a cord-set plug or a dummy plug into the jack and operating the station reset button.
  - f. Patient control unit controls entertainment volume and channel selection. Nurse button on the unit initiates a patient station call. Integral speaker reproduces entertainment sound.

C. Equipment

1. Single-Patient Stations: Include a polarized receptacle to match the cord-set plug, a call-placed lamp, and a reset push button.
2. Dual-Patient Station: Include 2 polarized receptacles to match the cord-set plug, a single call-placed lamp, and a single reset push button.
3. Ambulatory-Patient Station: Include a call push-button switch, a call-placed lamp, and a reset push button.
4. Staff/Duty Station: Include 2, minimum, call indicator lamps, one each for "Routine" and "Emergency" calls; and an audible tone signal device.
5. Central Annunciator: Lamp type.
  - a. Lamp Legends: Machine lettered. Identify station initiating call and priority of call. Legible from a distance of 48 inches (1219 mm), minimum, when a call is present.
  - b. Power-On Indicator: Lamp type with legend.
  - c. Audible Signal: Electronic tone, coded for frequency and pulse rate, depending on priority of call.

6. Central Equipment Cabinet: Lockable metal. Houses power supplies, controls, system terminal strips, and other components. Features include the following:
    - a. Power-on indicator lamp.
    - b. Battery Back-Up Unit: Sealed battery supplies power through an automatic switch when normal power fails.
- D. Miscellaneous System Components
1. Emergency Call Station: Include a locking-type push button, labeled "Push to Call Help," a reset trigger to release push button and cancel call, and a call-placed indicator lamp.
  2. Pull-Cord Call Station: Water-resistant construction.
    - a. PULL-DOWN Switch: Lever-locking type, labeled "Pull Down to Call Help."
    - b. Reset trigger.
    - c. Call-placed indicator lamp.
  3. Patient Control Unit: Equipped with plug and 96-inch (2438-mm) white cord.
    - a. Ethylene oxide sterilizable.
    - b. LIGHT-CONTROL Switch: Arranged for independent on-off control of patient's up light and down light.
    - c. Integral Speaker: 2 inch (51 mm), with 0.35-oz. (9.9-g) magnet, minimum, rated 0.2 W.
    - d. Controls: Speaker volume, TV control, nurse call.
    - e. Housing: High-impact white plastic.
    - f. Attachment: Stainless-steel bed clamp with permanently attached mylar strap.
    - g. Quantity of Units to Be Furnished: 12 units for every 10 patient beds.
  4. Call-Button Cord Set: Plug and 72-inch (1829-mm) white, cord-equipped, momentary action, call-button switch.
    - a. Ethylene oxide sterilizable.
    - b. Washable cord.
    - c. Palladium switch contacts in high-impact white housing with cord-set strain relief.
    - d. Attachment: Stainless-steel bed clamp with permanently attached mylar strap.
    - e. Quantity of Units to Be Furnished: 3 cord sets for every 10 patient beds.
  5. Geriatric Call-Button Cord Set: Plug and 72-inch (1829-mm) white, cord-equipped, momentary action, light-pressure switch in soft outer jacket.
    - a. Ethylene oxide sterilizable.
    - b. Washable cord.
    - c. Palladium switch contacts in high-impact white housing with cord-set strain relief.
    - d. Attachment: Stainless-steel bed clamp with permanently attached mylar strap.
    - e. Quantity of Units to Be Furnished: 2 for every 10 patient beds.
  6. Squeeze-Bulb Switch Cord Set: Plug and 72-inch (1829-mm) washable tube with white, washable neoprene squeeze-bulb activator, plug-mounted, momentary contact switch.
    - a. Ethylene oxide sterilizable.
    - b. Attachment: Stainless-steel bed clamp with permanently attached mylar strap.
    - c. Quantity of Units to Be Furnished: 2 for every 10 patient beds.
  7. Call-Button Plug: Designed to plug into patient station cord-set receptacle. Button switches call circuit. Furnish 2 for every 10 patient beds.
  8. Dummy Plugs: Designed to plug into patient station cord-set receptacle when call-button plug or patient cord set is not used. Furnish 3 for every 10 patient beds.
  9. Indicator Lamps: Light-emitting-diode (LED) type with 20-year rated life, except as otherwise indicated.
  10. Equipment Mounting Provisions: To suit mounting arrangement indicated.
  11. Station Faceplates: Type 302 stainless steel, 0.0375-inch (0.95-mm) minimum, brushed finish. Machine-lettered labeling identifies lamp indications and controls.
  12. Station Faceplates: High-impact plastic, beige color. Machine-lettered labeling identifies indicator lamp and controls.
  13. Corridor Dome Lights and Zone Lights: 3-lamp signal lights.

- a. Lamps: Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.
- b. Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
- c. Filters: 2 per unit, amber and red.
14. Cable: Features include the following, except as otherwise indicated:
  - a. Conductors: Jacketed single and multitwisted pair, untinned solid copper. Sizes as recommended by system manufacturer, but not smaller than No. 22 AWG.
  - b. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.
  - c. Shielding: For speaker-microphone leads and elsewhere where recommended by the manufacturer; No. 34 AWG tinned, soft-copper strands formed into a braid or approved equivalent foil. Shielding coverage on the conductors not less than 60 percent.
  - d. Cable for Use in Plenums: Listed and labeled for plenum installation.
15. Grounding Components: As specified in DIVISION 26 Section "Grounding."

## 2.17 ELECTRIC HEATING CABLES

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering heating cables and accessories that may be incorporated in the Work include, but are not limited to, the following:
  1. Chromalox.
  2. Flexwatt Corp.
  3. General Signal; Hevi-Duty/Nelson Heat Tracing Systems.
  4. Infloor Heating Systems.
  5. Pyrotenax USA Inc.
  6. Raychem Corporation; Chemelex Div.
  7. Thermon Manufacturing Co.
- B. Roof and Gutter De-Icing Heating Cables
  1. Parallel-resistance, thermoplastic-insulated heating cables suitable for use on roofs and in gutters for snow and ice melting as indicated.
    - a. Temperature, wattage, and voltage ratings as indicated.
    - b. Copper-nickel-alloy resistance wires spiraled on fiber-glass core, polyvinyl chloride (PVC) insulation, nylon sheath, and 16 strands of 30 AWG copper braid.
    - c. Cables terminated with factory-assembled nonheating leads with connectors.
  2. Series-resistance, mineral-insulated (MI), copper-sheathed heating cables in 2-conductor configuration, suitable for use on roofs and in gutters for snow and ice melting as indicated. Temperature, wattage, and voltage ratings as indicated. Cables terminated with factory-assembled nonheating leads with connectors.
  3. Outdoor Thermostat: Temperature range from 0 to 120 deg F (-20 to 50 deg C).
- C. Pipe-Freeze-Protection Heating Cables
  1. Self-regulating, electric heating cables suitable for freeze protection of metal or plastic piping as indicated.
    - a. Temperature, wattage, and voltage ratings as indicated.
    - b. Heater output reduction at least 90 percent from 40 to 150 deg F (4 to 65 deg C) pipe temperature.
    - c. Pair of parallel 16 AWG tinned-copper bus wires are embedded in cross-linked conductive polymer core, which varies power output in response to temperature along its length.
    - d. Cable suitable for crossing over itself without overheating.
    - e. Cable cover fabricated of cross-linked, modified, polyolefin dielectric jacket and tinned-copper braid, and polyolefin outer jacket.

2. Parallel-resistance, thermoplastic-insulated heating cables suitable for freeze protection of metal or plastic piping as indicated.
  - a. Temperature, wattage, and voltage ratings as indicated.
  - b. Copper-nickel-alloy resistance wires spiraled on fiber-glass core, polyvinyl chloride (PVC) insulation, nylon sheath, and 16 strands of 30 AWG copper braid.
  - c. Cables terminated with factory-assembled nonheating leads with connectors.
3. Series-resistance, mineral-insulated (MI), copper-sheathed heating cables in single-conductor configuration, suitable for freeze protection of metal or plastic piping as indicated.
  - a. Temperature, wattage, and voltage ratings as indicated.
  - b. Cables terminated with factory-assembled nonheating leads with connectors.
4. Series-resistance, mineral-insulated (MI), copper-sheathed heating cables in single-conductor configuration, suitable for freeze protection of metal or plastic piping as indicated. Temperature, wattage, and voltage ratings as indicated. Cables terminated with factory-assembled nonheating leads with connectors.
5. Series-resistance, mineral-insulated (MI), copper-sheathed heating cables in single-conductor loop configuration, suitable for freeze protection of metal or plastic piping as indicated. Temperature, wattage, and voltage ratings as indicated. Cables terminated with factory-assembled nonheating leads with connectors.
6. Series-resistance, mineral-insulated (MI), copper-sheathed heating cables in 2-conductor configuration, suitable for freeze protection of metal or plastic piping as indicated. Temperature, wattage, and voltage ratings as indicated. Cables terminated with factory-assembled nonheating leads with connectors.
7. Series-resistance, mineral-insulated (MI), copper-sheathed heating cables in configuration as indicated, suitable for freeze protection of metal or plastic piping as indicated. Temperature, wattage, and voltage ratings as indicated. Cables terminated with factory-assembled nonheating leads with connectors.
8. Pipe Thermostat: Temperature range from 35 to 50 deg F (2 to 10 deg C), with remote bulb for directly sensing pipe-wall temperature.

D. Accessories

1. Cable installation accessories include tapes, cable ties, warning labels, end seals and splices, and installation clips for the application indicated and for a complete system.

## 2.18 LIGHTING AND LOW VOLTAGE CONTROL EQUIPMENT

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Contactors and Relays:
  - a. Automatic Switch Co.
  - b. Challenger Electrical Equipment Corp.
  - c. Eaton Corporation, Cutler-Hammer Products.
  - d. Furnas Electric Co.
  - e. GE Lighting Controls.
  - f. Hubbell Lighting, Inc.
  - g. Siemens Energy and Automation, Inc.
  - h. Square D Co.
  - i. Zenith Controls, Inc.
2. Time Switches:
  - a. Grasslin Controls Corp.
  - b. Intermatic, Inc.
  - c. Leviton Manufacturing Co., Inc.
  - d. Paragon Electric Co., Inc.
  - e. Tork, Inc.

- f. Zenith Controls, Inc.
  - 3. Photoelectric Relays:
    - a. Allen-Bradley Co, Inc.; Industrial Control Group Div.
    - b. Area Lighting Research, Inc.
    - c. Control Systems Engineering, Inc.
    - d. Fisher Pierce.
    - e. Intermatic, Inc.
    - f. Paragon Electric Co, Inc.
    - g. Rhodes: MH Rhodes, Inc. (Ripley Photocontrols).
    - h. SSAC, Inc.
    - i. Tork, Inc.
  - 4. Occupancy Sensors:
    - a. SensorSwitch
    - b. Honeywell, Inc.; Home Building Controls.
    - c. Hubbell Lighting, Inc.
    - d. Novitas, Inc.
    - e. Watt Stopper, Inc. (The).
- B. Lighting Control Equipment, General
- 1. Include line-voltage surge protection in all solid-state equipment. Comply with UL 1449 and ANSI C62.41.
  - 2. Load Compatibility: Components compatible with each other and with controlled loads.
  - 3. Dimmers and Dimmer Modules: Comply with UL 508.
    - a. Noise and Radio Frequency Interface (RFI) Suppression: Solid-state dimmers operate smoothly over their operating ranges without audible lamp noise or RFI at any setting. Modules include integral or external filters that provide audible noise and RFI suppression.
    - b. Dimmer or Dimmer Module Rating: As indicated, but not less than 125 percent of connected load.
- C. Programmable, Low-Voltage Lighting Control Systems
- 1. General: Conform to UL 916.
  - 2. System Control Module Description: Microprocessor-based, solid-state, 365-day timing and control unit. Unit is programmable for control of indicated number of output circuits. Output circuits are switched on or off by internally programmed time signals or by analog or digital signals from external sources. System output circuits are pilot-duty relay type, capable of operating latching-type single-pole lighting circuit relays, multipole lighting contactors, and other devices, all located in other enclosures. System is programmed with an integral keyboard. Keyboard use is protected by locked cover and security access code. Manual control and programming steps are viewed on an alphanumeric display. Modules include the following features:
  - 3. System Control Module Description: Microprocessor-based control unit receives programming from hand-held programmer. Control units include a solid-state, programmable, 365-day timing unit that can receive inputs from other indicated sensors and sources. Output circuits are pilot-duty relay circuits, capable of operating latching-type single-pole lighting circuit relays, multipole lighting contactors, and other devices. Output circuits also include digital circuits arranged to transmit control commands to remote preset dimmers. Modules include the following features:
  - 4. System Control Module Description: Panelboard using low-voltage, controlled, electrically operated, molded-case circuit breakers as prime output circuit device. Circuit breakers and a limited number of digital or analog, low-voltage control circuit outputs are individually controlled by microprocessor-based control unit installed in panelboard. Control unit receives inputs from indicated sensors and other sources. Line-voltage components and wiring are separated from low-voltage components and wiring by barriers. Control unit is locally programmable. Modules include the following features:

5. System Control Module Description: Programmable, microprocessor-based control unit mounted in preassembled modular relay panel. Low-voltage, controlled, latching-type, single-pole lighting circuit relays are prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control circuit outputs are supported by control unit and circuit boards associated with each relay. Control unit receives inputs from indicated sensors and other sources. Line-voltage components and wiring are separated from low-voltage components and wiring by barriers. Control unit is locally programmable. Modules include the following features:
  - a. System Memory: Nonvolatile. Reboots program and resets time automatically without errors after power outages up to 90 days' duration.
  - b. Automatic Adjustment: System automatically adjusts for leap year and daylight savings time and provides weekly routine and annual holiday scheduling.
  - c. Astronomic Control: Automatic adjustment of dawn and dusk switching.
  - d. Demand Control: Demand is monitored through pulses from a remote meter and is controlled by programmed switching of loads. System capability includes sliding window averaging and programming of load priorities and characteristics. Minimum of 2 different time-of-day demand schedules execute load-management control actions by switching output circuits or by transmitting other types of load-control signals.
  - e. Confirmation: Each relay, contactor, and other control device operated by system has auxiliary contacts connected to provide a confirmation signal to system of on or off status of device.
    - 1) Software interprets status signals, provides for their display, and initiates failure signals.
    - 2) Lamp or light-emitting diode (LED) at control module or display panel identifies status of each controlled circuit.
  - f. Remote Communications Capability: Allows programming, data-gathering interrogation, status display, and controlled command override from an IBM-compatible microcomputer at a remote location over telephone or data lines. System includes modem, communications and control software, and remote computer compatibility verification for this purpose. Microcomputer is not in this Contract. Override programmed lighting shutdown commands by telephoning computer and entering an override touch-tone code specific to zone to be controlled.
  - g. Local Override Capability: Manual, low-voltage control devices override programmed shutdown of lighting and other programmed control for intervals that may be programmed as to duration.
  - h. Automatic battery back-up provides power to maintain program and system clock operation for 90 days' minimum duration when power is off.
  - i. Compatibility with dimmer controls permits commands that change preset scenes and dimmer settings according to programmed signals.
  - j. Flick Warning: Programmable momentary turnoff of lights warns that programmed shutoff will occur in 5 minutes. Warning is repeated 5 minutes before end of programmed override period.
  - k. Diagnostics: When system operates improperly, software initiates factory-programmed diagnosis of failure and displays messages identifying problem and possible causes.

D. Contactors and Relays

1. Comply with NEMA ICS 2.
2. Description: Devices are electrically operated and mechanically held. Number of poles and ratings are as indicated. Coordinate rating of each unit with type of load served, including tungsten filament and inductive-type loads.
3. Modular Single-Pole Relays: Split-coil, momentary-pulsed type, knockout mounting.
  - a. Low-Voltage Leads: 5-pin plug connector.



- b. Pilot Contacts: Single pole.
      - c. Rated Capacity: 20 A, 125 VAC for tungsten filaments, and 20 A, 277 VAC for ballasts.
      - d. Endurance: 50,000 cycles at rated capacity.
    4. Modular Relay Panels: Steel cabinets, preassembled with modular single-pole relays, transformer power supplies, and associated components.
      - a. Barriers separate low-voltage and line-voltage components.
      - b. Cover: Hinged, lockable type.
      - c. Directory: Mounted on back of door. Identifies relays and loads controlled.
- E. Time Switches
  1. Time Switches: Solid-state programmable units with alphanumeric display conforming to UL 917. Include the following features:
  2. Time Switches: Electromechanical-dial type conforming to UL 917. Include the following features:
    - a. Astronomic dial.
    - b. Contacts: 2, rated 30 A at 277 VAC, except as otherwise indicated.
    - c. Pilot-Duty Contacts: 2, rated 2 A at 240 V, except as otherwise indicated.
    - d. Eight-Day Program: Uniquely programmable for each day of the week and holidays.
    - e. Skip-day mode.
- F. Photoelectric Relays
  1. Conform to UL 773A.
  2. Type: Solid-state, with SPDT dry contacts rated to operate relay or contactor coils to which connected.
  3. Time delay prevents false operation.
  4. Indoor Ceiling- or Wall-Mounted Units: Semiflush, calibrated to detect adequacy of daylighting in perimeter locations and arranged to turn artificial illumination on and off to suit varying intensities of available daylighting. Units are adjustable for turn-on/turn-off levels.
  5. Indoor Skylight Units: Housed in a threaded plastic fitting for mounting under skylight, suitable for monitoring light levels from 0 to 3500 foot candles (0 to 37 673 lux), with an adjustment for turn-on/turn-off levels.
  6. Outdoor Sealed Units: Weathertight housing, resistant to high temperatures and equipped with sun-glare shield and ice preventer.
- G. Occupancy Sensors
  1. General: Designed for type of mounting and space detection coverage requirements indicated. Connected to receive power from and operate a light switching relay in a separately mounted auxiliary power control unit, except as otherwise indicated.
  2. Operation: Turns lights on when room or covered area is occupied and off when unoccupied, except as otherwise indicated.
    - a. Time Delay for Turning Lights Off: Adjustable.
    - b. Ambient-Light-Level Control: Adjustable to set a level of ambient illumination above which sensor will not turn lights on.
    - c. Isolated Relay Contact: Operates on detection of occupancy to activate an independent function.
    - d. Dual switching: Energy code compliant for perimeter non-exam room spaces such as offices, meeting rooms, etc.
  3. Auxiliary Power Control Units: Relays are rated for a minimum of 20-A ballast load or 13-A tungsten lamp load. Sensor power supply is rated to supply number of sensor heads to which it is connected.
  4. Passive Infrared Type: Occupancy is detected by a combination of heat and movement in zone of coverage. Each sensing head detects occupancy anywhere in an area of 1000

sq. ft. (93 sq. m) by detecting occurrence of 6-inch (150-mm) minimum movement of any portion of a human body that presents a minimum target of 36 sq. in. (232 sq. cm) to sensor head.

5. Ultrasonic Type: Unit emits a beam of ultrasonic energy and detects occupancy through use of doppler principal in discerning movement in zone of coverage by sensing a change in pattern of reflected ultrasonic energy.
6. Dual-Technology Type: Unit uses a combination of passive infrared and microphonic detection methods to distinguish between occupied and unoccupied conditions for area covered. Particular technology or combination of technologies that controls each function (on or off) is selectable in field by operating controls on unit.

#### H. Manual Switches and Plates

1. Switches: Specification grade, modular, momentary push-button, low-voltage type.
  - a. Color: White, except as otherwise indicated.
  - b. Integral Pilot Light: Indicates when circuit is on. Use where indicated.
  - c. Locator Light: Internal illumination helps locate switch in the dark. Use where indicated.
  - d. Wall Plates: Match those specified in DIVISION 26 Section "Wiring Devices" to materials, finish, and color. Use multigang plates where more than one switch is indicated at a location.
  - e. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

#### I. Low-Voltage Wiring

1. Digital and Multiplexed Signal Wire: Shielded, twisted-pair cable as specified in DIVISION 26 Section "Voice and Data Systems."
2. Low-Voltage Control Cable: Multiple conductor, color coded, No. 20 AWG copper.
  - a. Sheath: Polyvinyl chloride (PVC), except in plenum-type spaces. In plenum-type spaces, use sheath listed for such use.
  - b. Ordinary Switch Circuits: 3 conductors, except as otherwise indicated.
  - c. Switch Circuits with Pilot Lights or Locator Feature: 5 conductors, except as otherwise indicated.

### 2.19 SEISMIC RESTRAINTS AND VIBRATION ISOLATION TYPES

1. General
  - a. All isolation and seismic restraint devices shall be capable of accepting, without failure, the "G" forces as determined by the seismic certification and calculations as described in the "SUBMITTAL DATA REQUIREMENTS" section of these specifications.
  - b. Corrosion protection for outdoor applications shall be as follows:
    - 1) Springs shall be cadmium plated, zinc electroplated or powder coated.
    - 2) Hardware shall be cadmium or zinc plated.
    - 3) All other metal parts shall be hot spray or hot dipped galvanized or zinc electroplated.
  - c. All seismic restraint devices
    - 1) Shall maintain the equipment in a captive position and not short circuit isolation device during normal operating conditions.
    - 2) Shall have provisions for bolting and/or welding to the structure.
  - d. Welding of springs to isolator housing, base plates, etc. is strictly prohibited.
2. Seismic Restraint Types
  - a. TYPE I: Same as Type B isolator.
  - b. TYPE II: Where required, each corner or side of equipment base shall incorporate a seismic restraint snubber having an all directional resilient neoprene pad limit

- stops. Restraints shall be fabricated of plate, structural members or square metal tubing. Model "SS" as manufactured by NAI.
- c. TYPE III: Restraints for suspended systems.
    - 1) Vibration isolated systems shall be braced with multiple 7 x 19 galvanized steel cables with approved attachment devices (such as thimbles and wire rope clips) to equipment and structure.
    - 2) Non-isolated systems shall be braced with structural steel strut or cable with approved attachment devices to equipment and structure.
    - 3) Steel angles (by contractor) shall be provided to prevent rod bending of hung equipment where indicated by the Seismic Restraint Supplier's submittals. Steel angles shall be attached to the rods with a minimum of three clamps model "SRC" at each restraint location. Welding of support rods to angles is not acceptable.
  - d. TYPE IV: Double deflection neoprene.
    - 1) Mountings shall be fabricated to resist the wind or seismic forces. Model "RNM" as manufactured by NAI.
  - e. TYPE V: Rigid attachment to structure utilizing wedge type expansion anchors for bolting and steel plates, either cast-in or anchored with wedge type expansion bolts, for welding. Powder shots are not acceptable. Concrete anchor bolt spacing shall be in accordance with anchor manufacturer's published standards.
3. Vibration Isolator Types
- a. TYPE A: Spring Isolator - Free Standing
    - 1) Spring shall have a minimum outer diameter to overall height ratio of 0.8: 1 at rated deflection.
    - 2) Reserve deflection (from published load ratings to solid height) of 50% of the rated deflection.
    - 3) Minimum 1/4" thick neoprene acoustical base pad or cup on underside, unless designated otherwise.
    - 4) Model "SM" as manufactured by NAI.
  - b. TYPE B: Spring Isolator - Restrained
    - 1) Shall be the same as TYPE A with the following additional features.
      - a) Integral restraining bolts with elastomeric cushions preventing metal-to-metal contact.
      - b) Internal spring adjusting nut or bolt.
      - c) Built-in all-directional limit stops with minimum 1/8" clearance under normal operation.
      - d) Model "RSM" as manufactured by NAI.
  - c. TYPE C: Spring Hanger Isolator
    - 1) a. Spring element (same as TYPE A) within a steel box with an Elastomer bushing to insulate lower support rod from the hanger box.
    - 2) b. Steel hanger box shall be capable of 30-degree misalignment between the rod attachment to structure and the connection to the supported equipment. Hanger boxes shall withstand three times the rated load without failure.
    - 3) Model "SH" as manufactured by NAI.
  - d. TYPE D: Double deflection neoprene
    - 1) Mountings shall be fabricated to resist the wind or seismic forces.
    - 2) Model "RNM" as manufactured by NAI.
  - e. TYPE E: Elastomer Hanger Isolator
    - 1) Molded neoprene element with a bushing to insulate lower support rod from the hanger box.
    - 2) Steel hanger box shall withstand three times the rated load without failure.
    - 3) Model "NH" as manufactured by NAI.
  - f. TYPE F: Combination Spring/Elastomer Hanger Isolator

- 1) Spring and neoprene elements in a steel hanger box with the features as described for TYPE C and E isolators.
- 2) Model "SNH" as manufactured by NAI.
- g. TYPE M: Flashable restrained isolator
  - 1) Shall have all features of TYPE B isolator.
  - 2) Shall have galvanized steel spring pocket covers for adjustment and/or removal and replacement of springs.
  - 3) The combination floating top rail and top flashing shall be fabricated of two formed and nested layers of 12 ga. galvanized steel.
  - 4) Isolator shall be flashed directly into the waterproofing membrane.
  - 5) To be complete with wood nailers, plywood sides, counter flashing and resilient weather seal.
  - 6) Model "FRSM" as manufactured by NAI.
- h. TYPE P: Elastomer Isolator
  - 1) Double deflection neoprene compression mountings.
  - 2) Non-skid top and bottom surfaces.
  - 3) Threaded bolting sleeves shall be embedded in the isolator.
  - 4) Drilled tie-down bolt holes shall be provided in the base plate.
  - 5) Model "FMD" by NAI.

B. EQUIPMENT BASES, CURBS & SUPPORTS

1. GENERAL

- a. All non galvanized materials shall be prime paint finished.

2. BASE TYPES

- a. TYPE B-1: Structural Steel Base
  - 1) Welded steel stand with 1-1/2" +/- adjustable legs.
  - 2) Provide pre-drilled holes for unit attachment to the stand.
  - 3) Model "CRS" as manufactured by NAI.

2.20 TOUCHUP PAINT

- A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.
- B. For Nonequipment Surfaces: Matching type and color of undamaged, existing adjacent finish.

PART 3 - INSTALLATION

3.1 EXAMINATION

- A. Verify that field measurements and circulating arrangements are as shown on Drawings.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition Drawings are based on casual field observation and existing record documents. Contractor shall report discrepancies to Owner and Architect/Engineer before disturbing existing installation.
- D. The start of demolition is verification that the contractor accepts and thoroughly understands existing conditions.

### 3.2 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings scheduled for removal.
- B. Coordinate service outages with owner, owners representative and Construction Site Superintendent.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment, feeders or branch circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from or notify Owner and Architect/Engineer at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Notify Owner, Architect/Engineer, and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

### 3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Demolish and extend existing electrical work under provisions of DIVISION 1, DIVISION 2, and this Section. Install relocated materials and equipment under the provisions of DIVISION 1.
- B. Accessible Work Indicated to Be Demolished: Remove exposed electrical installation in its entirety.
- C. Abandoned Work: Cut and remove buried raceway 2 inches (50 mm) below the surface of adjacent construction. Remove existing wiring in its entirety. Cap and patch surface to match existing finish.
- D. Removal: Contractor (DIVISION 26) shall be responsible to disconnect, make safe and lower to the ground all electrical systems, equipment, materials and components indicated for removal or demolition. Electrical conduit and conductors, feeders and branch circuits for all electrical systems indicated on the drawings and in the specifications shall be removed in their entirety unless otherwise indicated. The demolished material shall be collected and removed from the project site by the Demolition or General Contractor.
- E. Temporary Disconnection: Remove, store, clean, reinstall, reconnect, and make operational components indicated for relocation or labeled existing to be maintained.
- F. Remove, relocate, and extend existing installations to accommodate the construction process, phasing and the temporary partitions utilized to segregate the construction areas from occupied areas.
- G. Where electrical work to remain is damaged or disturbed in the course of the Work, remove damaged portions and install new products of equal capacity, quality, and functionality.
- H. Repair adjacent construction and finishes damaged during demolition and extension work.

- I. Maintain access to existing electrical installations which remain active. Modify installation or provide access panel as appropriate.
- J. Extend existing installations using materials and methods compatible with existing electrical installations or as specified.

### 3.4 CLEANING AND REPAIR OF EXISTING EQUIPMENT

- A. Clean and repair existing materials and equipment indicated as, existing to be maintained or existing to be relocated.
- B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide filler plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.
- C. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts, and broken electrical components. Install luminaires in new location as indicated on the drawings.

### 3.5 CUTTING AND PATCHING

- A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for electrical installations. Perform cutting by skilled mechanics of the trades involved.
- B. Repair disturbed surfaces to match adjacent undisturbed surfaces.

### 3.6 ROUGH-IN

- A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.
- B. Refer to equipment specifications, drawings, elevations and shop drawings in Divisions 2 through 28 to verify rough-in requirements.

### 3.7 ELECTRICAL INSTALLATIONS

- A. General: Sequence, coordinate, and integrate the various elements of electrical systems, materials, and equipment. Comply with the following requirements:
  - 1. Coordinate electrical systems, equipment, and materials installation with other building components.
  - 2. Verify all dimensions by field measurements.
  - 3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for electrical installations.
  - 4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
  - 5. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
  - 6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible.

7. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect.
8. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components, where installed exposed in finished spaces.
9. Install electrical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
10. Install access panel or doors where units are concealed behind finished surfaces. Access panels and doors are specified in DIVISION 8.
11. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.

### 3.8 ELECTRICAL SUPPORTING METHODS

- A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.
- B. Dry Locations: Steel materials.
- C. Support Clamps for PVC Raceways: Click-type clamp system.
- D. Conform to manufacturer's recommendations for selecting supports.
- E. Strength of Supports: Adequate to carry all present and future loads, times a safety factor of at least 4; 200-lb- (90-kg-) minimum design load.

### 3.9 INSTALLATION OF ELECTRICAL SUPPORTING DEVICES

- A. Install devices to securely and permanently fasten and support electrical components.
- B. Raceway Supports: Comply with NFPA 70 and the following requirements:
  1. Conform to manufacturer's recommendations for selecting and installing supports.
  2. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
  3. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.
  4. Spare Capacity: Size supports for multiple conduits so capacity can be increased by a 25 percent minimum in the future.
  5. Support individual horizontal raceways with separate, malleable iron pipe hangers or clamps.
  6. Hanger Rods: 1/4-inch (6-mm) diameter or larger threaded steel, except as otherwise indicated.
  7. Spring Steel Fasteners: Specifically designed for supporting single conduits or tubing. May be used in lieu of malleable iron hangers for 1-1/2-inch (38-mm) and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to channel and slotted angle supports.
  8. In vertical runs, arrange support so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports, with no weight load on raceway terminals.

- C. Vertical Conductor Supports: Install simultaneously with conductors.
- D. In open overhead spaces, cast boxes threaded to raceways need not be separately supported, except where used for luminaire support; support sheet-metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches (610 mm) from the box.
- E. Fastening: Unless otherwise indicated, securely fasten electrical items and their supporting hardware to the building structure. Perform fastening according to the following:
  - 1. Fasten by means of machine screws, welded threaded studs, or spring-tension clamps on steel.
  - 2. Select fasteners so the load applied to any fastener does not exceed 25 percent of the proof-test load.

### 3.10 INSTALLATION OF CONDUCTORS AND CABLES

- A. Examination
  - 1. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.
- B. Wire and Insulation Applications
  - 1. Feeders: Type THHN/THWN, in raceway.
  - 2. Branch Circuits:
    - a. General: Type THHN/THWN, copper conductor, in raceway.
    - b. Optional:
      - 1) Hospital Grade Armored Cable may be used only for lighting and convenience outlet wiring and only for those branches, applications, and areas which are not identified herein as exceptions. The exception branches and areas where AC cable is not acceptable are as follows:
        - a) Emergency branch circuits.
        - b) Life safety branch circuits.
        - c) Critical branch circuits
        - d) Emergency equipment branch circuits.
        - e) Exposed locations.
        - f) Mechanical, electrical, and boiler rooms.
        - g) Wet and damp locations.
      - 2) If AC cable is utilized, branch circuit wiring for receptacles and lighting in areas with accessible suspended ceilings shall be installed in electric metallic tubing from panelboards to a junction box within the room served, above the suspended ceiling. Where structural conditions and code rules permit and only when approved by the authority having jurisdiction, hospital grade No. 12 gauge armor-clad (AC) cable with a No. 12 insulated green ground wire and with an internal bond wire may be used for all wiring within each room beyond the junction box mounted above the suspended ceiling. If AC cable is used, T&B insulated Tite-Bite connectors or equal shall be used, and wiring shall be installed in a neat and workmanlike manner.
      - 3) AC cable shall be secured at intervals not exceeding 4-1/2 feet and within 12 inches of every outlet box or fitting. At all terminations, a fitting shall be provided to protect the conductors from abrasion. Approved insulating bushings shall be provided between the conductors and the armor. The connector or clamp by which the cable is fastened to boxes or cabinets shall



be metal, of double lock-nut construction, UL approved for use with AC cable, and of such design that the insulating bushing will be visible for inspection. Internal box cable clamps are not acceptable.

3. Fire Alarm Circuits: Type THHN/THWN, in raceway.
4. Class 1 Control Circuits: Type THHN/THWN, in raceway.
5. Class 2 Control Circuits: Type THHN/THWN, in raceway.

C. Installation

1. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
2. Remove existing wires from raceway before pulling in new wires and cables.
3. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
4. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
5. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
6. Support cables according to DIVISION 26 Sections.
7. Seal around cables penetrating fire-rated elements according to DIVISION 7 Section "Firestopping."
8. Identify wires and cables according to DIVISION 26 Section "Electrical Identification."

D. Connections

1. Conductor Splices: Keep to minimum.
2. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
3. Use splice and tap connectors compatible with conductor material.
4. Use oxide inhibitor in each splice and tap connector for aluminum conductors.
5. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
6. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
7. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Equipment Connections

1. Follow homerun circuit numbers on Drawings in connecting circuits to panelboards. If field observation shows that the indicated circuit numbers are not connected to the corresponding panel overcurrent device, make all corrections necessary. Each branch circuit homerun containing two or more circuits with a common neutral shall be connected to the circuit breaker or switch in a three- or four-wire branch circuit panelboard so that no two of the circuits will be fed from the same phase.
2. Provide all wiring to and between motors, starters, line voltage (120-600 volt) control devices, disconnect switches, and other related electrical equipment, except where such items are factory wired.
3. Terminate power wiring for elevator systems at the respective controller, and be in compliance with the manufacturer's approved shop drawings.
4. Provide power and wiring connections to the control devices for electrically operated overhead doors, door operators, and control devices which will be provided under other DIVISIONS.

F. Maximum Branch Circuit Lengths

1. The following indicates maximum installed length a circuit can have and still maintain an adequate voltage level at the last point of use. If the circuit length exceeds the length listed, use the next largest wire size. Multiple circuit runs in the same raceway shall have all conductors sized the same based on worst case circuit lengths.
2. The following table is based on copper conductors, 85% pf, and steel conduit.

<b>CIRCUIT FEET (LENGTH – &lt; 2% VOLTAGE DROP)</b>						
WIRE SIZE (AMPS)	1-PHASE (1P CIRCUIT BREAKER)		1-PHASE (2P CIRCUIT BREAKER)		3-PHASE (3P CIRCUIT BREAKER)	
	120V	277V	208V	480V	208V	480V
#12 (20ACB-16A)	75' (2.0%)	175' (2.0%)	125' (1.9%)	300' (2.0%)	75' (1.9%)	175' (2.0%)
#10 (30ACB-24A)	75' (1.8%)	200' (2.0%)	150' (2.0%)	325' (1.9%)	85' (2.0%)	175' (1.8%)
#6 (50ACB-40A)			200' (1.88%)	450' (1.83%)	125' (2.0%)	275' (1.94%)
#6 (60ACB-48A)			175' (1.97%)	400' (1.96%)	100' (1.95%)	225' (1.9%)

G. Field Quality Control

1. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
2. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
3. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.11 INSTALLATION OF ELECTRICAL WIRING DEVICES

- A. Comply with NECA 1-2006, including the mounting heights listed in that standard, unless otherwise noted.
- B. Coordination with Other Trades:
  1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
  2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
  3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
  4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
  1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
  2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.

3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
  4. Existing Conductors:
    - a. Cut back and pigtail, or replace all damaged conductors.
    - b. Straighten conductors that remain and remove corrosion and foreign matter.
    - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
  2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
  3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
  4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
  5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
  7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
  8. Tighten unused terminal screws on the device.
  9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.
- E. Receptacle Orientation:
1. Install ground pin of vertically mounted receptacles **up**, and on horizontally mounted receptacles to the **right**.
  2. Install hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.
- F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- G. Dimmers:
1. Install dimmers within terms of their listing.
  2. Verify that dimmers used for fan speed control are listed for that application.
  3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
- H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- I. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and furnishings.
- J. For "Psych – Safe" applications: Review drawings for remote control systems controlling receptacle circuits. Typical system consists of control panel at nurses' station, electronic relay panel to intercept circuits and local override switches.

K. IDENTIFICATION

1. Comply with Division 26 Section "Identification for Electrical Systems."
2. Receptacles: Identify panelboard and circuit number from which served. Use hot, stamped or engraved machine printing with **black**-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

L. FIELD QUALITY CONTROL

1. Perform tests and inspections and prepare test reports.
  - a. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
  - b. Test Instruments: Use instruments that comply with UL 1436.
  - c. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.
2. Tests for Convenience Receptacles:
  - a. Line Voltage: Acceptable range is 105 to 132 V.
  - b. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
  - c. Ground Impedance: Values of up to 2 ohms are acceptable.
  - d. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  - e. Using the test plug, verify that the device and its outlet box are securely mounted.
  - f. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
3. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

3.12 INSTALLATION OF RACEWAYS AND BOXES

- A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. WIRING METHODS

1. Outdoors: Use the following wiring methods:
  - a. Exposed: RMC or IMC.
  - b. Concealed: RMC or IMC.
  - c. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - d. Boxes and Enclosures: NEMA 250, Type 3R or Type 4.
2. Indoors: Use the following wiring methods:
  - a. Exposed: EMT.
  - b. Concealed: EMT.
  - c. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
  - d. Damp or Wet Locations: RMC.
  - e. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
    - 1) Damp or Wet Locations: NEMA 250, Type 4X, stainless steel.

C. Installation

1. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.
2. Minimum Raceway Size: 3/4-inch trade size (DN21).
3. Conceal conduit and EMT, unless otherwise indicated, within finished walls and ceilings.
4. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
5. Install raceways level and square and at proper elevations. Provide adequate headroom.
6. Complete raceway installation before starting conductor installation.
7. Support raceways as specified in DIVISION 26.
8. Use temporary closures to prevent foreign matter from entering raceways.
9. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.
10. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.
11. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.
12. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.
13. Raceways Embedded in Slabs (Not Permitted Without Explicit, Written Directive From Owner, Architect Or Engineer): Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
  - a. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
  - b. Space raceways laterally to prevent voids in concrete.
  - c. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
  - d. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
14. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
  - a. Run parallel or banked raceways together, on common supports where practical.
  - b. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.
15. Join raceways with fittings designed and approved for the purpose and make joints tight.
  - a. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
  - b. Use insulating bushings to protect conductors.
16. Tighten set screws of threadless fittings with suitable tools.
17. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.
18. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.
19. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.
20. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45

- m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.
21. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
    - a. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
    - b. Where otherwise required by NFPA 70.
  22. Stub-up Connections (Not Permitted Without Explicit, Written Directive From Owner, Architect Or Engineer): Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.
  23. Flexible Connections: Use maximum of 6 feet (1830 mm) of FMC for recessed and semirecessed luminaires; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in wet or damp locations. Install separate ground conductor across flexible connections.
  24. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or luminaire ground terminals.
    - a. Select each surface raceway outlet box, to which a luminaire is attached, of sufficient diameter to provide a seat for the luminaire canopy.
    - b. Where a surface raceway is used to supply a fluorescent luminaire having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
    - c. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent luminaire having end-stem suspension.
    - d. Where a surface metal raceway extension is made from an existing outlet box on which a luminaire is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the luminaire canopy.
  25. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

D. Protection

1. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
  - a. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - b. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

E. Cleaning

1. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

### 3.13 INSTALLATION OF ELECTRICAL IDENTIFICATION

- A. Install identification devices according to manufacturer's written instructions.
- B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

- C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.
- D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.
- E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.
- F. Identify feeders over 600 V with "DANGER--HIGH VOLTAGE" in black letters 2 inches (51 mm) high, stenciled with paint at 10-foot (3-m) intervals over a continuous, painted orange background. Identify the following:
  - 1. Entire floor area directly above conduits running beneath and within 12 inches (305 mm) of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
  - 2. Wall surfaces directly external to conduits concealed within wall.
  - 3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in the building, or concealed above suspended ceilings.
  - 4. Entire surface of exposed conduits.
- G. Install painted identification as follows:
  - 1. Clean surfaces of dust, loose material, and oily films before painting.
  - 2. Prime Surfaces: For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty, acrylic-resin block filler. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.
  - 3. Apply one intermediate and one finish coat of silicone alkyd enamel.
  - 4. Apply primer and finish materials according to manufacturer's instructions.
- H. Identify Raceways and Exposed Cables of Certain Systems with Color Banding: Band exposed and accessible raceways of the systems listed below for identification.
  - 1. Bands: Pretensioned, snap-around, colored plastic sleeves; colored adhesive tape; or a combination of both. Make each color band 2 inches (51 mm) wide, completely encircling conduit, and place adjacent bands of 2-color markings in contact, side by side.
  - 2. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25 feet (7.6 m) in congested areas.
  - 3. Colors: To match facility standards or as follows:
    - a. Fire-Alarm System: Red.
    - b. Fire-Suppression Supervisory and Control System: Red and yellow.
    - c. Combined Fire-Alarm and Security System: Red and blue.
    - d. Security System: Blue and yellow.
    - e. Mechanical and Electrical Supervisory System: Green and blue.
    - f. Telecommunications System: Green and yellow.
- I. Install Caution Signs for Enclosures Over 600 V: Use pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover.
- J. Install Circuit Identification Labels on Boxes: Label externally as follows:
  - 1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
  - 2. Concealed Boxes: Plasticized card-stock tags.
  - 3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

- K. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6 to 8 inches (150 to 200 mm) below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16 inches (400 mm), use a single line marker.
1. Limit use of line markers to direct-buried cables.
  2. Install line marker for underground wiring, both direct buried and in raceway.
- L. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.
1. 208/120-V System: As follows:
    - a. Phase A: Black.
    - b. Phase B: Red.
    - c. Phase C: Blue.
    - d. Neutral: White.
    - e. Ground: Green.
  2. 480/277-V System: As follows:
    - a. Phase A: Yellow.
    - b. Phase B: Brown.
    - c. Phase C: Orange.
    - d. Neutral: Grey.
    - e. Ground: Green.
  3. Factory-apply color the entire length of the conductors, except the following field-applied, color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
    - a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply the last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch- (25-mm-) wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
    - b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 inches (76 mm) from the terminal and spaced 3 inches (76 mm) apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.
- M. Device Coverplate Identification: Engraved or P-Touch label with 1/8 inch high black capital letters designating as follows:
1. All receptacle coverplates, both normal and emergency, shall be engraved with the following branch circuit source information:
    - a. Panelboard number.
    - b. Circuit number.
    - c. Example: "RLNIA - 5"
  2. Emergency NEMA 5-15R and 5-20R receptacle coverplates shall be engraved with the following branch circuit source information:
    - a. "EMERGENCY".
    - b. Panelboard number.
    - c. Circuit number.
    - d. Example: "EMERGENCY"
    - e. "RLNIA - 5"
  3. Other than NEMA 5-15R and 5-20R receptacle coverplates shall be engraved with the following:
    - a. Voltage
    - b. Number of phases.
    - c. Current rating.
    - d. Example: "208/3P/50A"



4. Single outlet type NEMA 5-20R bed receptacle, tied to bedside headwall bedstop relay, shall be engraved "BED".
  5. Receptacles protected upstream on associated branch circuit by a ground fault circuit interrupter device shall be engraved "GFCI PROTECTED".
  6. Special systems/communication systems devices shall be engraved designating device (ie. FIREPHONE, DATA, EKG, TEL, TV, etc.)
- N. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.
1. Legend: 1/4-inch- (6.4-mm-) steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
  2. Fasten tags with nylon cable ties; fasten bands using integral ears.
- O. Apply identification to conductors as follows:
1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
  2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
  3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.
- P. Apply warning, caution, and instruction signs and stencils as follows:
1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.
  2. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch- (9-mm-) high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.
- Q. Install identification as follows:
1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high lettering on 1-1/2-inch- (38-mm-) high label; where 2 lines of text are required, use lettering 2 inches (51 mm) high. Use black lettering on white field. Apply labels for each unit of the following categories of equipment.
    - a. Panelboards, electrical cabinets, and enclosures.
    - b. Access doors and panels for concealed electrical items.
    - c. Remote-controlled switches.
    - d. Dimmers.
    - e. Control devices.
    - f. Transformers.
    - g. Call system master station.
    - h. TV/audio monitoring master station.
    - i. Fire-alarm master station or control panel.
  2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above, except panelboards and alarm/signal components where labeling is specified elsewhere. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

### 3.14 INSTALLATION OF GROUNDING SYSTEMS

- A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.
- B. Electrical Room Grounding Bus: Space 1 inch (25 mm) from wall and support from wall 6 inches (150 mm) above finished floor, except as otherwise indicated.
- C. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- D. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
- E. APPLICATION
  - 1. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.
    - a. Install equipment grounding conductor with circuit conductors for the items below in addition to those required by Code:
      - 1) Feeders and branch circuits.
      - 2) Lighting circuits.
      - 3) Receptacle circuits.
      - 4) Single-phase motor or appliance branch circuits.
      - 5) Three-phase motor or appliance branch circuits.
      - 6) Flexible raceway runs.
      - 7) Armored and metal-clad cable runs.
    - b. Computer Outlet Circuits: Install separate equipment grounding conductor in branch circuit runs from computer area power panels or power-distribution units.
    - c. X-Ray Equipment Circuits: Install separate equipment grounding conductor in circuits supplying X-ray equipment.
    - d. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.
    - e. Air-Duct Equipment Circuits: Install an equipment grounding conductor to duct-mounted electrical devices operating at 120 V and above, including air cleaners and heaters. Bond conductor to each unit and to air duct.
    - f. Water Heater, Heat-Tracing, and Antifrost Heater Circuits: Install a separate equipment grounding conductor to each electric water heater, heat-tracing assembly, and antifrost heating cable. Bond conductor to heater units, piping, connected equipment, and components.
  - 2. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
    - a. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch (6-by-50-by-300-mm) grounding bus.
    - b. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.
  - 3. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Paragraph 250-26.
  - 4. Connections to Lightning Protection System: Bond grounding conductors, including grounding-conductor conduits, to lightning protection down conductors or lightning protection grounding conductors in compliance with NFPA 780.

5. Common Ground Bonding with Lightning Protection System: Bond electric power system ground directly to lightning protection system grounding conductor at closest point to electric service grounding electrode. Use bonding conductor sized same as system grounding conductor and install in conduit.

F. Connections

1. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
  - a. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.
  - b. Make connections with clean, bare metal at points of contact.
  - c. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
  - d. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
  - e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
2. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.
3. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.
4. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.
5. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

G. Field Quality Control

1. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81.
2. Maximum grounding to resistance values are as follows:
  - a. Equipment Rated 500 kVA and Less: 10 ohms.
  - b. Equipment Rated 500 to 1000 kVA: 5 ohms.
  - c. Equipment Rated More than 1000 kVA: 3 ohms.
  - d. Unfenced Substations and Pad-Mounted Equipment: 5 ohms.
  - e. Manhole Grounds: 10 ohms.
3. Excessive Ground Resistance: Where resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance and to accomplish recommended work.
4. Report: Prepare test reports, certified by the testing organization, of ground resistance at each test location. Include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

H. Adjusting and Cleaning

1. Restore surface features, including vegetation, at areas disturbed by work of this Section. Reestablish original grades, except as otherwise indicated. Where sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with DIVISION 2 Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

### 3.15 INSTALLATION OF DRY-TYPE TRANSFORMERS

- A. Comply with safety requirements of IEEE C2.
- B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.
- C. Identify transformers and install warning signs according to DIVISION 26 Section "Electrical Identification."
- D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. GROUNDING
  1. Separately Derived Systems: Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near the transformer.
  2. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping as indicated and to comply with NFPA 70.
  3. Comply with DIVISION 26 Section "Grounding" for materials and installation requirements.
- F. Field Quality Control
  1. Manufacturer's Field Service: Engage a factory-authorized service representative to supervise the field assembly and connection of components, and the testing and adjusting of transformer components and accessories.
  2. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.
  3. Test Labeling: On satisfactory completion of tests for each transformer, attach a dated and signed "Satisfactory Test" label to tested component.
  4. Schedule tests and provide notification at least 7 days in advance of test commencement.
  5. Report: Submit a written report of observations and tests. Report defective materials and installation.
  6. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.
    - a. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.
    - b. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.
    - c. Insulation Resistance: Perform megohmmeter tests of primary and secondary winding to winding and winding to ground.
      - 1) Minimum Test Voltage: 1000 V, dc.

- 2) Minimum Insulation Resistance: 500 megohms.
  - 3) Duration of Each Test: 10 minutes.
  - 4) Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.
7. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

G. Cleaning

1. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

H. Adjusting

1. After installing and cleaning, touch up scratches and mars on finish to match original finish.
2. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.
3. Adjust buck-boost transformer connections to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility.
4. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in readjusting transformer tap settings to suit actual occupied conditions. Provide up to 2 visits to Project site for this purpose without additional cost.
  - a. Voltage Recordings: Contractor performed. Provide up to 48 hours of recording on the low-voltage system of each medium-voltage transformer.
  - b. Point of Measurement: Make voltage recordings at load outlets selected by Owner.

### 3.16 INSTALLATION OF PANELBOARDS

- A. Install panelboards and accessory items according to NEMA PB 1.1.
- B. Mounting Heights: Top of trim 74 inches (1880 mm) above finished floor, unless otherwise indicated.
- C. Mounting: Plumb and rigid without distortion of box. Mount flush panelboards uniformly flush with wall finish.
- D. Circuit Directory: Type directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing.
  1. Circuit Numbering: Number each pole permanently using the convention of odd numbers on the left, even numbers on the right. Utilize manufacturer's self-adhering number stickers or if not available provide self-adhering number stickers from Brady, Panduit, Ideal or equal. Hand-written numbering is not acceptable.
- E. Install filler plates in unused spaces.
- F. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch (27-RMC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-RMC) empty conduits into raised floor space or below slab not on grade.

- G. Wiring in Panelboard Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.
- H. IDENTIFICATION
  - 1. Identify field-installed wiring and components and provide warning signs as specified in DIVISION 26 Section "Electrical Identification."
  - 2. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic or metal nameplates mounted with corrosion-resistant screws.
- I. Grounding
  - 1. Make equipment grounding connections for panelboards as indicated.
  - 2. Provide ground continuity to main electrical ground bus as indicated.
- J. Connections
  - 1. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- K. Field Quality Control
  - 1. Prepare for acceptance tests as follows:
    - a. Make insulation-resistance tests of each panelboard bus, component, and connecting supply, feeder, and control circuits.
    - b. Make continuity tests of each circuit.
  - 2. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
    - a. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
    - b. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units, and retest.
  - 3. Balancing Loads: After Substantial Completion, but not more than 2 months after Final Acceptance, conduct load-balancing measurements and make circuit changes as follows:
    - a. Perform measurements during period of normal working load as advised by Owner.
    - b. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility. Make special arrangements with Owner to avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
    - c. Recheck loads after circuit changes during normal load period. Record all load readings before and after changes and submit test records.
    - d. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as required to meet this minimum requirement.
  - 4. Infrared Scanning: After Substantial Completion, but not more than 2 months after Final Acceptance, perform an infrared scan of each panelboard. Remove fronts to make joints and connections accessible to a portable scanner.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scanning of each panelboard 11 months after date of Substantial Completion.
    - b. Instrument: Use an approved infrared scanning device designed to measure temperature or detect significant deviations from normal values. Provide calibration record for device used.
    - c. Record of Infrared Scanning: Prepare a certified report identifying panelboards checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

- L. Adjusting
  - 1. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- M. Cleaning
  - 1. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

### 3.17 INSTALLATION OF FUSES

- A. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.
- B. Install spare fuse cabinet where indicated.
- C. EXAMINATION
  - 1. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.
  - 2. Do not proceed with installation until unsatisfactory conditions have been corrected.
- D. Fuse Applications
  - 1. Main Service: Class L, fast acting.
  - 2. Main Feeders: Class J, time delay.
  - 3. Motor Branch Circuits: Class RK1, time delay.
  - 4. Other Branch Circuits: Class RK5, non-time delay.
- E. Identification
  - 1. Install typewritten labels on inside door of each fused switch to indicate fuse replacement information.

### 3.18 INSTALLATION OF DISCONNECTS AND CIRCUIT BREAKERS (Not provided with equipment)

- A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.
- B. Install disconnect switches and circuit breakers level and plumb.
- C. Install wiring between disconnect switches, circuit breakers, control, and indication devices.
- D. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.
  - 1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Identify each disconnect switch and circuit breaker according to requirements specified in DIVISION 26 Section "Electrical Identification."
- F. FIELD QUALITY CONTROL
  - 1. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

- a. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

G. Adjusting

1. Set field-adjustable disconnect switches and circuit-breaker trip ranges as indicated.

H. Cleaning

1. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

3.19 INSTALLATION OF MOTOR CONTROLLERS (Not provided with equipment)

- A. Install independently mounted motor-control devices according to manufacturer's written instructions.

- B. Manufacturer's Field Services: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components, including the pretesting and adjustment of solid-state controllers.

- C. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.

- D. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks.

- E. Install freestanding equipment on concrete housekeeping bases conforming to DIVISION 3 Section "Cast-in-Place Concrete."

- F. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

G. APPLICATIONS

1. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
2. Select horsepower rating of controllers to suit motor controlled.
3. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.
4. Use manual controllers for 3-phase motors up to 5 hp not requiring automatic or remote control.
5. Use manual controllers for 3-phase motors up to 7-1/2 hp not requiring automatic or remote control.
6. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.
7. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment.

H. Identification

1. Identify motor-control components and control wiring according to DIVISION 26 Section "Electrical Identification."



- I. Control Wiring Installation
  - 1. Install wiring between motor-control devices according to DIVISION 26 Section "Wires and Cables."
  - 2. Bundle, train, and support wiring in enclosures.
  - 3. Connect hand-off-automatic switch and other automatic control devices where available.
    - a. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
    - b. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.
  
- J. Connections
  - 1. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
  
- K. Field Quality Control
  - 1. Testing: After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
    - a. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.
    - b. Remove and replace malfunctioning units with new units, and retest.
  
- L. Cleaning
  - 1. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.
  
- M. Demonstration
  - 1. Training: Engage a factory-authorized service representative to demonstrate solid-state and variable- speed controllers and train Owner's maintenance personnel.
    - a. Conduct a minimum of 4 hours of training in operation and maintenance as specified in DIVISION 1 Section "Contract Closeout." Include training relating to equipment operation and maintenance procedures.
    - b. Schedule training with at least 7 days' advance notice.

### 3.20 INSTALLATION OF INTERIOR LIGHTING

- A. Set units plumb, square, and level with ceiling and walls, and secure according to manufacturer's written instructions and approved Shop Drawings. Support luminaires according to requirements of DIVISION 26.
  
- B. Support for Recessed and Semirecessed Grid-Type Fluorescent Luminaires: Units may not be supported from suspended ceiling support system. Install support system rods or wires at a minimum of 4 rods or wires for each luminaire, located not more than 6 inches (150 mm) from luminaire corners.
  - 1. Install support clips for recessed luminaires, securely fastened to ceiling grid members, at or near each luminaire corner.
  - 2. Luminaires Smaller than Ceiling Grid: Install a minimum of 4 rods or wires for each luminaire and locate at corner of ceiling grid where luminaire is located. Do not support luminaires by ceiling acoustical panels.

3. Luminaires of Sizes Less than Ceiling Grid: Center in acoustical panel. Support luminaires independently with at least two 3/4-inch (20-mm) metal channels spanning and secured to ceiling tees.
- C. Support for Suspended Luminaires: Brace pendants and rods over 48 inches (1200 mm) long to limit swinging. Support stem-mounted, single-unit, suspended fluorescent luminaires with twin-stem hangers. For continuous rows, use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of chassis, including one at each end.
  - D. Air-Handling Luminaires: Install with dampers closed.
  - E. Lamping: Where specific lamp designations are not indicated, lamp units according to manufacturer's instructions.
  - F. Emergency Fluorescent Power Supply Unit:
    1. Each unit shall have a constant-hot connection in addition to any switch legs. This unswitched conductor shall be connected to the same branch circuit as the luminaires.
  - G. CONNECTIONS
    1. Ground lighting units. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
  - H. Field Quality Control
    1. Inspect each installed luminaire for damage. Replace damaged luminaires and components.
    2. Give advance notice of dates and times for field tests.
    3. Provide instruments to make and record test results.
    4. Tests: Verify normal operation of each luminaire after luminaires have been installed and circuits have been energized with normal power source. Interrupt electrical energy to demonstrate proper operation of emergency lighting installation. Include the following information in tests of emergency lighting equipment:
      - a. Duration of supply.
      - b. Low battery voltage shutdown.
      - c. Normal transfer to battery source and retransfer to normal.
      - d. Low supply voltage transfer.
    5. Replace or repair malfunctioning luminaires and components, then retest. Repeat procedure until all units operate properly.
    6. Report results of tests.
    7. Replace luminaires that show evidence of corrosion during Project warranty period.
  - I. Adjusting and Cleaning
    1. Clean luminaires after installation. Use methods and materials recommended by manufacturer.
    2. Adjust aimable luminaires to provide required light intensities.
- ### 3.21 INSTALLATION OF LIGHTNING PROTECTION SYSTEMS
- A. Install lightning protection as indicated, according to manufacturer's written instructions.
  - B. Comply with UL 96A, LPI-175, and NFPA 780.
  - C. Conform to the most stringent requirements when more than one standard is specified.

- D. Install conductors with direct paths from air terminals to ground connections. Avoid sharp bends and narrow loops. Where indicated, run conductors in nonmetallic raceway, Schedule 40, minimum.
- E. Conceal system conductors.
- F. Conceal down conductors.
- G. Conceal interior conductors.
- H. Conceal conductors from normal view from exterior locations at grade within 200 feet (60 m) of building.
- I. Provide notification at least 48 hours before concealing lightning protection components.
- J. Cable Connections: Use approved exothermic-welded connections for all conductor splices and connections between conductors and other components, except those above single-ply membrane roofing.
- K. Air Terminals on Single-Ply Membrane Roofing: Comply with adhesive manufacturer's installation instructions.
- L. Bond extremities of vertical metal bodies exceeding 60 feet (18 m) in length to lightning protection components.
- M. Bond ground terminals to counterpoise conductor.
- N. Bond grounded metal bodies on building within 12 feet (4 m) of ground to counterpoise conductor.
- O. Bond grounded metal bodies on building within 12 feet (4 m) of roof to counterpoise conductor.
- P. Bond grounded metal bodies on building within 12 feet (4 m) of roof to interconnecting loop at eave level or above.
- Q. Bond lightning protection components to grounded metal bodies on building at every 60 feet (18 m) with intermediate-level interconnection loop conductors.
- R. EXAMINATION
  - 1. Examine surfaces, areas, and conditions, with Installer present, for compliance with installation tolerances and other conditions affecting performance of lightning protection. Do not proceed with installation until unsatisfactory conditions have been corrected.
- S. Corrosion Protection
  - 1. Do not combine materials that can form an electrolytic couple that will accelerate corrosion in the presence of moisture, unless moisture is permanently excluded from the junction of such materials.
  - 2. Use conductors with protective coatings where conditions would cause deterioration or corrosion of conductors.
- T. Field Quality Control
  - 1. Periodic Inspections: Provide the services of a qualified inspector to perform periodic inspections during construction and at its completion, according to LPI-177.
  - 2. UL Inspection: Apply for inspection by UL as required for UL master labeling of system.

3. ETL Inspection: Provide the services of ETL to inspect completed system for conformance with specified requirements.

### 3.22 INSTALLATION OF RACEWAY SUPPORT SYSTEMS

- A. Furnish and install the trunk riser raceways, outlet box, and outlet box raceways as shown on Drawings and specified.
- B. Stub trunk riser and homerun outlet box raceways to load cable tray system, or to nearest accessible CORRIDOR ceiling.

- C. Minimum outlet box conduit sizes shall be as follows:

Conduit Size	Homerun	Homerun Box to 2nd Box	2nd Box to 3rd Box
No. Boxes Connected			
1	3/4	-	-
2	1	3/4	-
3	1-1/4	1	3/4

- D. Install telephone raceways to within six inches of telephone backboards.
- E. Paint telephone backboards with two coats of black enamel paint on all sides. Provide 1/2" spacers between wall and backboards. Install 120 volt receptacle on the lower left corner of backboard.
- F. Furnish and install 200 pound test, braided nylon pull-cords in all empty conduits.
- G. Mark each conduit end for identification and destination of raceway.
- H. Provide system (identifying nameplate centered on main trunk riser boxes and cabinets (ie. TEL, DATA, CCTV, etc.).
- I. Coordination
  1. Comply with all requirements of the Owner's representative for all raceways, boxes, cover plates, etc., and their specific installation considerations.
  2. Consult with Owner's representative prior to installation to determine special device plate and raceway requirements for the following communication/special systems:
    - a. Tel/Data
    - b. Local Area Network
    - c. Security

### 3.23 INSTALLATION OF FIRE ALARM SYSTEMS

- A. Existing fire alarm riser loops are to be found in the two electric rooms at P6. New devices shall be wired to fire alarm terminal boxes in the existing electric rooms.
- B. Manual Pull Stations: Mount semiflush in recessed back boxes with operating handles 48 inches (1220 mm) above the finished floor or lower as indicated.
  1. Provide clear Lexan covers where shown.
  2. Local alarm sounds when cover is raised.

- C. Water-Flow Detectors and Valve Supervisory Switches: Connect for each sprinkler valve station required to be supervised.
- D. Smoke Detectors: Install ceiling-mounted detectors not less than 4 inches (100 mm) from a side wall to the near edge. Install detectors located on the wall at least 4 inches (100 mm), but not more than 12 inches (300 mm), below the ceiling. For exposed solid-joist construction, mount detectors on the bottom of the joists. On smooth ceilings, install detectors not over 30 feet (9 m) apart in any direction. Install detectors no closer than 60 inches (1520 mm) from air registers.
- E. Audible Alarm-Indicating Devices: Install not less than 90 inches (2280 mm) above the finished floor nor less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille or as indicated. Combine audible and visual alarms at the same location into a single unit.
- F. Visual Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and not more than 80 inches (2030 mm) above the finished floor and at least 6 inches (150 mm) below the ceiling.
- G. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- H. FACP: Surface mount with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- I. Graphic Annunciator: Arrange as indicated, with the top of the panel no more than 72 inches (1830 mm) above the finished floor.
  - 1. For extension or modification of existing system provide programming of main fire alarm control panel to incorporate revised layout.
- J. Install system according to NFPA standards referenced in Parts 1 and 2 of this Section.
- K. Fire Alarm Power Supply Disconnect: Paint red and label "FIRE ALARM." Provide with lockable handle or cover.
- L. WIRING INSTALLATION
  - 1. Wiring Method: Install wiring in metal raceway according to DIVISION 26 Section "Raceways, Boxes, and Cabinets." Conceal raceway except in unfinished spaces and as indicated.
  - 2. Wiring within Enclosures: Install conductors parallel with or at right angles to the sides and back of the enclosure. Bundle, lace, and train the conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
  - 3. Cable Taps: Use numbered terminal strips in junction, pull or outlet boxes, cabinets, or equipment enclosures where circuit connections are made.
  - 4. Color Coding: Color-code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and a different color code for supervisory circuits. Color-code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visual alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
  - 5. Risers: Install at least 2 vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signal from other floors or zones.

6. Wiring to Central-Station Transmitter: 1-inch (27) GRC between the FACP and the central-station transmitter connection as indicated. Install number of conductors and electrical supervision for connecting wiring as needed to suit central-station monitoring function. Final connections to terminals in central-station transmitter are made under another contract.

M. Identification

1. Identify system components, wiring, cabling, and terminals according to DIVISION 26 Section "Electrical Identification."

N. Grounding

1. Ground cable shields and equipment according to system manufacturer's instructions to eliminate shock hazard and to minimize, to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments.
2. Signal Ground Terminal: Locate at main equipment rack or cabinet. Isolate from power system and equipment grounding.
3. Install grounding electrodes of type, size, location, and quantity as indicated. Comply with installation requirements of DIVISION 26 Section "Grounding."
4. Ground equipment and conductor and cable shields. For audio circuits, minimize, to the greatest extent possible, ground loops, common mode returns, noise pickup, cross talk, and other impairments. Provide 5-ohm ground at main equipment location. Measure, record, and report ground resistance.

O. Field Quality Control

1. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the pretesting, testing, and adjustment of the system.
2. Pretesting: After installation, align, adjust, and balance the system and perform complete pretesting. Determine, through pretesting, the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed in pretesting. Replace malfunctioning or damaged items with new ones and retest until satisfactory performance and conditions are achieved. Prepare forms for systematic recording of acceptance test results.
3. Report of Pretesting: After pretesting is complete, provide a letter certifying the installation is complete and fully operable, including the names and titles of the witnesses to the preliminary tests.
4. Final Test Notice: Provide a 10-day minimum notice in writing when the system is ready for final acceptance testing.
5. Minimum System Tests: Test the system according to the procedures outlined in NFPA 72. Minimum required tests are as follows:
  - a. Verify the absence of unwanted voltages between circuit conductors and ground.
  - b. Test all conductors for short circuits using an insulation-testing device.
  - c. With each circuit pair, short circuit at the far end of the circuit and measure the circuit resistance with an ohmmeter. Record the circuit resistance of each circuit on the record drawings.
  - d. Verify that the control unit is in the normal condition as detailed in the manufacturer's operation and maintenance manual.
  - e. Test initiating and indicating circuits for proper signal transmission under open circuit conditions. One connection each should be opened at not less than 10 percent of the initiating and indicating devices. Observe proper signal transmission according to class of wiring used.
  - f. Test each initiating and indicating device for alarm operation and proper response at the control unit. Test smoke detectors with actual products of combustion.
  - g. Test the system for all specified functions according to the approved operation and maintenance manual. Systematically initiate specified functional performance

items at each station, including making all possible alarm and monitoring initiations and using all communications options. For each item, observe related performance at all devices required to be affected by the item under all system sequences. Observe indicating lights, displays, signal tones, and annunciator indications. Observe all voice audio for routing, clarity, quality, freedom from noise and distortion, and proper volume level.

- h. Test Both Primary and Secondary Power: Verify by test that the secondary power system is capable of operating the system for the period and in the manner specified.
  6. Retesting: Correct deficiencies indicated by tests and completely retest work affected by such deficiencies. Verify by the system test that the total system meets the Specifications and complies with applicable standards.
  7. Report of Tests and Inspections: Provide a written record of inspections, tests, and detailed test results in the form of a test log. Submit log upon the satisfactory completion of tests.
  8. Tag all equipment, stations, and other components at which tests have been satisfactorily completed.
- P. Cleaning And Adjusting
1. Cleaning: Remove paint splatters and other spots, dirt, and debris. Touch up scratches and marred finish to match original finish. Clean unit internally using methods and materials recommended by manufacturer.
- Q. Demonstration
1. Startup Services: Engage a factory-authorized service representative to provide startup service and to demonstrate and train Owner's maintenance personnel as specified below.
    - a. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, adjusting, and preventive maintenance. Provide a minimum of 8 hours' training.
    - b. Training Aid: Use the approved final version of the operation and maintenance manual as a training aid.
    - c. Schedule training with Owner with at least 7 days' advance notice.
- R. On-Site Assistance
1. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels, controls, and sensitivities to suit actual occupied conditions. Provide up to 3 requested adjustment visits to the site for this purpose.

### 3.24 INSTALLATION OF TONE-VISUAL NURSE CALL SYSTEMS

- A. Install equipment to comply with manufacturer's written instructions.
- B. Wiring Method: Install wiring in raceway except within consoles, desks, and counters. Conceal raceway and wiring except in unfinished spaces.
- C. Install exposed cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings so designed and installed as not to damage the cables. Secure cable at intervals not exceeding 30 inches (762 mm) and not more than 6 inches (152 mm) from cabinets, boxes, or fittings.
- D. Wiring Within Enclosures: Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points with no excess. Provide and use lacing bars in cabinets.

- E. Control Circuit Wiring: Provide number and size of conductors as recommended by system manufacturer for control functions indicated.
- F. Separation of Wires: Separate speaker-microphone, line-level, speaker-level, and power wiring runs. Run in separate raceways or, where exposed or in same enclosure, provide 12-inch (305-mm) minimum separation between conductors to speaker microphones and adjacent parallel power and telephone wiring. Provide physical separation as recommended by equipment manufacturer for other nurse call system conductors.
- G. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes, terminal cabinets, and equipment enclosures.
- H. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks where required.
- I. Identification of Conductors and Cables: Use color coding of conductors and apply wire and cable marking tape to designate wires and cables so all media are identified in coordination with system wiring diagrams. Label stations, controls, and indication using approved consistent nomenclature.
- J. Existing Systems
  - 1. Examine the systems in detail, checking them for completeness, freedom from deficiencies, proper operation, and compatibility with the system and equipment being provided under this Section. If discrepancies or impairments to successful connection and operation of the interconnected systems are found, report them and do not proceed with installation until directed. Schedule the existing systems' examination so there is reasonable time to resolve any problems without delaying construction.
- K. Grounding
  - 1. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common mode returns, noise pickup, cross talk, and other impairments.
  - 2. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding.
  - 3. Install grounding electrodes of type, size, location, and quantity indicated. Comply with installation requirements of DIVISION 26 Section "Grounding."
- L. Field Quality Control
  - 1. Manufacturer's Field Service: Provide services of a factory-authorized service representative to supervise the field assembly and connection of components and the testing and adjusting of the system.
  - 2. Test Procedure: Conform to the following:
    - a. Schedule tests a minimum of 7 days in advance of performance of tests.
    - b. Report: Submit a written record of test results.
    - c. Operational Test: Perform an operational system test to verify conformance of system to these Specifications. Perform tests that include originating station-to-station, all-call, and page messages at each nurse call station. Verify proper routing and volume levels and freedom from noise and distortion. Test each available message path from each station on the system.
    - d. Frequency Response Test: Determine frequency response of 2 transmission paths by transmitting and recording audio tones. Minimum acceptable performance within 3 dB from 150 to 2500 Hz.
    - e. Signal-to-Noise Ratio Test: Measure the ratio of signal to noise of the complete system at normal gain settings, using the following procedure:



- 1) Disconnect a speaker microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for 4 speaker microphones.
- 2) The minimum acceptable ratio is 35 dB.
- f. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 150, 200, 400, 1000, and 2500 Hz into each nurse call system amplifier and measure the distortion in the amplifier output. The maximum acceptable distortion at any frequency is 5 percent total harmonics.
- g. Ground Test: Measure ground resistance at signal ground terminal using method specified in DIVISION 26 Section "Grounding." Submit report of measurement.
3. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify by the system test that the total system meets the Specifications and complies with applicable standards. Provide a written record of all retest results.
4. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.

M. Cleaning

1. Prior to final acceptance, clean system components and protect from damage and deterioration.

N. Demonstration

1. Demonstration and Training: Obtain and pay for the services of a factory-authorized service representative to demonstrate the system in all operating modes and functions and to train Owner's maintenance personnel.
  - a. Schedule training with Owner with at least 7 days' advance notice.
2. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance. Provide a minimum of 8 hours' training.
3. Train Owner's nursing personnel on proper use of the system. Periods of training shall be coordinated with the Architect to assure all nursing shifts receive the required training. Each session shall include instructions utilizing audio and visual graphics and hands-on operation of the nurse call equipment in a typical system zone selected by the Architect. Provide handout material describing system features and functions to all who attend. Provide a minimum of three, 3-hour sessions.
4. Training Aid: Use approved operation and maintenance manual material as an instructional aid. Refer to DIVISION 1 Section "Contract Closeout." Provide copies of this material for use in the instruction.

O. On-Site Assistance

1. Occupancy Adjustments: When requested within one year of date of Substantial Completion, provide on-site assistance in adjusting sound levels and controls to meet actual occupancy conditions. Provide up to 3 visits to the site for this purpose.

### 3.25 INSTALLATION OF ELECTRIC HEATING CABLES

- A. Install heating cables and accessories as indicated, according to manufacturer's written instructions, rough-in drawings, the original design, and referenced standards.
- B. Cut cable to length required.
- C. Do not install heater-to-cold lead connections in concrete or plaster.

- D. Avoid crossing expansion, construction, or control joints with heating cables. Where indicated or required, provide sufficient slack conductor in an appropriately arranged expansion loop.
- E. Do not install heating cable mats across expansion, construction, or control joints.
- F. Install cables and mats following application of bituminous binder course to lower base and ensure that second bituminous binder is applied to cables prior to pouring of finish topping.
- G. Connect heating cables and other components to wiring systems and to ground as indicated and instructed by manufacturer. Tighten connectors and terminals, including screws and bolts, according to equipment manufacturer's published torque-tightening values for equipment connectors. Where manufacturer's torquing requirements are not indicated, tighten connectors and terminals according to tightening torques specified in UL 486A.
- H. Do not energize cables embedded in concrete, asphalt, or plaster until they are cured, except for brief testing.
- I. EXAMINATION
  - 1. Examine surfaces and substrates to receive heating cables for compliance with requirements for installation tolerances and other conditions affecting performance of the heating cables. Do not proceed with installation until unsatisfactory conditions have been corrected.
    - a. Ensure surfaces and pipes in contact with electric heating cables are free of burrs and sharp protrusions.
    - b. Ensure pipe testing is complete.
    - c. Ensure surfaces and substrates are plumb and level.
  - 2. Test cables for electrical continuity before installing.
  - 3. TEST CABLES FOR INSULATION RESISTANCE BEFORE INSTALLING.
- J. Field Quality Control
  - 1. Test installed electric heating cables after installation. Perform tests prior to application of coverings, such as insulation, plaster, or concrete.
    - a. Test cables for electrical continuity before energizing.
    - b. Test cables for insulation resistance before energizing. Remove cables if measured resistance is less than 10 megohms to ground.
    - c. Test cables to verify rating and power input. Energize and measure voltage and current simultaneously.
  - 2. Repeat tests for continuity, insulation resistance, and input power after applying plaster.
  - 3. Repeat tests for continuity, insulation resistance, and input power after applying concrete.
  - 4. Repeat tests for continuity, insulation resistance, and input power after applying thermal insulation.
- K. Demonstration
  - 1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.
  - 2. Review data in the operation and maintenance manual. Refer to DIVISION 1 Section "Project Closeout."
- L. Protection
  - 1. Provide final protection and maintain conditions in a manner acceptable to Manufacturer and Installer to ensure that installed electric heating cables, including leads, are not damaged or crushed prior to Substantial Completion.

### 3.26 INSTALLATION OF LIGHTING CONTROL EQUIPMENT

- A. Install equipment according to manufacturers' written instructions.
- B. Mount control equipment according to manufacturers' instructions and DIVISION 26 Sections.
- C. Mounting heights indicated are to bottom of unit for suspended items and to center of unit for wall-mounted ones.
- D. CONTROL WIRING INSTALLATION
  - 1. Install wiring between control devices as specified in DIVISION 26 Sections "Wires and Cables" for low-voltage connections, and "Voice and Data Systems" for digital circuits.
  - 2. Wiring Method: Install all wiring in raceway as specified in DIVISION 26 Section "Raceways, Boxes, and Cabinets."
  - 3. Wiring Method: Install all wiring in raceway as specified in DIVISION 26 Section "Raceways, Boxes, and Cabinets" except where run in accessible ceiling space, and gypsum board partitions.
  - 4. Bundle, train, and support wiring in enclosures.
  - 5. Grounding: Ground equipment. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- E. Identification
  - 1. Identify components and power and control wiring according to DIVISION 26 Section "Electrical Identification."
  - 2. Label each system control module with a unique designation. Make designations on elevated components readable from floor.
- F. Field Quality Control
  - 1. Manufacturer's Field Services: Provide services of a factory-authorized service representative to test, adjust, and program lighting control systems.
  - 2. Reports: Prepare written reports of tests and observations. Report defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.
  - 3. Test Labeling: After satisfactory completion of tests and inspections, apply a label to tested components indicating test results, date, and responsible organization and person.
  - 4. Schedule visual and mechanical inspections and electrical tests with at least 7 days' advance notice.
  - 5. Visual and Operational Inspections: Include the following inspections:
    - a. Inspect control components for defects and physical damage, NRTL labeling, and nameplate compliance with current Project Drawings.
    - b. Check tightness of electrical connections with torque wrench calibrated within previous 6 months. Use manufacturer's recommended torque values.
    - c. Verify settings of photoelectric devices with photometer calibrated to National Institute for Science and Technology (NIST) standards within past 6 months.
    - d. Exercise and perform operational tests on mechanical parts and operable devices according to manufacturer's instructions for routine functional operation.
  - 6. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following tests according to manufacturer's instructions:
    - a. Continuity tests of circuits.
    - b. Operational Tests: Set and operate controls to demonstrate controls in a methodical sequence that cues and reproduces actual operating functions. Include testing of dimming equipment and ambient-light, programmable, and occupancy controls under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

7. Correct deficiencies disclosed by inspections and tests, make necessary adjustments, and retest deficient items. Verify that specified requirements are met.

G. Adjusting and Cleaning

1. Occupancy Adjustments: Upon request within 1 year of date of Substantial Completion, make up to 3 on-site visits to Project site to assist in adjusting light levels, making program changes, and adjusting sensors and controls.
2. Repair scratches and mars of finish to match original finish. Clean equipment and devices internally and externally using methods and materials recommended by manufacturers.

H. Demonstration

1. Training: Provide services of a factory-authorized service representative to demonstrate programmable lighting control system and to train Owner's maintenance personnel.
  - a. Train Owner's personnel to operate, service, maintain, adjust, and program equipment and system components. Allow at least 8 hours to conduct training. Schedule training with at least 7 days' advance notice. Use final approved operation and maintenance manual as a training aid throughout training. Use both classroom training and hands-on exercises.

### 3.27 INSTALLATION OF VIBRATION ISOLATION AND SEISMIC RESTRAINT

A. GENERAL

1. Isolation and seismic restraint systems must be installed in strict accordance with the manufacturer's submittal data.
2. Vibration isolators shall not cause any change of position of equipment resulting in stress on equipment connections.

B. SEISMIC RESTRAINTS

1. Installation
  - a. All floor mounted equipment whether isolated or not shall be snubbed, anchored, bolted or welded to the structure. Calculations that determine that isolated equipment movement may be less than the operating clearance of snubbers (restraints) do not preclude the need for snubbers. All equipment must be positively attached to the structure.
  - b. All suspended equipment including, but not limited to transformers, etc. shall be two or four point independently braced with TYPE III restraints. Install cable braces taught for non-isolated equipment and slack with 1/2" cable deflection for isolated equipment. Rod bracing shall be installed as per approved submittals and shop drawings. Equipment connected to ductwork weighing less than 75 lbs. is excluded.
  - c. All horizontally suspended cable trays, bus duct and conduit shall use RESTRAINT TYPE III. Spacing of seismic bracing shall be as per TABLE B at the end of this section.
  - d. For all trapeze-supported conduit, the individual conduits must be transversely and vertically attached to the trapeze support at the designated restraint locations.
  - e. For overhead supported equipment, over stress of the building structure must not occur. Bracing may occur from:
    - 1) Flanges of structural beams.
    - 2) Upper truss chords in bar joists.
    - 3) Cast in place inserts or drilled and shielded inserts in concrete structures.
  - f. Conduit Risers
    - 1) Where conduits pass through cored holes, holes must be packed with resilient material or fire stop as specified in other sections of this

specification and/or state and local codes. No additional horizontal seismic bracing is required at these locations.

- g. Luminaires such as panel light shall be attached to lay-in ceilings with earthquake clips or other approved means of positive attachment to the T- bar ceiling structure.
  - h. A rigid conduit, cable tray or bus duct system shall not be braced to dissimilar parts of a building or two dissimilar building systems that may respond in a different mode during an earthquake. Examples: Wall and roof; solid concrete wall and a metal deck with lightweight concrete fill, conduit that crosses a building expansion joint.
2. Exclusions from seismic requirements on non life safety equipment:
    - a. All conduit less than 2-1/2" diameter.
    - b. All clevis or single level trapeze supported conduit, cable tray or bus duct suspended by hangers with positive attachment to the structure that are less than 12 inches in length as measured from the top of the conduit, cable tray or bus duct to the point of attachment to the structure. If any hanger in the run exceeds the 12" limit, seismic bracing is required for the run.
  3. Exclusions from seismic requirements on life safety equipment.
    - a. None

**C. INSPECTION**

1. If in the opinion of the project engineer the seismic restraint installation does not meet with the project requirements, an outside consultant will be retained to inspect, verify and submit corrective measures to be taken. The consultant's fees and all work associated with such a review shall be borne by the contractor.

TABLE A VIBRATION REQUIREMENTS FOR ELECTRICAL EQUIPMENT			EQUIPMENT INSTALLATION ATTACHMENT POINT						
			ON GRADE			ABOVE GRADE			
EQUIPMENT	SIZE	MOUNTING	ISOL	DEFL	BASE	ISOL	DEFL	BASE	
GENERAL PURPOSE TRANSFORMERS – DRY TYPE	ALL	FLOOR	D	0.30	- -	D	0.30	- -	
		CEILING	E	0.30	- -	E	0.30	- -	
GENERATORS	ALL	FLOOR	B	0.75	- -	B	1.50	- -	
UPS	Over 15 Kva	FLOOR	D	0.30	B-1	B	0.75	B-1	

TABLE B SEISMIC BRACING TABLE			ON CENTER SPACING		
EQUIPMENT	TRANSVERSE		LONGITUDINAL		
	CONDUIT	40 Feet		80 Feet	
BUS DUCT	30 Feet		60 Feet		
CABLE TRAY	40 Feet		80 Feet		

**NOTE WELL**

(1) Projects that contain large concentrations of conduit may require that the allowable spacing shown in this Table be reduced to minimize structural loading. All associated costs shall be the responsibility of the contractor. Close coordination and approval by the structural engineer is mandatory for all seismic point loads exceeding 2,000 lbs.

**3.28 TOUCHUP PAINTING**

- A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.
- B. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

Maine Medical Center  
P6 Renovations  
Portland, Maine

MorrisSwitzer Environments for Health, LLC  
Project Number: 28034

**END OF SECTION 26 00 00**