

# PROJECT MANUAL

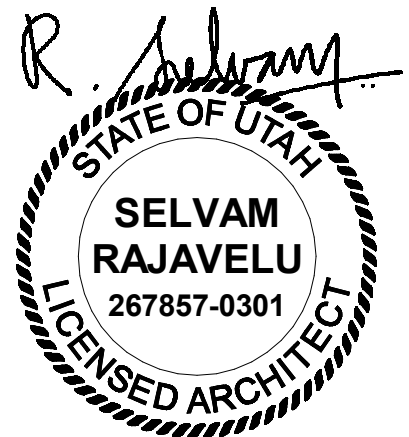
## Primary Children's Hospital Operating Room 17

100 N. Mario Capecchi Dr.  
Salt Lake City, UT 84113

Owner  
**Intermountain Health**

## Construction Documents

Date: April 17, 2024



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5223 S. Ascension Way, Suite 350 | Murray, Utah 84123 | Phone: (801) 364-9259  
[www.njraarchitects.com](http://www.njraarchitects.com)

## **PROJECT MANUAL INDEX**

Title Page  
Project Manual Index  
Drawing Index

### **Bidding and Contract Requirements**

A/E Certificate of Substantial Completion – Intermountain Form  
Application and Certification for Payment  
Intermountain Lien Waiver and Release Form  
Utilities Shutdown Request Form  
Above Ceiling Work Permit Form  
Hot Work Permit Form  
Infection Control Risk Assessment (ICRA)  
Sample – ASI Form  
Sample – CCD Form  
Sample – CO Form  
Sample – PCO Form  
Sample – PR Form  
Sample – RFI Form  
Contractor Orientation  
Construction Safety Requirements  
Intermountain Responsibility Matrix  
Tax Exemption Certificate TC-721  
Bid Form  
Intermountain Healthcare - General Conditions

## **TECHNICAL SPECIFICATIONS**

### **DIVISION 1 - GENERAL REQUIREMENTS**

01 10 00	Summary
01 29 00	Payment Procedures
01 31 00	Project Management and Coordination
01 33 00	Submittal Procedures
01 40 00	Quality Requirements
01 50 00	Temporary Facilities and Controls
01 60 00	Product Requirements
01 76 00	Guaranties and Warranties
01 78 23	Operation and Maintenance Data
01 78 39	Project Record Documents
01 79 00	Cleaning

### **DIVISION 2 – EXISTING CONDITIONS**

02 41 19	Selective Structure Demolition
----------	--------------------------------

### **DIVISION 3 - CONCRETE**

03 53 00 Concrete Topping

### **DIVISION 5 - METALS**

05 05 00 Metal Fasteners  
05 12 00 Structural Steel Framing  
05 40 00 Cold-Formed Metal Framing  
05 50 00 Metal Fabrications

### **DIVISION 6 - WOOD AND PLASTICS**

06 10 00 Rough Carpentry  
06 16 00 Sheathing  
06 41 23 Interior Architectural Woodwork

### **DIVISION 7 – THERMAL AND MOISTURE PROTECTION**

07 21 00 Building Insulation  
07 42 13 Metal Composite Material Wall Panel (ACM)  
07 62 00 Sheet Metal Flashing & Trim  
07 81 00 Spray Applied Fireproofing  
07 84 00 Firestopping  
07 92 00 Joint Sealants

### **DIVISION 8 – DOORS AND WINDOWS**

08 31 13 Access Panels  
08 80 00 Glazing

### **DIVISION 9 - FINISHES**

09 22 16 Non-Structural Metal Framing  
09 22 20 Acoustical Insulation  
09 29 00 Gypsum Board  
09 51 13 Acoustical Panel Ceilings  
09 65 19 Resilient Flooring  
09 91 23 Interior Painting

## **DIVISION 10 – SPECIALTIES**

- 10 26 00 Wall and Door Protection
- 10 52 00 Fire Protection Specialties

### **Mechanical**

#### **DIVISION 21 - FIRE SUPPRESSION**

- 211313 Wet-Pipe Sprinkler Systems

#### **DIVISION 22 - PLUMBING**

- 220517 Sleeves and Sleeve Seals for Plumbing Piping
- 224216.16 Commercial Sinks
- 226213 Vacuum and Gas Piping for Laboratories and Healthcare Facilities
- 226400 Medical Gas Alarms

#### **DIVISION 23 - HEATING, VENTILATING, AND AIR CONDITIONING (HVAC)**

- 230517 Sleeves and Sleeve Seals for HVAC Piping
- 230553 Identification for HVAC Piping and Equipment
- 230593 Testing, Adjusting, And Balancing for HVAC
- 230713 Duct Insulation
- 230719 HVAC Piping Insulation
- 230923.11 Control Valves
- 232113 Hydronic Piping
- 232116 Hydronic Piping Specialties
- 233113 Metal Ducts
- 233300 Air Duct Accessories
- 233600 Air Terminal Units
- 233713 Diffusers, Registers, And Grilles

#### **DIVISION 26 - ELECTRICAL**

- 260519 Low-Voltage Electrical Power Conductors and Cables
- 260526 Grounding And Bonding for Electrical Systems
- 260529 Hangers And Supports for Electrical Systems
- 260533 Raceways And Boxes for Electrical Systems
- 260544 Sleeves And Sleeve Seals for Electrical Systems
- 260548 Seismic Controls for Electrical Systems
- 260553 Identification For Electrical Systems
- 260572 Overcurrent Protective Device Short-Circuit Study
- 260573 Overcurrent Protective Device Coordination Study
- 260574 Overcurrent Protective Device Arc-Flash Study

260923	Lighting Control Devices
262416	Panelboards
262726	Wiring Devices
262813	Fuses
262816	Enclosed Switches and Circuit Breakers
262913	Enclosed Controllers
265119	Led Interior Lighting

## **DIVISION 27 - COMMUNICATIONS**

270000	Common General Conditions for Communications Sections
270100	Operation And Maintenance of Communication Systems
270113	Warranty Product and System
270119	Field Testing and Reporting
270133	Shop Drawings Product Data Samples Design Records and Existing Conditions
270143	Qualifications And Required Training for Contractor and Installer
270171	Responsibility And Workmanship of Contractor
270500	Common Work Results for Communications
270526	Grounding And Bonding for Communications Systems
270528	Pathways For Communications Systems
270529	Hangers And Supports for Communications Systems
270533	Conduits And Back Boxes for Communications Systems
270536	Cable Trays For Communications Systems
270543	Campus Cable Routing
270553	Identification For Low-Voltage Cables and Labeling
271100	Equipment Room Fitting
271116	Cabinets, Racks, Frames, And Enclosures
271119	Termination Blocks and Patch Panels
271300	Backbone Cabling
271500	Horizontal Cabling
271513	Copper Cable
271543	Faceplates And Connectors
271619	Patch Cables
275113	Overhead Paging
275223	Nurse Call Code Blue Systems
275319	Internal Cellular Paging and Antenna Systems
276001	Appendix 01 Deviation Request Process
276002	Appendix 02 Document Refresh Process
276003	Appendix 03 Data Center, TEC, TDR Part Numbers
276004	Appendix 04 Reference Standards

276005	Appendix 05 Definitions and Abbreviations
276006	Appendix 06 Material Suppliers
276007	Appendix 07 Siemon - Certified Installation Firms
276008	Appendix 08 Lead Wall Penetrations

END OF TABLE OF CONTENTS

## **DRAWING INDEX**

### **GENERAL**

G001	Cover Sheet
G002	General Information
G003	General Information
G004	American National Standard Institute Requirements
G005	General
G001	Cover Sheet
G002	General Information
G003	General Information
G004	American National Standard Institute Requirements
G005	General Legend & Notes
G121	Code Compliance Plan Level 2 - Overall

### **STRUCTURAL**

S001	Structural General Notes
S101	Partial Framing Plans
S501	Structural Details

### **ARCHITECTURAL**

A121	Demolition Floor Plan Level 2 - Overall
A122	Floor Plan Level 2 - Overall
A123	Demolition Reflected Ceiling Plan Level 2 - Overall
A124	Reflected Ceiling Plan Level 2 - Overall
A126	Finish Floor Plan Level 2 - Overall
A121A	Demolition Floor Plan Level 2
A122A	Floor Plan Level 2
A123A	Dimension Plan Level 2
A124A	Reflected Ceiling Plan Level 2
A126A	Finish Plan Level 2
A127A	Floor Pattern Plan Level 2
A253	Interior Elevations
A401	Enlarged Floor Plan
A402	Enlarged Ceiling Plan
A403	Enlarged Views
A404	Enlarged Finish Plan
A501A	Wall Types
A502A	Wall Details
A502B	Wall Details
A503A	Ceiling Details
A504A	Door & Window Details
A505A	Cabinet Legend & Details
A505B	Cabinet Details
A506A	Details
A601A	Door Schedule
A603A	Finish Schedule & Details
A603B	Finish Details

**MECHANICAL**

M001	Mechanical Cover Sheet
M601	Mechanical Details and Schedules
M121	Mechanical Demo Plan Level 2
M122	Mechanical Plan Level 2
M123	Mechanical Piping Plan Level 2

**PLUMBING**

P001	Plumbing Cover Sheet
P601	Plumbing Details and Schedules
P122	Plumbing Plan - Level 2
P123	Plumbing Plan - Med Gas Level 2

**ELECTRICAL**

EE001	Electrical Cover Sheet
EE002	Telecom Schedule and Notes
EE701	Typical Mounting Details
ED102	Level 2 Electrical Demolition Plan
EP102	Level 2 Power Plan
EP102A	Level 2 Steris Integration Rough-In Plan
EP601	One-Line Diagram
EL102	Level 2 Lighting Plan
EL601	Interior Lighting Fixture Schedule
ET501	Telecom Details
ET601	Telecom Riser Diagrams
EY101	Level 2 Auxiliary Plan

**EQUIPMENT**

EQ101	Equipment Drawings
EQ102	Equipment Drawings
EQ103	Equipment Drawings
EQ104	Equipment Drawings
EQ105	Equipment Drawings
EQ106	Equipment Drawings
EQ107	Equipment Drawings
EQ108	Equipment Drawings
EQ109	Equipment Drawings
EQ110	Equipment Drawings
EQ111	Equipment Drawings



## A/E CERTIFICATE OF SUBSTANTIAL COMPLETION

<b>Project Name:</b>	<b>Project Name Address City, State, Zip</b>	<b>Intermountain Health:</b>	<b>IHC Health Services, Inc. 36 South State Street, 21<sup>st</sup> Flr Salt Lake City, Utah, 84111</b>
<b>Intermountain Health Project No:</b>	<b>1001XXXX</b>		
<b>Contractor:</b>	<b>Name Address City, State, Zip</b>	<b>A/E:</b>	<b>Name Address City, State, Zip</b>
<b>Agreement For:</b>	<b>Construction</b>	<b>Certificate Number:</b>	<b>Enter No. (e.g., BP001)</b>
<b>Agreement Date:</b>	<b>DD/MM/YEAR</b>	<b>DATE OF SUBSTANTIAL COMPLETION:</b>	<b>DD/MM/YEAR</b>

**THE DEFINITION OF SUBSTANTIAL COMPLETION** is the stage in the progress of the Work when the Project Work or designated portion of the Project is sufficiently complete in accordance with the Contract Documents so Intermountain Health can occupy and utilize the Project Work for its intended use. The Project Work, or designated portion of the Project, identified and described below has been reviewed and found, to the A/E's best knowledge, information, and belief, to be substantially complete.

*(A/E to identify the Project Work, or designated portion of the Project, that is substantially complete)*  
A/E to enter Project Work text here.

### WARRANTIES

The **DATE OF SUBSTANTIAL COMPLETION** of the Project Work or portion designated above is the date established by this Certificate, which is also the date of commencement of applicable warranties required by the Contract Documents, except as stated below:

*(A/E to identify warranties that do not commence on the date of Substantial Completion, if any, and indicate their date of commencement)*  
A/E to enter N/A, None, or additional text here.

### WORK TO BE COMPLETED OR CORRECTED

A list of Project Work items to be completed or corrected has been prepared by the Contractor and provided to the A/E. This list has been reviewed, amended, and additional Project Work items have been documented by the A/E. This list is attached hereto or included by reference. The failure to include any Project Work items does not alter the responsibility of the Contractor to complete all Project Work in accordance with the Contract Documents. This Certificate is subject to provisions of the A/E's Project Manual substitution section and does not include items noted as unacceptable or nonconforming.

*(A/E to identify the list of Project Work to be completed or corrected)*  
A/E to enter text or See attached Punch List as applicable.

The date of commencement of warranties for **WORK TO BE COMPLETED OR CORRECTED** items on the attached list will be the date of the final Intermountain Health approval of the Contractor's final Application and Certification For Payment, unless otherwise agreed to in writing.

The Contractor will complete or correct the Project Work items attached or referenced hereto within the timeframe indicated from the **DATE OF SUBSTANTIAL COMPLETION**: Thirty (30) days. Time is of the essence in completing or correcting the Project Work items identified in the attached list.

In addition to any other holdback or retention, Intermountain Health will withhold \$0.00 from the Contract Sum until Contractor has completed and corrected the Project Work items identified in the attached list.

The Contractor will secure from Authorities Having Jurisdiction (AHJ) the Certificate of Occupancy, Fire Clearance approvals, State Department of Health approvals, and any other approvals required prior to full possession by Intermountain Health. These documents, including the **WORK TO BE COMPLETED OR CORRECTED** items, if any, are attached for reference to this Certificate.

Intermountain Health accepts the Project Work, or designated portion of the Project, as substantially complete as determined by the A/E and will assume full possession thereof at: Enter Time and Date (verify all AHJ approvals will be provided).

Neither this certificate nor the achievement of Substantial Completion shall constitute a release or waiver by Intermountain Health of any claims or Contractor obligations (including without limitation claims or obligations relative to warranty, patent or latent defects, indemnity, bonds, insurance, payments).

Nothing herein will be construed to relieve the Contractor of its duty to perform the Work in accordance with the Contract Documents

By signing this document, Intermountain Health, the Contractor, and the A/E agree and accept the foregoing and the responsibilities assigned to Intermountain Health and to the Contractor in this A/E Certificate of Substantial Completion.

**Contractor:**

Contractor Firm  
Contractor Rep. Name - Title

**A/E:**

A/E Firm  
A/E Rep. Name - Title

**Intermountain Health:**

IHC Health Services, Inc.  
Adam Jensen

\_\_\_\_\_  
Signature                                  Date

\_\_\_\_\_  
Signature                                  Date

\_\_\_\_\_  
Executive Director, Design and Construction                  Date

\_\_\_\_\_  
System Construction Director<sup>1</sup>                                  Date

\_\_\_\_\_  
FD&C Project Manager    Date

<sup>1</sup> For local facility managed projects, System Construction Director to sign.



APPLICATION AND CERTIFICATION FOR PAYMENT

To Owner: IHC Health Services, Inc. Owner Project #: Owner Project #
36 South State Street Application #: 1
Salt Lake City, UT 84111 Application Date: 12/1/2018
From Contractor: Contractor Name Architect Name Address Address
City, State, Zip City, State, Zip
Via A/E:
Contract Invoice #: 1
Project Name: Project Name Contract Date: 12/17/2016

CONTRACTOR'S APPLICATION FOR PAYMENT

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

Table with 2 columns: Description and Amount. Rows include: 1. Original Contract Sum (\$100.00), 2. Total Contract Change By Change Orders (\$0), 3. Current Contract Sum (\$100.00), 4. Total Completed & Stored To Date (\$75.00, 75.00%), 5. Retention (5.1-5.6), 6. Total Earned Less Retainage (\$71.25), 7. Less Previous Certificates For Payments (\$0, 0.00%), 8. Current Payment Due (\$23.75, 23.75%), 9. Balance To Finish, Plus Retention (\$76.25, 76.25%).

CONTRACTOR'S CONTRACTOR NAME

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.

By: John Doe Date: 12/31/2018

State of:
Subscribed and sworn to before me this \_\_\_ day of \_\_\_
Notary Public:
My Commission Expires: \_\_\_

A/E'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based upon on-site observations and the data comprising the application, the A/E certifies to the Owner that to the best of the A/E'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: \$23.75

A/E: 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.

Approved by FD&C PM 1,2: (Signature) (Date)

Change Order Summary table with columns: Description, Amount. Rows: Total Changes Approved in Previous Months By Owner (\$), Total Approved Changes This Month (\$), Total Contract Change By Change Orders (\$).

1 For major capital projects, FD&C Project Manager to sign. 2 Intermountain's "Monthly Pay Application Checklist" must be submitted by PM with Contractor's Application & Certification for Payment before processing. 3 Contractor has verified the work associated with the "Current Payment Due" and has attached all relevant invoices and backup information with this application & certification for payment.



**CONTINUATION SHEET**

**Project Name: Project Name**

**Application Date: 12/1/2018**

**Application and Certification for Payment,**

**Owner Project #: Owner Project #**

**Period To: 12/31/2018**

Containing Contractor's signed certification is attached.

**Application #: 1**

**Contractor Invoice #: 1**

A Item No.	B Description of Work	C Original Contract Sum (CM/GC Pre-Construction Fee; Contract Buyouts)	D Total Contract Change By Change Orders	E Current Contract Sum (C + D)	F Work Completed		G Materials Presently Stored This Period (Not in For G)	H Total Completed and Stored Through This Period (F + G + H)	I % (I / E)	J Balance To Finish (E - I)	K This Period Retention (G + H * 5%)	L Total Retention Withheld (I * 5%)	M This Period Retention Released	N Total Retention Released	O Current Payment Due <sup>3</sup> (G + H - L + N)	P
					From Previous Applications	This Period In Place										
00001	Enter Description of Work	\$ 100.00	\$ -	\$ 100.00	\$ 50.00	\$ 25.00	\$ -	\$ 75.00	75%	\$ 25.00	\$ 1.25	\$ 3.75	\$ -	\$ -	\$ -	23.75
00002		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00003		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
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00028		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
00029		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
<b>Intermountain Project Grand Totals</b>		\$ 100.00	\$ -	\$ 100.00	\$ 50.00	\$ 25.00	\$ -	\$ 75.00	75%	\$ 25.00	\$ 1.25	\$ 3.75	\$ -	\$ -	\$ -	23.75

**Attachment "D"**

**UTAH**

**CONDITIONAL WAIVER AND RELEASE UPON PROGRESS PAYMENT**

TO:	IHC HEALTH SERVICES, INC.	("Owner")
FROM:	<u>ENTER CONTRACTOR NAME</u>	("Contractor")
PROPERTY NAME:	<u>Enter Project Name</u>	("Property")
PROPERTY LOCATION:	<u>Enter Project Address</u>	
CONTRACT DATE:	<u>Enter Date (April 16, 2019)</u>	
INVOICE DATE/NUMBER:		("Invoice")
PAYMENT PERIOD:		
PAYMENT AMOUNT:	\$	("Payment Amount")

Under this Conditional Waiver and Release, Contractor releases Owner and the Property from, and waives, any notice of lien or right under Utah law (see Utah Code Ann., Title 38, Chapter 1a, Pre-construction and Construction Liens, and Utah Code Ann., Title 14, Contractors' Bonds, or Section 63G-6a-1103) related to payment rights the Contractor has on the Property once:

1. Contractor endorses a check in the Payment Amount payable to Contractor or provides valid wire transfer or direct deposit instructions; and
2. The check is paid by the depository institution on which it is drawn or the wired or direct-deposited funds in the Payment Amount are deposited into Contractor's designated account.

This Conditional Waiver and Release applies to the progress payment for the work, materials, equipment, or combination of work, materials, and equipment furnished by Contractor to the Property or to Owner covered by the Invoice. This Conditional Waiver and Release does not apply to any retention withheld; any items, modifications, or changes pending approval; disputed items and claims; or items furnished or invoiced after the Invoice Period.

Contractor warrants that it either has already paid, or will promptly use the Payment Amount received to pay in full all of Contractor's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or combination of work, materials, and equipment under the Invoice. Contractor has not assigned any lien or right to perfect a lien against the Property and has the right, power, and authority to execute this Conditional Waiver and Release.

ENTER CONTRACTOR NAME, a Enter  
Corporation Type

By: \_\_\_\_\_  
Print Name: \_\_\_\_\_  
Title: \_\_\_\_\_

**Attachment “D”**

**UTAH**

**WAIVER AND RELEASE UPON FINAL PAYMENT**

TO:	IHC HEALTH SERVICES, INC. (“Owner”)
FROM:	<u>ENTER CONTRACTOR NAME</u> (“Contractor”)
PROPERTY NAME:	<u>Enter Project Name</u> (“Property”)
PROPERTY LOCATION:	<u>Enter Project Address</u>
CONTRACT DATE:	<u>Enter Date (April 16, 2019)</u>
INVOICE DATE/NUMBER:	(“Invoice”)
PAYMENT PERIOD:	
TOTAL PAYMENT AMOUNT:	\$ (“Payment Amount”)

Under tis Waiver and Release, Contractor releases Owner and the Property from, and waives, any notice of lien or right under Utah law (see Utah Code Ann., Title 38, Chapter 1a, Pre-construction and Construction Liens, and Utah Code Ann., Title 14, Contractors' Bonds, or Section 63G-6a-1103) related to payment rights the Contractor has on the Property once:

1. Contractor endorses a check in the Payment Amount payable to Contractor or provides valid wire transfer or direct deposit instructions; and
2. The check is paid by the depository institution on which it is drawn or the wired or direct-deposited funds in the Payment Amount are deposited into Contractor’s designated account.

This Waiver and Release applies to the final payment for the work, materials, equipment, or combination of work, materials, and equipment furnished by Contractor to the Property or to Owner.

Contractor warrants that it either has already paid, or will promptly use the Payment Amount received to pay in full all of Contractor’s laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or combination of work, materials, and equipment under the Invoice. Contractor has not assigned any lien or right to perfect a lien against the Property and has the right, power, and authority to execute this Waiver and Release.

ENTER CONTRACTOR NAME, a Enter

Corporation Type

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

Print Name: \_\_\_\_\_

Title: \_\_\_\_\_

## UTILITIES SHUTDOWN REQUEST (Utilities & Emergency Egress, Etc.)

<b>Project Name:</b>	Project Name Address Address	<b>Contractor:</b>	Contractor Contact Name Phone Number
<b>Owner:</b>	IHC Health Services, Inc.	<b>Contractor(s)/ Subcontractor(s) Performing Work:</b>	Contractor Contact Name Phone Number
<b>FD&amp;C PM:</b>	PM Name		
<b>Start of Impairment:</b>	Date Time	<b>End of Impairment:</b>	Date Time

### IMPAIRMENT REQUIREMENTS

The Utilities Shutdown Request **MUST** be approved by Facility Management 3 working days (min.) before work begins.

Facility Management **MUST** be notified when work is ready to begin and when work is complete.

Facility Management and Contractor(s) will reactivate system(s) at approved times and **MUST** be notified if impairments need to be extended.

### SECTION 1 – IMPAIRED INFORMATION TO BE COMPLETED BY CONTRACTOR

#### AREA(S) AFFECTED (Building, Floor, Area/Department, Users, Devices, etc.)

Text

#### TYPE OF SHUTDOWN (CHECK ALL THAT APPLY)

<input type="checkbox"/> <b>Electrical</b>	<input type="checkbox"/> Emergency Power* <input type="checkbox"/> Main Switch Gear* <input type="checkbox"/> Individual Panel	<input type="checkbox"/> Single Breaker <input type="checkbox"/> Fire Alarm System* <input type="checkbox"/> _____
<input type="checkbox"/> <b>Plumbing</b>	<input type="checkbox"/> Sewer Stock <input type="checkbox"/> Vent <input type="checkbox"/> Hot Water Domestic	<input type="checkbox"/> Cold Water Domestic <input type="checkbox"/> Steam Line <input type="checkbox"/> _____
<input type="checkbox"/> <b>Sprinkler</b>	<input type="checkbox"/> Riser* <input type="checkbox"/> Individual Heat <input type="checkbox"/> Horizontal Mains/Areas	<input type="checkbox"/> Valves* <input type="checkbox"/> _____
<input type="checkbox"/> <b>Medical Gas</b>	<input type="checkbox"/> Compressed Air <input type="checkbox"/> Oxygen <input type="checkbox"/> Nitrous Oxide	<input type="checkbox"/> Vacuum <input type="checkbox"/> Special Mix Gas <input type="checkbox"/> Zone Valve Boxes <input type="checkbox"/> _____

<input type="checkbox"/> <b>Mechanical</b>	<input type="checkbox"/> Chilled Water	<input type="checkbox"/> Hot Water	<input type="checkbox"/> VAV's
	<input type="checkbox"/> Steam	<input type="checkbox"/> Compressor	<input type="checkbox"/> Electrical Disconnects
	<input type="checkbox"/> Glycol	<input type="checkbox"/> Condenser	<input type="checkbox"/> _____

\* Requires Fire Alarm & Security Coordination

**FACILITY PERMITS**

**\*\*Above Ceiling**

**\*\*Hot Work**

**\*\*Infection Control Risk Control (ICRA)**

**\*\*Other** \_\_\_\_\_

\*\* Completed forms must be attached

**PERCENT OF IMPAIRMENT** (For partial impairment, attach a list showing the area, smoke head, fire suppression system etc. that will be impaired)

*Text*

**REASON FOR IMPAIRMENT**

*Text*

**COMMENTS**

*Text*

**ATTACHMENTS**

1. *3\_Pre-Construction GC Detailed Shutdown Plan\_Template.xlsx*
2. *Facility Site Area Floor Plan*

**SECTION 2 – TO BE COMPLETED BY FACILITY MANAGEMENT**

1. Will fire alarm be taken off line for any amount of time? Yes \_\_\_\_\_ No \_\_\_\_\_  
If Yes, Facility Management must review and sign. \_\_\_\_\_
2. Will this impairment extend more than 4 hours? Yes \_\_\_\_\_ No \_\_\_\_\_  
If Yes, a fire watch must be implemented, Intermountain Healthcare Safety Officer and Insurance Provider must be notified.
3. Department Managers of impaired areas notified:  
Facility Management: \_\_\_\_\_ Date: \_\_\_\_\_  
FD&C Project Manager: \_\_\_\_\_ Date: \_\_\_\_\_



# Above Ceiling Work Permit

\*\*Standards Referenced: NFPA 101 2012; NFPA 30 2012; NFPA 45 2011; NFPA 99 2012

Facility Name:   
Requestor Name:   
Company/Dept:   
Contact Phone:

Permit No.:   
Project No.:   
Work/PO No.:

Start Date:  Start Time:   
End Date:  End Time:

Exact Location of Work:

Description of Work:

Will ANY penetrations be made in walls, roof, floor or ceilings?  Yes  No

Will wiring or data cabling be installed or modified?  Yes  No

### Type of Wiring

- Communication
- Door Control
- Low or High Voltage Electrical
- Fiber Optic
- Fire Alarm

- HVAC
- Security
- Telephone
- Television
- Other -

Will fixtures, appliances, duct work or equipment be installed?  Yes  No

### How will the work be supported?

- Fastened to deck or structure
- Fastened to wall
- Existing cable tray
- Existing pipe rack or conduit rack

- New cable tray
- New pipe rack or conduit rack
- Other -

Intermountain Point of Contact:  POC Phone:   
Print Name Clearly

### Site Pre-Inspection

Intermountain Representative:  Requestor:   
Print Name Clearly Print Name Clearly

Notes or Observations (if any):

### Site Post-Inspection

Intermountain Representative:  Requestor:   
Print Name Clearly Print Name Clearly

- No unsealed penetrations observed
- All installations properly supported

Notes or Observations (if any):

### Intermountain Review and Approval of Work

Intermountain Representative:  Date:   
Signature

### Why do we have to do this?

- Because more people die of smoke inhalation in fires than die of fires in fires.
- Because 6% of all TJC findings at Intermountain are penetrations in smoke or fire barriers.

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# Hot Work Permit



Facility Name:

Requestor Name:

Company/Dept:

Contact Phone:

Permit No.:

Project No.:

Start Date:

End Date:

Work / PO No.:

Start Time:

End Time:

Exact Location of Work:

Description of Work:

### Heat Sources

- Gas Torch     Grinder     Arc Welder     Drill     Chemical  
 Other -

Will work require disabling fire detection or suppression systems?  Yes  No

Will systems be disabled longer than 4 hours in any 24 hours?  Yes  No

Will work generate smoke, odors or fumes?  Yes  No

### Establishing The Work Area

- |  |  |
|--|--|
| <input type="checkbox"/> 35' space clear of combustibles           | <input type="checkbox"/> Appropriate fire extinguishers on hand      |
| <input type="checkbox"/> Fire blankets or protective mats in place | <input type="checkbox"/> Confined space permit on hand or not needed |
| <input type="checkbox"/> Space is well-ventilated                  | <input type="checkbox"/> Atmosphere tested non-explosive             |
| <input type="checkbox"/> Signage and barricades in place           | <input type="checkbox"/> Welding shields are in place as needed      |
| <input type="checkbox"/> Safety observer on hand                   | <input type="checkbox"/> Fire watch arranged for                     |
| <input type="checkbox"/> Other precautions: <input type="text"/>   |  |

Intermountain Point of Contact:  POC Phone:

Emergency Phone Number:

### Upon Conclusion of Work

Name of Fire Watch Personnel:  Supervisor:

- Fire watch was kept for 60 minutes after hot work was complete  
 No sign of smoke or fire was detected during fire watch

Notes or Observations (if any):

### Intermountain Review and Approval of Work

Intermountain Point of Contact:  Date:

### Why do we have to do this?

- Because more people die of smoke inhalation in fires than die of fires in fires.
- Because 6% of all TJC findings at Intermountain are penetrations in smoke or fire barriers.

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## A/E SUPPLEMENTAL INSTRUCTIONS

## ASI # 001

<b>Project Name:</b>	<b>Project Name</b> <b>Address</b> <b>Address</b>	<b>A/E:</b>	<b>A/E</b>
<b>Bid Package:</b>	<b>1.0X</b>	<b>Date:</b>	<b>Date Issued</b>
<b>Owner:</b>	<b>IHC Health Services, Inc.</b>	<b>ASI Page Count:</b>	<b>XX</b>
<b>Intermountain Project #:</b>	<b>Project ID #</b>	<b>ASI Prepared By:</b>	<b>Name</b>
<b>FD&amp;C PM:</b>	<b>PM Name</b>	<b>Contractor:</b>	<b>Contractor</b>
<b>ASI Description:</b>	<b>Description</b>		

### Reason For Change (Required):

- A/E Error  
  A/E Omission  
  A/E Request  
  GC Request  
  Owner/FD&C Request  
  Functional Request  
 Unknown Condition

*The Work shall be executed in accordance with the following supplemental instructions, which interpret the Contract Documents or order minor changes in the Work without change in Construction Costs, Contract Sum and/or Contract Time.*

*If the Contractor believes that a change in Construction Costs, Contract Sum, and/or Contract Time is warranted, the Contractor shall submit written notice in the form of a Proposed Change Order (PCO) substantiating such claim to the A/E. The claim shall be made in accordance with the provisions of the Contract Documents. The Owner's authorization is required prior to proceeding with any Work which will incur additional cost and/or time.*

### DETAILED DESCRIPTION:

Text

### ATTACHMENTS:

Text

**Approved by FD&C<sup>1</sup>:**

\_\_\_\_\_  
(Signature)

\_\_\_\_\_  
(Date)

<sup>1</sup> For major and geographical capital projects, FD&C Project Manager to sign.

**CONSTRUCTION CHANGE DIRECTIVE****CCD # 001**

<b>Project Name:</b>	<b>Project Name</b> <b>Address</b> <b>Address</b>	<b>A/E:</b>	<b>A/E</b>
<b>Bid Package:</b>	<b>1.0X</b>	<b>Date:</b>	<b>Date Issued</b>
<b>Owner:</b>	<b>IHC Health Services, Inc.</b>	<b>CCD Page Count:</b>	<b>XX</b>
<b>Intermountain Project #:</b>	<b>Project ID #</b>	<b>CCD Prepared By:</b>	<b>Name</b>
<b>FD&amp;C PM:</b>	<b>PM Name</b>	<b>Contractor:</b>	<b>Contractor</b>
<b>CCD Subject:</b>	<b>Subject</b>		

**Reason For Change (Required):**

- A/E Error    A/E Omission    A/E Request    GC Request    Owner/FD&C Request    Functional Request
- Unknown Condition

**ESTIMATED CHANGE IN CONSTRUCTION COSTS, CONTRACT SUM, OR CONTRACT TIME:**

\$

*In order to expedite the work and avoid or minimize delays in the work which may affect the contract sum and/or contract time, the Contract Documents are hereby amended as described below. Proceed with this work promptly. Submit final costs for work involved and change in Contract Time (if any as a Proposed Change Order), for inclusion in a subsequent Change Order, per the General Conditions.*

*All work shall be in accordance with the terms, stipulations and conditions of the original Contract Documents.*

**DESCRIBE BRIEFLY ANY PROPOSED CHANGES:**

Text

**ATTACHMENTS:**

Text

**Approved by FD&C PM<sup>1</sup>:** \_\_\_\_\_  
(Signature) (Date)

**Approved by System Construction Director<sup>2</sup>:** \_\_\_\_\_  
(Signature) (Date)

**Approved by Executive Director<sup>3</sup>:** \_\_\_\_\_  
(Signature) (Date)

---

<sup>1</sup> For major and geographical capital projects, FD&C Project Manager to sign.

<sup>2</sup> System Construction Director to sign when the charge exceeds \$40,000 for geographical managed projects, or \$200,000 for major capital projects, as outlined in the "Approval Authority Capital Expenditures Policy".

<sup>3</sup> Executive Director, Design & Construction to sign when the charge exceeds \$200,000 as outlined in the "Construction Change Order Procedure".

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# CHANGE ORDER

**CO # 001**

<b>Project Name:</b>	Project Name Address Address	<b>Contractor:</b>	Contractor
<b>Bid Package:</b>	1.0x	<b>CO Date:</b>	Date Issued
<b>Owner:</b>	IHC Health Services, Inc.	<b>CO Page Count:</b>	XX
<b>Intermountain Project #:</b>	Project ID	<b>CO Prepared By:</b>	Name
<b>FD&amp;C PM:</b>	PM Name	<b>A/E:</b>	A/E

This Change Order is not valid until signed by the Owner, A/E, and Contractor.

**CO Description:** Description

PCO #	Description	Reason for Change	Amount
<b>Total This Change Order:</b>			<b>\$</b>

<b>CO Details:</b>		
	The Original Contract Sum	\$
	The net change by previously authorized Change Orders	\$
	The Contract Sum prior to this Change Order	\$
	The Contract Sum will be increased (decreased) by this Change Order	\$
	The new Contract Sum including this Change Order, will be	\$
	The Contract Time will be increased (decreased) by	
	The date of Substantial Completion as of this Change Order therefore is	

**Contractor:**  
Contractor Firm  
Contractor Rep. Name - Title

**A/E:**  
A/E Firm  
A/E Rep. Name - Title

**Intermountain Health:**  
IHC Health Services, Inc.  
Clay L. Ashdown / Adam C. Jensen<sup>1</sup>

_____ Signature	_____ Date	_____ Signature	_____ Date	_____ Sr. Vice President, Finance Operations / Executive Director, Design and Construction	_____ Date
				_____ Executive Director <sup>2</sup>	_____ Date
				_____ System Construction Director <sup>3</sup>	_____ Date
				_____ FD&C Project Manager <sup>4</sup>	_____ Date

<sup>1</sup> Executive Director, Design and Construction to sign when Change Order amount is \$100,000 or less, otherwise, Sr. Vice President, Finance Services is required to sign per the "Contract Policy" and "Approval Authority Expenditures Policy".

<sup>2</sup> Executive Director, Design & Construction to sign in this location when Change Order exceeds \$100,000.

<sup>3</sup> System Construction Director to sign in this location as pertaining to their portfolio of work.

<sup>4</sup> For major and geographical capital projects, FD&C Project Manager to sign.

# PROPOSED CHANGE ORDER

## PCO # 001

<b>Project Name:</b>	<b>Project Name</b> <b>Address</b> <b>Address</b>	<b>Contractor:</b>	<b>Contractor</b>
<b>Bid Package:</b>	<b>1.0X</b>	<b>PCO Issue Date:</b>	<b>Date Issued</b>
<b>Owner:</b>	<b>IHC Health Services, Inc.</b>	<b>PCO Page Count:</b>	<b>XX</b>
<b>Intermountain Project #:</b>	<b>Project ID #</b>	<b>PCO Prepared By:</b>	<b>Name</b>
<b>FD&amp;C PM:</b>	<b>PM Name</b>	<b>A/E:</b>	<b>A/E</b>

\*Once this document is executed the Contractor is authorized to proceed with the work described below and to include this PCO in a Change Order for A/E and Owner approval.

<b>PCO Description:</b>	<b>Description</b>
<b>Reference:</b>	<b>Reference ASI, RFI, PR, CCD change document this PCO is in response to.</b>

### Reason For Change (Required):

- \*A/E Error  
  \*A/E Omission  
  A/E Request  
  GC Request  
  Owner/FD&C Request  
  \*\*Functional Request  
 Unknown Condition

\*If A/E Error or A/E Omission is checked, the Contractor is to provide pricing delta (bid cost vs. C.O. cost) to determine A/E responsibility.

\*\*If Functional Request is checked, the Facility (or responsible department) and FD&C PM are to determine the Facility's cost responsibility, including design fees and the Facility representative is to initial the PCO or provide email acknowledgement of financial commitment and attach to PCO. FD&C PM to coordinate with Capital Finance on facility reimbursement once PCO is signed.

\*\*\*Contract Time request must be in compliance with the Agreement, General Conditions, and be included in a subsequent Change Order.

### PCO Details:

\*A/E is responsible for \$ \_\_\_\_\_ . Agreed to if PCO is signed.  
 \*\*Facility is responsible for \$ \_\_\_\_\_ . Agreed to if PCO is signed.

Item	Subcontractor	Description	Amount
-	-	Enter Description	\$
		PCO Subtotal	\$
		Subcontractor Default Insurance (SDI) (Insert %)	\$
		General Liability Insurance Fee (Insert %)	\$
		Contractors (CM/GC) Fee (Insert %)	\$
		Total Cost of this PCO Request	\$
		***Contract Time will be increased (decreased) by	0 Days

---

**Contractor:**

Contractor Firm  
Contractor Rep. Name - Title

**A/E:**

A/E Firm  
A/E Rep. Name - Title

**Intermountain Health:**

IHC Health Services, Inc.  
Owners' Rep. – PM Name

\_\_\_\_\_  
Signature Date

\_\_\_\_\_  
Signature Date

\_\_\_\_\_  
FD&C Project Manager<sup>1</sup> Date

\_\_\_\_\_  
System Construction Director<sup>2</sup> Date

\_\_\_\_\_  
FD&C Executive Director,  
Design & Construction<sup>3</sup> Date

---

<sup>1</sup> For major and geographical capital projects, FD&C Project Manager to sign.\*\*\*\*

<sup>2</sup> System Construction Director to sign when the charge exceeds \$40,000 for geographical managed projects, or \$200,000 for major capital projects, as outlined in the "Approval Authority Capital Expenditures Policy".

<sup>3</sup> Executive Director, Design & Construction to sign when the charge exceeds \$200,000 as outlined in the "Construction Change Order Procedure".

**\*\*\*\*PM signatures are required for all PCO's prior to work commencing.**

# PROPOSAL REQUEST

**PR # 001**

<b>Project Name:</b>	<b>Project Name</b> <b>Address</b> <b>Address</b>	<b>A/E:</b>	<b>A/E</b>
<b>Bid Package:</b>	<b>1.0X</b>	<b>Date:</b>	<b>Date Issued</b>
<b>Owner:</b>	<b>IHC Health Services, Inc.</b>	<b>PR Page Count:</b>	<b>XX</b>
<b>Intermountain Project #:</b>	<b>Project ID #</b>	<b>PR Prepared By:</b>	<b>Name</b>
<b>FD&amp;C PM:</b>	<b>PM Name</b>	<b>Contractor:</b>	<b>Contractor</b>
<b>PR Description:</b>	<b>Description</b>		

**Reason For Change (Required):**

- A/E Error  
  A/E Omission  
  A/E Request  
  GC Request  
  Owner/FD&C Request  
  Functional Request  
 Unknown Condition

*Please submit a fully itemized list of Construction Costs, with supporting documentation, for any changes in the Construction Costs, Contract Sum, and/or Contract Time incidental to the proposed modifications to the Contract Documents.*

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

**DESCRIPTION:**

Text

**ATTACHMENTS:**

Text

**Requested by:** \_\_\_\_\_  
 (Signature) (Printed Name and Title) (Date)

**Approved by FD&C PM<sup>1</sup>:** \_\_\_\_\_  
 (Signature) (Date)

<sup>1</sup> For major and geographical capital projects, FD&C Project Manager to sign.

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# REQUEST FOR INFORMATION

**RFI # 001**

<b>Project Name:</b>	<b>Project Name</b> <b>Address</b> <b>Address</b>	<b>Contractor:</b>	<b>Contractor</b>
<b>Bid Package:</b>	<b>1.0X</b>	<b>Date:</b>	<b>Date Issued</b>
<b>Owner:</b>	<b>IHC Health Services, Inc.</b>	<b>RFI Page Count:</b>	<b>XX</b>
<b>Intermountain Project #:</b>	<b>Project ID #</b>	<b>RFI Prepared By:</b>	<b>Name</b>
<b>FD&amp;C PM:</b>	<b>PM Name</b>	<b>A/E:</b>	<b>A/E</b>
<b>RFI Description:</b>	<b>Description</b>		
<b>Cross Reference:</b>	<b>ASI #, Drawing Info, etc.</b>	<b>RFI Response Date Requested:</b>	<b>Date</b>

**Contractor Attestation (Required checkbox):** *The undersigned Contractor has reviewed the Contract Documents and is unable to locate this requested information within the Contract Documents. This RFI requests information, direction, or clarification for this specific item.*

**Contractor Signature:** *Signature* **Date:** *Date*

**QUESTION:**

Text

**RESPONSE:**

Text

**A/E Response By:** **Name** **Date:** **Date**

**A/E PM Acknowledgement:** **Name** **Date:** **Date**

# Contractor Orientation

Intermountain Healthcare Facilities Management

*This orientation is to be read to all workers by the Facility Manager or designee, and a copy is to be given to each worker on the job site.*

## Safety on the Job Site

### Your Safety

Unsafe acts will not be tolerated on the job site. We want you to be as healthy and whole when you go home, as you were when you arrived.

Appropriate PPE will be worn at all times while working on the job site. Ladders and other equipment will be used properly.

Always use the proper lock-out/tag-out (LOTO) procedures and equipment to ensure that you and others are protected from hazardous energy while working. Be aware that energized systems in healthcare facilities can be complex, and your work may affect others in remote areas of the facility. Coordinate any LOTO activity with the Facility Manager and other affected trades.

### The Safety of Others

Nothing you do should put others in danger or harm them in any way. Be thoughtful and deliberate about safety.

## Your Behavior on the Job Site

### How You Should Act

You should come to work with a clean body in clean clothes. You should come to work sober. Attempting to work while under the influence of any drugs or alcohol – even if they are prescribed – can be dangerous to you and others, and is cause for immediate removal from the job site.

Be considerate of others. Remember that others may take offense at things you do, even when you mean no harm. Avoid doing or saying things that may bother or upset others.

No music, no smoking, no cursing, no shouting, no leering, no fighting, no racially or culturally insensitive comments, no suggestive or offensive comments, no propositions, and no soliciting are permitted while you are on the job site.

### Phones, Cameras, and Other Communication or Recording Devices

You should not carry on personal communication or phone conversations while on the job site.

You must NEVER photograph, or video or audio record ANYTHING or ANYONE on Intermountain Healthcare property. This will not be tolerated, and in some cases this may violate the law. If work needs to be photographed, have your supervisor or the facilities team on site take the pictures.

On this job site, the person who authorizes photography or recording is: \_\_\_\_\_.



## Where You Should Be on the Property

### Parking

Park only in the location identified by the Facility Manager in your orientation. Parking personal vehicles in any other location may result in their removal.

On this job site, the parking location is: \_\_\_\_\_.

### Smoking

Smoking is not allowed on any Intermountain property. If you need to smoke, vape, or use tobacco in other ways, you must leave the property and return when you're done.

Drugs are never allowed.

### Break Time

Take breaks only in areas identified by the Facility Manager in your orientation. During breaks do not engage in loud conversation or use offensive language.

On this job site, the break location is: \_\_\_\_\_.

### Meals

The Facility Manager will tell you in your orientation if you are permitted to use the facility cafeteria and dining room during your meal time. Take meals only in areas identified by the Facility Manager in your orientation.

Never take breaks in public areas meant for patients and their guests.

On this job site, the meal location is: \_\_\_\_\_.

On this job site, the break location is: \_\_\_\_\_.

## When You Should Be on the Property

When you are working, or on the property for work you should not arrive earlier than is necessary for you to assemble your tools and equipment for the day. Arriving very early and 'hanging around' is not permitted. Your supervisor will tell you what time you should arrive at work.

When you are done with the work day, and your tools and equipment are cleaned and put away, and your job site is clean, you should leave the property directly. Staying on the job site after work is not permitted.

Of course, if you are a patient, or are visiting one of our patients, you are always welcome in the public areas of the facility. Do not visit the job site unless you are here for work.

We ask you that while you are here you remember that you may be seen by others as representing your company or ours, and to please comport yourself accordingly.

## How a Healthcare Facility May Be Different from Other Jobs Sites

### People

The people who come to our hospitals and other facilities come because they feel sick, hurt, scared, or sad. They don't come to see us when everything is going fine. They want to feel safe and comfortable and confident that everything will be better soon.

Many of them are sensitive to noise, dust, fumes, odors, and vibrations. Please do everything you can to control these irritants.

The procedures we do in our facilities frequently require quiet and stillness. Please be sensitive to this and be ready to accommodate requests to stop work briefly or move to a different area of the facility to continue working.

### Building Systems

The structure of our hospitals and other facilities is intended to actively work to protect our staff, patients, and visitors in the event of an emergency. This means that you must be very careful about how your work impacts other systems and parts of the building. Some of the rules are strange, but all are important.

Certain walls are intended to stop smoke or fire from spreading because when our buildings catch fire we cannot leave. We continue to care for our patients, perform surgeries, help birth babies, and provide emergency medical care. When working around or through these walls – “rated assemblies” – it is critical that you do so properly.

A pre-inspection by a member of the facility's maintenance team of the area you'll be working in is required so that you can understand where rated assemblies are, and how you must treat them. This also gives you an opportunity to identify existing conditions for which you may not be responsible.

A post-inspection by a member of the facility's maintenance team of the work you've done is required so that you can demonstrate that you've complied with all requirements for maintaining the integrity of our protective rated assemblies.

On this job site, the contact for fire stopping materials is: \_\_\_\_\_.

Along with rated assemblies, our facilities have very sensitive fire and smoke detection systems, as well as automatic sprinkler systems. If your activities will cause dust or vibration or impact, be aware and mitigate any adverse effect you may have on these systems.

On this job site, the contact for fire alarm systems is: \_\_\_\_\_.

If your work interrupts or disables any portion of the building's life safety systems, including fire alarm, fire suppression, and emergency egress, you may be required to implement interim life safety measures.

On this job site, the contact for interim life safety is: \_\_\_\_\_.

Much of our air is exhausted to the outside. If you are working around exhaust fans, you must know what areas the exhaust is coming from. Some exhausts are laden with radioactive elements. Some carry infectious diseases and other germs. Your supervisor will tell you about these areas.

On this job site, the hazardous exhaust areas are: \_\_\_\_\_.

Many of our patients depend on clean and fresh outside air to be provided to them. Smoking on roofs or around air intakes is strictly forbidden for this reason. If you must operate equipment on roofs or around air intakes, be certain to coordinate your work with the Facility Manager.

On this job site, the sensitive air intakes are: \_\_\_\_\_.

Much of our equipment may start without notice. Take care to avoid being harmed by unexpected starts, or unexpected discharges of steam, hot water, or chemicals. Unless you are authorized to be working around this equipment you should stay out of these spaces.

All work above the ceiling requires an Above Ceiling Work Permit, and all hot work requires a Hot Work Permit.

On this job site, the contact for Above Ceiling Work Permits is: \_\_\_\_\_.

On this job site, the contact for Hot Work Permits is: \_\_\_\_\_.

### Infection Control

Because many of our patients are ill, there is a chance that you will be exposed to germs. There is also a chance that you will expose our patients to germs you've brought from outside the hospital. We do our best to keep our physical environment clean and to control all infectious matter.

You can protect yourself by ensuring that your vaccinations are current, and by only going in places you are authorized to go. Wash or sanitize your hands frequently – especially after using the restroom and before eating. Never eat food anywhere except where you are told to have meal breaks. The Plumber's Rule No. 3 applies to everyone in healthcare: Don't bite your fingernails!

Your work may require an Infection Control Risk Assessment. The Facility Manager will help you determine when that is, and will help you through the process. This process helps identify the best ways to keep you and our patients safe from infections and other impediments to healing. Once the assessment is done, be certain to abide by all of its conditions.

On this job site, the infection control contact is: \_\_\_\_\_.

### A Clean Job Site

Throughout the work day, you will be responsible to maintain a reasonably clean job site. This makes it a safer place for you to work. It makes it a safer place for others to work, as well.

At the end of each work day, you will be responsible to leave all materials in an orderly state, remove all waste, scrap, and debris from the site, and leave the area broom clean. All potential hazards will be secured and made as safe as possible.

All construction waste and debris must be disposed of properly. Never use toilets or floor drains for this purpose. Cover all carts while moving debris through the facility, and use tacky mats to control dust tracking over floors.

## Our Expectation of Workmanship

It doesn't matter if you're a ventilation mechanic, an electrician, a painter, or a plumber. It doesn't matter if you're installing carpet, or ceiling tiles, or kitchen equipment, or cabinetry. Every piece of our facilities is in place to support the lifesaving and healing work we do.

The hard reality is that someone's life will literally depend on the quality of the workmanship you put into the jobs you do in Intermountain Healthcare facilities.

And it's another hard reality that someone you care for may very likely come to the facilities you helped build. Please do the kind of job you'd trust your loved one's life to.

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## **CONSTRUCTION SAFETY REQUIREMENTS**

- I. Outside Contractors and Intermountain Construction Employees performing construction activities on occupied Intermountain Healthcare property shall meet the following requirements. Stand-alone, new construction sites are not covered by these requirements. Outside Contractors will meet additional qualifications through the Supply Chain Organization Supplier Credentialing Procedure.
  - a. No work will be performed in any Intermountain Facility without prior approval and coordination with the accountable Facility Engineering Manager or Director.
  - b. Each outside contractor will have a Safety Program that complies with 29 CFR 1926 Subpart C. The Safety Program will be in writing.
  - c. Any chemical brought onto Intermountain Property must meet the following requirements:
    - i. Approved by the facility's Chemical Safety Officer,
    - ii. Accompanied by a current material safety data sheet,
    - iii. Stored in accordance with the chemical manufacturer's safety requirements in the appropriate labeled container.
    - iv. Where the chemical quantity is restricted for Healthcare Occupancies by NFPA 30 or other standards, it is the contractor's responsibility to provide for off-site storage.
    - v. The Contractor is responsible to comply with Intermountain's Hazardous Materials policy.
    - vi. The Contractor is responsible for the removal of all chemicals from Intermountain Property and for proper disposal in accordance with applicable laws and regulations.
  - d. No work will be performed without the completion of an Interim Life Safety and Infection Control Risk Assessment. These risk assessments will cover each phase of the construction project.
  - e. In existing facilities, an Asbestos inspection and any necessary abatement will be conducted prior to any renovation or remodel per the Hazmat policy.
  - f. Where work will cause noise or vibration, an assessment will be made following facility procedures to mitigate potential hazards to patients.
  - g. Above the Ceiling Permits
    - i. The Contractor will follow each facility's procedure for obtaining an above the ceiling work permit.
    - ii. No work will be performed prior to obtaining this permit.
  - h. Hot Work Permits
    - i. The Contractor will obtain a Hot Work Permit from Facilities Engineering prior to performing any hot work.
    - ii. The Contractor will provide a continuous and qualified fire watch for the duration and location specified by the Facility Engineering Director.
  - i. Confined Space Permits
    - i. The contractor will coordinate with the Intermountain Facility Engineering Director to assure that all requirements are met and a permit is completed prior to entering a permit required confined space.

- j. Control of Airborne Contaminants
  - i. The contractor will control all airborne dusts, mists, fumes, and vapors such that there is no exposure to Intermountain employees, patients, or visitors. This includes the generation of contaminants outside the building.
  - ii. If necessary, work will be conducted after hours to minimize potential exposures to staff, patients, and members of the public.
- k. Personal Protective Equipment.
  - i. PPE for head, eye, face, hand, foot, and respiratory protection is the responsibility of the contractor, and will be provided and worn as necessary for the exposure, except as follows:
    - 1. Hard Hats and Safety Glasses are required to be worn at all times when in the construction area. Hard hats may be removed when working in areas where the suspended ceiling grid has been completely installed.
  - ii. Fall Protection is the responsibility of the contractors and shall meet all 29 CFR 1926 requirements of the applicable Subparts.

**RESPONSIBILITY MATRIX**

Updated February 13, 2023

The following list identifies the majority of the items that are to be included in the capital project build-out. All Owner items need to be coordinated with A/E (Design Team), Contractor, and Owner (Facility Design & Construction and Supply Chain Facility Equipment Planners). For OFOI or OFCI items, Contractor is required to track equipment on construction schedule and to notify Owner of required delivery times taking into account for equipment lead times.

ITEM	OWNER/VENDOR	NOTES	ADDITIONAL NOTES		
			Data	Power	Backlog
<b>OFOI - (Owner Furnished / Owner Installed)</b>					
<b>(Coordinate location of items with Owner and track within construction schedule)</b>					
Art	Owner / Owner (Alpine Art)	All artwork to be coordinated with Dan Kohler. Provide power and backing to required artwork.			
Audio/Video (A/V)	Owner / Owner	Intermountain SCO will source & supply the A/V system including specialized cabling (e.g. HDMI, etc). Refer to CFCI section for Contractor requirements. A/E to identify locations on drawings, coordinate with Owner. Contractor to provide infrastructure, back boxes, conduits, pathways and cabling (from wall side back).	Yes	Yes	
Brochure Racks	Owner / Owner	Contractor to provide proper backing.			Yes
Cash (Manual) Drawer	Owner / Owner	Identify locations and coordinate with point-of-sale equipment vendor.			Yes
Chart Racks	Owner / Owner (Midwest)	Contractor to provide proper backing.			Yes
Clinical Garbage Cans (Clinical, Office, PT, Etc.)	Owner / Owner				
Computers, Printers, Scanners, Keyboards, Mice, etc.	Owner / Owner	In-ceiling & wall mounts, conduits and boxes mounted by Contractor. Computers to be All-in-One, typ. in IMG exam rooms.	Yes	Yes	Yes
Copiers, fax	Owner / Owner	A/E to locate where copy/fax/printer is not visual clutter.	Yes	Yes	
Cup Dispensers	Owner / Owner				
Emergency Evacuation Medical Sled (Med Sled)	Owner / Owner	A/E to coordinate location with Owner.			
Exam Tables	Owner / Owner			Yes	
Infant/Pediatric Security System	Owner / Owner (Totguard)	A/E to identify locations on drawings. This system is to be coordinated with Owner, Women's and Children's Operations, Clinical Programs and Security.	Yes	Yes	
IV Hangar	Owner / Owner	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			
Keyboard Trays	Owner / Owner				
Magnetic Marker Boards, Cork Boards, Huddle Boards, Idea Tracking Boards, etc.	Owner / Owner (Midwest)	A/E to coordinate location with Owner.			Yes
Moveable Metal Shelving	Owner / Owner				
Nurse Notification Call (NNC) System & Devices (Hospital Campus)*	Owner / Owner (Hillrom)	Hospital local facility team to work with Supply Chain Facility Equipment Planning team to contract directly with Nurse Notification Call (NNC) system vendor (Hillrom) for devices, equipment, monitors, etc. A/E to coordinate with Owner and Hillrom for all NNC infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC devices (e.g. RCB, GSR-10, room devices, etc.). The cabling for the NNC system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.  *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes; see CFCI	Yes; see CFCI	
PACS	Owner / Owner				
Patient Monitoring System & Devices (Hospital Campus)	Owner / Owner	Hospital local facilities to work with Supply Chain Facility Equipment Planning team to contract directly with Patient Monitoring vendors for devices, equipment, monitors, etc. (from wall side out). A/E to identify locations on drawings, coordinate with Owner. Contractor to provide all infrastructure including conduits, back boxes, and home-run cabling from Patient Monitoring devices to TEC/TDR rooms that connect to Intermountain's network (Intermountain Siemon certified installer low voltage subcontractor to install). The Patient Monitoring system device to device cabling is by Vendor.	Yes	Yes	
Radiology Equipment	Owner / Owner (See subject matter expert list)	A/E responsible to coordinate final site equipment drawings into Construction Documents from Owner's Vendor.	Yes	Yes	
Receptionist Desk	Owner / Owner (Midwest & Steelcase)				
Recliners / Draw Chairs	Owner / Owner				
Sharps Disposal Container	Owner / Owner (Stericycle)	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			
Signage - Exterior	Owner / Owner (KB Signs, Trademark, YESCO)	Provide power and data to required exterior signage. Provide circuits for above ceiling signs. Coordinate thru-wall conduit sleeves with weather barrier. A/E to coordinate traffic signage and Contractor to install. Intermountain Logo Signs - (2) 20A Circuits - May vary. InstaCare and other Signs - (1) 20 A Circuits - May vary.	Yes	Yes	Yes
Signage - Interior (including Code Signage)	Owner / Owner (Intermountain Sign Shop, Scribbley, Hightech)	Provide power to required signage. Contractor to track in schedule and notify Owner for when Code Required signage is required to be installed.			



Staff Assist Notification Call System & Devices (Medical Group Clinics on hospital campuses to match NNC system)*	Owner / Owner (Hillrom)	Hospital local facility/IMG Ops team to work with Supply Chain Facility Equipment Planning team to contract directly with Staff Assist Notification Call system vendor (Hillrom) for devices, equipment, monitors, etc. (from wall side out). Staff Assist Notification system to be coordinated with Hospital Campus NNC system, as applicable, Medical Group Strategic Planner, and IMG Operations Officer. A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC and Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC and Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.  *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes; see CFCI	Yes; see CFCI	
Staff Assist Notification Call System & Devices (Stand-alone Medical Group Clinics)*	Owner / Owner (Hillrom)	IMG Ops team to work with Supply Chain Facility Equipment Planning team to contract directly with Staff Assist Notification Call system vendor (Hillrom) for devices, equipment, monitors, etc. (from wall side out). Staff Assist Notification Call system to be coordinated with Medical Group Strategic Planner and Operations Officer. A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.  *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes; see CFCI	Yes; see CFCI	
Supply Area Panels	Owner / Owner	Contractor to provide proper backing, coordinate with Owner.			Yes
Systems Furniture (including demountable partitions)	Owner / Owner (Midwest & Steelcase)	Coordinate modesty panels with elec. outlets. Sit/Stand desks to have modesty panel on front. Attention to be given to cord management. A/E to coordinate data and power with Midwest.	Yes	Yes	
Televisions, Digital Projectors, similar devices, etc.	Owner / Owner	These items to be provided by Owner, but A/E to coordinate locations and infrastructure. Contractor to refer to OFCI section.	Yes	Yes	Yes
<b>OFCI - (Owner Furnished / Contractor Installed) (Coordinate location of items with Owner and track within construction schedule)</b>					
Alertus - Mass Notification System (Public Areas)	Owner (Alertus) / Contractor	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	Backing
Apron Hooks/Rack (Heavy Duty in Radiology)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Automated External Defibrillator (AED)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner, A/E to coordinate recess, semi-recessed, or surface mount options with Owner.			Yes
Bio Safety Cabinet	Owner / Contractor	A/E to locate equipment on drawings and coordinate all connections. Contractor to track on construction schedule and coordinate final connections when equipment has been installed.		Yes	
Boom and Injector Ceiling Mounting Plates (Equipment, Lighting, Anesthesia, Injection, etc.)	Owner / Contractor	A/E to coordinate with Owner and Owner's selected equipment Vendor; A/E to identify boom locations on drawings, coordinate with Owner; A/E to coordinate the design of the boom support structure into drawings. Final site specific equipment drawings from Vendor to be coordinated with Construction Documents. Contractor to coordinate with Owner and install boom support structure and boom mounting plates. Contractor to coordinate with Owner for ordering and install of boom mounting plates.	Yes	Yes	Yes
Building Alarms / Medication Refrigerator Alarm / Pharmacy Alarm System	Owner / Contractor	A/E to identify locations and infrastructure on drawings, coordinate with Owner. Contractor to provide conduit and infrastructure into accessible ceiling for access from equipment and/or devices. Local Facility to contract with alarm company for alarm, wire, and monitoring.		Yes	
Chain Hoist Industrial Lift	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Clinical Clocks	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.		Yes	Yes
Clinical Storage Cabinet (Flammable Items)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Cubicle Curtains & Tracks	Owner (Medline) / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.			
Diagnostic Board including Wall Mount Replacable Tips (Otoscope / Ophthalmoscope)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes
Diaper Changing Station	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Digital Projector Mounts, TV Mounts, & Computer Mounts (Ergotron Brackets/Mounts, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination. In-ceiling & wall mounts, conduits and boxes provide and installed by Contractor A/E to coordinate A/V requirements. Contractor to pull required A/V cabling.	Yes	Yes	Yes
Distributed Antenna System (DAS) including Public Safety	Owner (DAS vendor selected and managed by Intermountain CTIS/Telecom) / Contractor	A/E to locate infrastructure on drawings to simplify the DAS install. Contractor to track on construction schedule and coordinate DAS install with Owner's Vendor.			
Exercise Rack Wall Rack	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Face Mask Dispenser (Wall Mount)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Grossing Workstation	Owner / Contractor	A/E to locate equipment on drawings and coordinate all connections. Contractor to track on construction schedule and coordinate final connections when equipment has been installed.	Yes	Yes	Yes
Hand Sanitizer Dispensers (Avagard)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			

Hoods (Chemical Soak Station, Ranges, Horizontal Laminar Flow, and similar Hoods)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	Yes	
Ice Machine Dispenser (Undercounter, Countertop, etc.)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes		
iCentra Tracking Boards	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes	Yes	
IV Track	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Backing to be coordinated, if required.			Yes	
Kitchen Range (Electric)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes		
Laundry Dryer, Washer (single, stacked, disinfectant)	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes		
Medication Return Bin	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. This is a pass-thru unit for medication return accessed from public corridor into a secured locked room.			Yes	
OR Clocks	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.	Yes	Yes	Yes	
Paper Towel Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.				
Pass-thru Cleanroom Chamber	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner. Perimeter of each pass-thru unit must be sealed to maintain space pressurization.		Yes	Yes	
Patient Lifts	Owner (Liko, subsidiary of Hillrom) / Contractor	A/E to identify locations on drawings, coordinate with Owner. A/E to design required support structure for Contractor to install for necessary Liko patient lift connections (e.g. pendant / rails / etc). Contractor to coordinate shop drawings and installation requirements prior with Liko. Connect to equipment branch if provided.		Yes		
Personal Protection Dispensers (gloves, gowns, masks, shoe covers, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Pharmaceutical Pass-thru Refrigerator	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner. Perimeter of each pass-thru unit must be sealed to maintain space pressurization.		Yes		
Pharmacy Dispensing Water Treatment System	Owner / Contractor	A/E to identify locations on drawings, including infrastructure requirements, coordinate with Owner.		Yes	Yes	
Procedure Lights	Owner / Contractor	A/E to coordinate with Owner and Owner's selected equipment Vendor; A/E to identify locations on drawings, coordinate with Owner; A/E to coordinate the design of the procedure light support structure into drawings. Contractor to provide and install procedure light support structure.		Yes	Yes	
Radiation Protection Calculations and Certification	Owner / Contractor	A/E to coordinate with Owner in the design phase for coordinating with Medical Physicists Consultants or others, when required. Contractor to coordinate prior to Gyp. Bd. install.			Yes	
Sanitary Napkin Dispensers/Receptacles	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.				
Scrub Brush Dispenser (Wall Mount)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Scrub Sinks & Carriers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and for install coordination.			Yes	
Shower Curtains & Rods	Owner (Medline) / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to coordinate with Owner for ordering and install coordination.				
Soap Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.				
Stadiometers, Recessed Scales	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner; coordinate power and floor recesses.		Yes		
Time Clocks	Owner / Contractor	Conduit and boxes by Contractor, Coordinate location with Owner.	Yes	Yes		
Tissue Dispenser (Wall Mount)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Toilet Paper Dispensers	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.				
Undercounter Dishwasher	Owner / Contractor	A/E to locate equipment on drawings and coordinate all connections. Contractor to track on construction schedule and coordinate final connections when equipment has been installed.		Yes		
UPS (MRI, Data Room, CPU, or other similar equipment)	Owner / Contractor	A/E to identify equipment locations on drawings, coordinate with Owner.	Yes	Yes	Yes	
Wall Mount Basket for Cuff	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount Bracket for Clinical Monitor (sizes vary)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes	
Wall Mount Bracket for Disinfectant Wipes	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount Bracket for Emesis Bags	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount Bracket for Eyewear/Eyeshield Dispenser	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount Bracket for Patient Transfer Device, Patient Evacuation Device (Med Sled)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount Bracket for Suction Canister	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount for Area Radiation Monitor	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes	
Wall Mount for Mops, Brooms, etc.	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount for Phlebotomy Station (Infant)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mount Hair Dryer	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes	Yes	
Wall Mounted Chemical Spill Kit	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mounted Modular Storage Shelving	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mounted Shelving	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Wall Mounted Thermometer (Temporal Artery, Digital, etc.)	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
Zip Line Exerciser Kit	Owner / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes	
<b>CFCI - (Contractor Furnished / Contractor Installed)</b>			<b>(Coordinate location of items with A/E Design Team and track within construction schedule)</b>	<b>Data</b>	<b>Power</b>	<b>Backing</b>
Access Control, Card Readers (Lenel)	Contractor / Contractor (AlphaCorp/Convergint)	A/E to identify locations on drawings, coordinate with Owner.	Yes	Yes		
Audio/Video (A/V)	Contractor / Contractor	Intermountain SCO will source & supply the A/V system including specialized cabling (e.g. HDMI, etc). A/E to identify locations on drawings, coordinate with Owner. Contractor to provide infrastructure, back boxes, conduits, pathways and misc. cabling (from wall side back).	Yes	Yes		
Blinds/Shades (manual and powered)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.		Yes		
Coat Hooks (Rest rooms>Showers, Exam rooms, Offices/Workstations only)	Contractor / Contractor	A/E to identify locations on drawings.			Yes	
Communication Boards (e.g. Patient Rooms)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. If boards are electronic, then data and power should also be provided.			Yes	
Communication Cabling	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. See Intermountain Design Guidelines and Construction Standards for additional information.				
Emergency Phones, Kiosks - Exterior	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Conduit and boxes by Contractor.	Yes	Yes	Yes	
Emergency Shower Station / Eye Wash Station	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. These shall meet ANSI and Owner requirements.			Yes	
Fire Extinguishers	Contractor / Contractor	A/E to identify types and locations on drawings, coordinate with Owner. 10 lbs. minimum - refer to Intermountain Design Guidelines & Construction Standards.			Yes	
Grab Bars (Rest rooms, Radiology, Exam rooms, etc.)	Contractor / Contractor	A/E to identify locations on drawings.			Yes	
Intrusion Detection	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.				
Med Gas Certification	Contractor / Contractor	Contractor to coordinate Vendor with Owner				

Mirrors (Rest rooms, Exams, Radiology, Rehab, etc.)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			Yes
Nurse Notification Call (NNC) System - Low Voltage Cabling (Hospital Campus)*	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all NNC infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.  *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes	Yes	
Patient Monitoring System & Devices (Hospital Campus)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Contractor to provide all infrastructure including conduits, back boxes, and home-run cabling from Patient Monitoring devices to TEC/TDR rooms that connect to Intermountain's network (Intermountain Siemon certified installer low voltage subcontractor to install). The Patient Monitoring system device to device cabling is by Vendor.	Yes	Yes	Yes
Plumbing Shrouds	Contractor / Contractor				
Pneumatic Tube Systems	Contractor / Contractor (SwissLog, Atreo Group, or other approved)	A/E to identify locations on drawings, coordinate with Owner. If SwissLog, verify pricing is per Intalere (Amerinet) Contract Agreement. Design assistance fees are included in this agreement.	Yes	Yes	
Radiation Protection (Lead) Installation - (ex. Cath Lab, CT Scanner, X-Ray)	Contractor / Contractor	A/E to identify locations on drawings and coordinate with Owner's Vendor on the required shielding thicknesses.			Yes
Radiofrequency/Magnetic (RF) Shielding Installation - MRI	Contractor / Contractor	A/E to coordinate with Owner in the design phase and coordinate appropriate shielding.			Yes
Security Cameras, Video Surveillance	Contractor / Contractor (AlphaCorp/Convergint)	A/E to identify locations on drawings, coordinate with Owner.	Yes		
Staff Assist Notification Call System - Low Voltage Cabling (Medical Group Clinics on hospital campuses to match NNC system)*	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all NNC and Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the NNC and Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.  *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes	Yes	
Staff Assist Notification Call System - Low Voltage Cabling (Stand-alone Medical Group Clinics)*	Contractor / Contractor (Hillrom)	A/E to coordinate with Owner and Hillrom for all Staff Assist Notification Call system infrastructure required to support the device locations and types designated by Hillrom on their site specific drawings. Hillrom site specific drawings to be coordinated and included in the A/E Contract Documents. Contractor to provide all infrastructure including conduits, back boxes, cabling (e.g. home-runs to RCB, RCB to device, device to device, etc.), etc. for all Staff Assist Notification Call devices (e.g. RCB, GSR-10, etc.). The cabling for the Staff Assist Notification Call system will be coordinated and installed by the Contractor/Subcontractor (i.e. low voltage sub). Contractor to coordinate with Hillrom.  *Where an existing non-Intermountain standard NNC system exists (e.g., Rauland), Clinical Engineering must be engaged to determine if this existing system will continue or be replaced with the Intermountain standard NNC system. Please also coordinate with CTIS and Facility Equipment Planners. When an existing NNC system is determined to continue, this NNC system will fall under the CFCI section, where the A/E will design the system and the Contractor will provide/furnish and install the system.	Yes	Yes	
Support Bracing/Structure for Radiology and similar equipment	Contractor / Contractor	A/E to coordinate with Owner and Owner's selected Radiology equipment Vendor; A/E to coordinate the design of the support bracing/structure into drawings. Final site specific equipment drawings from Vendor to be coordinated with Construction Documents. Contractor to coordinate with Owner for install of support structure.	Yes	Yes	Yes
TV System Distribution	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner.			
Voice/Data Cabling (all horizontal cabling)	Contractor / Contractor (Cache Valley Elec., IES Commercial, Data Tech Professionals, Hunt Electric, and others listed in Intermountain Div. 27)	Refer to Division 27 in the Intermountain Design Guidelines and Construction Standards. Coordinate with Owner/User on connections, pairs of fiber/copper, conduits, inner-ducts, etc.	Yes		
Wall Protection (Incl. Bumper and Corner Guards)	Contractor / Contractor	A/E to identify locations on drawings, coordinate with Owner. Backing should be included where heavy use/damage may occur.			

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## TAX EXEMPTION CERTIFICATE

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Construction materials purchased by or on behalf of **Intermountain Healthcare** *may be* exempt from Utah sales and use taxes. Tax Exempt **Form TC-721** must be used by vendors when purchasing construction materials for **Intermountain Healthcare** projects. A copy of Form TC-721, with the Owner's pertinent tax information, follows this cover page.



Utah State Tax Commission • 210 N 1950 W • Salt Lake City, UT 84137

**Exemption Certificate**  
(Sales, Use, Tourism and Motor Vehicle Rental Tax)

**TC-721**  
Rev. 11/18

Name of business or institution claiming exemption (purchaser) IHC Health Services, Inc.		Telephone number 801.442.2000	
Street address 36 South State Street, Suite 2200	City Salt Lake City	State UT	ZIP Code 84111
Authorized signature 	Name (please print) Brian Deppe	Title Corporate Tax Director	
Name of Seller or Supplier:		Date	
Sales Tax License Number: 11990296-013-STC		Required for all exemptions marked with an asterisk (*)	

The signer of this certificate MUST check the box showing the basis for which the exemption is being claimed.

**DO NOT SEND THIS CERTIFICATE TO THE TAX COMMISSION**  
Keep it with your records in case of an audit.

For purchases by government, Native American tribes and public schools, use form TC-721G.

**Resale or Re-lease**

I certify I am a dealer in tangible personal property or services that are for resale or re-lease. If I use or consume any tangible personal property or services I purchase tax free for resale, or if my sales are of food, beverages, dairy products and similar confections dispensed from vending machines (see Rule R865-19S-74), I will report and pay sales tax directly to the Tax Commission on my next sales and use tax return.

**Religious or Charitable Institution**

I certify the tangible personal property or services purchased will be used or consumed for essential religious or charitable purposes. **This exemption can only be used on purchases totaling \$1,000 or more, unless the sale is pursuant to a contract between the seller and purchaser.**

**Construction Materials Purchased for Religious and Charitable Organizations**

I certify the construction materials are purchased on behalf of a religious or charitable organization and that they will be installed or converted into real property owned by the religious or charitable organization.  
Name of religious or charitable organization: \_\_\_\_\_

Name of project: \_\_\_\_\_

**Fuels, Gas, Electricity**

I certify all natural gas, electricity, coal, coke, and other fuel purchased will be used for industrial use only and not for residential or commercial purposes.

**Machinery and Equipment and Normal Operating Repair or Replacement Parts Used in a Manufacturing Facility, Mining Activity, Web Search Portal or Medical Laboratory**

I certify the machinery and equipment, normal operating repair or replacement parts, or materials (except office equipment or office supplies) are for use in a Utah manufacturing facility described in SIC Codes 2000-3999 or a NAICS code within NAICS Sector 31-33; in a qualifying scrap recycling operation; in a co-generation facility placed in service on or after May 1, 2006; in the operation of a Web search portal by a new or expanding business described in NAICS Code 518112; in a medical laboratory described in NAICS Code 621511; or in a business described in NAICS 212, Mining (except Oil and Gas), or NAICS 213113, Support Activities for Coal Mining, NAICS 213114, Support Activities for Metal Mining, or NAICS 213115, Support Activities for Nonmetallic Minerals (except Fuels) Mining. For a definition of exempt mining equipment, see Utah Code §59-12-104(14).

**Machinery and Equipment and Normal Operating Repair or Replacement Parts Used in an Electronic Payment Service**

I certify the machinery and equipment and normal operating repair or replacement parts have an economic life of three years or more and are for use in the operation of an electronic payment service described in NAICS Code 522320.

**Machinery or Equipment Used by Payers of Admissions or User Fees**

I certify that: (1) the machinery or equipment has an economic life of three or more years and will be used by payers of admissions or user fees (Utah Code §59-12-103(1)(f)); (2) the buyer is in the amusement, gambling or recreation industry (NAICS Subsector 713); and (3) at least 51 percent of the buyer's sales revenue for the previous calendar quarter came from admissions or user fees.

**Refinery Machinery, Equipment and Normal Repair or Replacement Parts**

I certify the machinery, equipment, normal operating repair parts, catalysts, chemicals, reagents, solutions or supplies are for the use of a refiner who owns, leases, controls or supervises a refinery (see Utah Code §63M-4-701) located in Utah.

**Pollution Control Facility**

I certify our company has been granted a "Certification of Pollution Control Facilities" as provided for by Utah Code §§19-12-101 - 19-12-305 by either the Air Quality Board or the Water Quality Board. I further certify each item of tangible personal property purchased under this exemption is qualifying.

**Municipal Energy**

I certify the natural gas or electricity purchased: is for resale; is prohibited from taxation by federal law, the U.S. Constitution, or the Utah Constitution; is for use in compounding or producing taxable energy; is subject to tax under the Motor and Special Fuel Tax Act; is used for a purpose other than as a fuel; is used by an entity exempted by municipal ordinance; or is for use outside a municipality imposing a municipal energy sales and use tax. The normal sales tax exemptions under Utah Code §59-12-104 do not apply to the Municipal Energy Sales and Use Tax.

**Short-term Lodging Consumables**

I certify the tangible personal property is consumable items purchased by a lodging provider as described in Utah Code §59-12-103(1)(i).

**Direct Mail**

I certify I will report and pay the sales tax for direct mail purchases on my next Utah *Sales and Use Tax Return*.

**Commercial Airlines**

I certify the food and beverages purchased are by a commercial airline for in-flight consumption; or, any parts or equipment purchased are for use in aircraft operated by common carriers in interstate or foreign commerce.

**Commercials, Films, Audio and Video Tapes**

I certify that purchases of commercials, films, prerecorded video tapes, prerecorded audio program tapes or records are for sale or distribution to motion picture exhibitors, or commercial television or radio broadcasters. If I subsequently resell items to any other customer, or use or consume any of these items, I will report any tax liability directly to the Tax Commission.

**Alternative Energy**

I certify the tangible personal property meets the requirements of Utah Code §59-12-104 and is leased or purchased by or for an alternative energy electricity production facility, a waste energy production facility, or a facility that produces fuel from alternative energy.

**Locomotive Fuel**

I certify this fuel will be used by a railroad in a locomotive engine.

**Research and Development of Alternative Energy Technology**

I certify the tangible personal property purchased will be used in research and development of alternative energy technology.

**Life Science Research and Development Facility**

I certify that: (1) the machinery, equipment and normal operating repair or replacement parts purchased have an economic life of three or more years for use in performing qualified research in Utah; or (2) construction materials purchased are for use in the construction of a new or expanding life science research and development facility in Utah.

**Mailing Lists**

I certify the printed mailing lists or electronic databases are used to send printed material that is delivered by U.S. mail or other delivery service to a mass audience where the cost of the printed material is not billed directly to the recipients.

**Semiconductor Fabricating, Processing or Research and Development Material**

I certify the fabricating, processing, or research and development materials purchased are for use in research or development, manufacturing, or fabricating of semiconductors.

**Telecommunications Equipment, Machinery or Software**

I certify these purchases or leases of equipment, machinery, or software, by or on behalf of a telephone service provider, have a useful economic life of one or more years and will be used to enable or facilitate telecommunications; to provide 911 service; to maintain or repair telecommunications equipment; to switch or route telecommunications service; or for sending, receiving, or transporting telecommunications service.

**Ski Resort**

I certify the snow-making equipment, ski slope grooming equipment or passenger rope-ways purchased are to be paid directly with funds from the ski resort noted on the front of this form.

**Aircraft Maintenance, Repair and Overhaul Provider**

I certify these sales are to or by an aircraft maintenance, repair and overhaul provider for the use in the maintenance, repair, overhaul or refurbishment in Utah of a fixed-wing, turbine-powered aircraft that is registered or licensed in a state or country outside Utah.

**Leasebacks**

I certify the tangible personal property leased satisfies the following conditions: (1) the property is part of a sale-leaseback transaction; (2) sales or use tax was paid on the initial purchase of the property; and, (3) the leased property will be capitalized and the lease payments will be accounted for as payments made under a financing arrangement.

**Film, Television, Radio**

I certify that purchases, leases or rentals of machinery or equipment will be used by a motion picture or video production company for the production of media for commercial distribution.

**Prosthetic Devices**

I certify the prosthetic device(s) is prescribed by a licensed physician for human use to replace a missing body part, to prevent or correct a physical deformity, or support a weak body part. This is also exempt if purchased by a hospital or medical facility. (Sales of corrective eyeglasses and contact lenses are taxable.)

**Out-of-State Construction Materials**

I certify this tangible personal property, of which I am taking possession in Utah, will be taken out-of-state and will become part of real property located in a state that does not have sales tax, is taxed at a lower rate, or does not allow credit for tax paid to Utah. I will report the tax on my next Utah return at the lower of the Utah rate where the tangible personal property was purchased or the rate of the location where the tangible personal property is converted to real property in the other state if the other state allows a credit for tax paid to Utah.

**Agricultural Producer**

I certify the items purchased will be used primarily and directly in a commercial farming operation and qualify for the Utah sales and use tax exemption. **This exemption does not apply to vehicles required to be registered.**

**Tourism/Motor Vehicle Rental**

I certify the motor vehicle being leased or rented will be temporarily used to replace a motor vehicle that is being repaired pursuant to a repair or an insurance agreement; the lease will exceed 30 days; the motor vehicle being leased or rented is registered for a gross laden weight of 12,001 pounds or more; or, the motor vehicle is being rented or leased as a personal household goods moving van. This exemption applies only to the tourism tax (up to 7 percent) and the short-term motor vehicle rental tax (Transportation Corridor Funding – 2.5 percent) – not to the state, local, transit, zoo, hospital, highways, county option or resort sales tax.

**Textbooks for Higher Education**

I certify that textbooks purchased are required for a higher education course, for which I am enrolled at an institution of higher education, and qualify for this exemption. An institution of higher education means: the University of Utah, Utah State University, Utah State University Eastern, Weber State University, Southern Utah University, Snow College, Dixie State University, Utah Valley University, Salt Lake Community College, or the Utah System of Technical Colleges.

\* Purchaser must provide sales tax license number in the header on page 1.

**NOTE TO PURCHASER:** You must notify the seller of cancellation, modification, or limitation of the exemption you have claimed.

Questions? Email [taxmaster@utah.gov](mailto:taxmaster@utah.gov), or call 801-297-2200 or 1-800-662-4335.

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**BID FORM**

**TO:** **IHC Health Services, Inc.** (Intermountain Healthcare)  
Facility Design and Construction (FD&C)  
36 South State Street, 16th Floor  
Salt Lake City, Utah 84111-1486

**Attention:** AnnaLisa Silcox  
Email: AnnaLisa.silcox@imail.org

**PROJECT:** **Intermountain Primary Children's- Operating Room 17**  
100 North Mario Capecchi Dr.  
Salt Lake City, UT 84113

**NAME OF BIDDER:** \_\_\_\_\_

**BIDDER ADDRESS:** \_\_\_\_\_

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

The undersigned, in compliance with your Invitation To Bid, having examined the Drawings and Specifications (Contract Documents) and related documents and the site of the proposed work and being familiar with all of the conditions surrounding the construction of the proposed project, including the availability of labor, hereby propose to furnish all labor, materials, services, equipment and appliances required in connection with or incidental to the construction of the above named project in strict conformance with the following specification and drawings:

Instructions to Bidders, General Conditions, Supplemental General Conditions, Specification Divisions as shown, and all applicable addenda and Drawings as listed on the drawing cover sheets as prepared by NJRA Architects.

I/We certify, by signing this BID FORM, that I/We have a working relationship with the proposed subcontractors and that Bids we're not solicited from; and/or the received Contract Documents were not listed in any Plan Rooms for distribution to subcontractors broadly.

**BASE BID – for the Intermountain Primary Children's – Hybrid Operating Room**

For Work of the contract listed above and shown on the Drawings and described in the Project Manual, I/We agree to perform for the sum of:

\_\_\_\_\_ Dollars (\$ \_\_\_\_\_ )

(In the case of discrepancy, written amount shall govern)

**CONTRACTOR'S PROPOSED CONSTRUCTION TIME PERIOD:**

This Bid requires a construction time in **calendar days** from the date of authorization of \_\_\_\_\_ calendar days. The anticipated date of Substantial Completion is thus \_\_\_\_\_, 20\_\_.

The above Bid includes \_\_\_\_\_ winter weather delay days.

**ADDENDA:**

I/We acknowledge receipt of the following addenda for the above noted project:

Addendum # \_\_\_\_/ \_\_\_\_/ \_\_\_\_/ \_\_\_\_

**SCHEDULE OF VALUES:**

I/We have attached with this Bid Form our Schedule of Values (Section 01 43 73) which reflects the above Base Bid. We submit this for Owner review of subcontractors that are being proposed for this Project.

**TYPE OF ORGANIZATION:**

(Corporation, Partnership, Individual, etc.) \_\_\_\_\_

SEAL (If a Corporation)

Respectfully Submitted,

\_\_\_\_\_  
Name of Bidder

\_\_\_\_\_

\_\_\_\_\_  
Authorized Signature

## GENERAL CONDITIONS

1. General Provisions
2. Intermountain
3. A/E
4. Contractor
5. Subcontractors
6. Protection of Persons and Property
7. Modifications, Request for Information, Proposed Change Orders, and Claims Process
8. Payments and Completion
9. Tests and Inspections, Substantial and Final Completion, Uncovering, Correction of Work, and Guaranty Period
10. Insurance and Bonds
11. Miscellaneous Provisions
12. Termination or Suspension of the Contract

### 1. GENERAL PROVISIONS.

#### 1.1 Basic Definitions.

**“Adverse Weather”**: Weather conditions that are seasonably abnormal and could not reasonably have been anticipated.

**“A/E”**: Generally, the licensed architect (or architecture firm) or engineer (or engineering firm) for the Project. For Contracts where the design professional is an interior designer, landscape subconsultant or other design professional, “A/E” will be deemed to refer to that design professional. If the type of design professional is not subject to professional licensure requirements, the professional must meet the prevailing standards in the State in which the Project is located for the applicable practice. When Intermountain elects not to engage an A/E for a Project, Intermountain will be considered the A/E for the Project.

**“A/E’s Agreement”**: Unless the context requires otherwise, the agreement executed by A/E and Intermountain for the Project.

**“Addenda”**: Written or graphic instruments issued before the opening of Bids, which clarify, correct or change the bidding documents or the Contract Documents.

**“ASI”**: A Supplemental Instruction issued by A/E to Contractor, which may result in clarifications or minor changes in the Work, but which does not affect the Contract Time or the Contract Sum.

**“Bid”**: The offer of the bidder submitted on the prescribed form setting forth the proposed stipulated sum for the Work to be performed.

**“Bonds”**: The bid bond, payment and performance bonds, and other instruments of security.

**“Change Order”**: A written instrument signed by Intermountain and Contractor, stating their agreement for changes to the Contract as specified on the required Intermountain change order form.

**“Claim”**: A dispute, demand, assertion or other matter arising in connection with the Contract or the Project submitted by Contractor or a Subcontractor at any tier in accordance with these General Conditions. A requested amendment, requested Change Order, or a Construction Change Directive (CCD) is not a Claim unless agreement cannot be reached in accordance with the procedures in these General Conditions.

**“Construction Change Directive” or “CCD”**: A written order signed by Intermountain, directing a change in the Work, and stating a proposed basis for adjustment, if any, in the Contract Sum or Contract Time, or both. Intermountain 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; even if it may impact the Contract Sum and Contract Time.

**“Contract”**: The Contract Documents form the Contract for Construction.

**“Contract Documents”**: The documents identified as such in the Contractor’s Agreement.

**“Contract Sum”**: The amount stated in the Contractor’s Agreement payable by Intermountain to Contractor for performance of the Work under the Contract Documents.

**“Contract Time”**: The Contract Time means the period of time for Contractor’s Substantial Completion of the Work to be established as set forth in the Contractor’s Agreement.

**“Contractor”**: The person or entity identified as the “Contractor” in the Contractor’s Agreement.

**“Contractor’s Agreement”**: The “Contractor’s Agreement” means the Construction Manager/General Contractor Agreement or the General Contractor Agreement for a Stipulated Sum, as applicable, executed by Contractor and Intermountain for the Project.

**“Contractor’s Direct Costs”**: Actual costs incurred by the Contractor for labor, materials, equipment, insurance, bonds, Subcontractors and on-site supervision. They do not include labor costs for project managers or other off-site administration.

**“Day” or “Days”**: Calendar day unless otherwise specified.

**“Defective”**: Work that does not conform to the Contract Documents or does not meet the requirements of any inspection, referenced standard, code, test or approval referred to in the Contract Documents or by applicable law, or has been damaged.

**“Director”**: Intermountain’s Executive Director of Design & Construction unless the context requires otherwise. Director may include a designee selected by the Director for a specific function.

**“Drawings”**: The construction drawings identified in the Contractor’s Agreement.

**“Intermountain”**: IHC Health Services, Inc., operating through its Department of Facility Design and Construction. Unless the context requires otherwise, Intermountain is the “Owner” as that term is commonly referred to in the construction industry.

**“Intermountain Representative” or “Owner’s Representative”**: The person identified as such in the Contract Documents.

**“Inspection” (or any derivative)**: A review of the Project, including but not limited to a visual review of the Work to ascertain if the Work is in accordance with the Contract Documents, including all applicable building codes and construction standards.

**“Invitation to Bid”**: Intermountain’s solicitation or request to a contractor to provide a Bid.

**“Modification”**: (1) Change Order, (2) Construction Change Directive, or (3) ASI.

**“Notice to Proceed”**: A document prepared by Intermountain authorizing Contractor to commence Work on the Project. It is deemed issued upon delivery to Contractor or upon being sent by Intermountain to the address for Contractor’s specified in the Bid or Proposal.

**“Partial Use”**: Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work. Partial Use does not constitute “substantial completion.”

**“Product Data”**: Illustrations, standard schedules, performance charts, instructions, brochures, diagrams and other information furnished by Contractor to illustrate materials or equipment for some portion of the Work.

**“Project”**: Generally identified and defined in the Contractor’s Agreement and Contract Documents. It includes all of the Work to be performed under the Contract Documents.

**“Project Manual” (for construction)**: The volume of assembled Specifications for the Work, which may include the bidding/proposal requirements, sample forms, and General or Supplementary Conditions of the Contract.

**“Proposal”**: A/E’s or Contractor’s response to Intermountain’s Request for Proposal.

**“Proposal Request”** or **“PR”**: A written request submitted to Contractor for a proposal to resolve an issue as part of the Change Order or Contract Modification process.

**“Proposed Change Order”** or **“PCO”**: An informal request by Contractor to Intermountain Representative to commence the Contract Modification Process. It will not be considered a “Claim.” The PCO may be related to any potential or actual delay, disruption, unforeseen condition or materials or any other matter for which Contractor intends to seek additional monies or time.

**“Record Drawings”**: Record drawings, compiled by the A/E based upon redline “as-built” construction drawings and/or other information provided by Contractor, for each completed phase or portion of the Project for which a certificate of occupancy is issued, or for the final, completed Project (as applicable), in both AutoCAD (.dwg) and REVIT (.rvt) format (or other format as reasonable requested by Intermountain).

**“Request for Information”** or **“RFI”**: A request by Contractor to A/E for information, direction or clarification regarding the Contract Documents, plans or specifications.

**“Request for Proposal”** or **“RFP”**: Intermountain’s solicitation for Contractor Proposals.

**“Sales Tax”** and/or **“Use Tax”**: Unless the context requires otherwise, the sales tax or use tax collected or to be collected by any Federal or State Tax Commission as well as by any special district, local government or political subdivision.

**“Samples”**: Physical examples, which illustrate materials, equipment or workmanship and establish standards by which the Work will be judged.

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

**“Specifications”**: The portion of the Contract Documents consisting of the written requirements for materials, equipment, construction systems, standards, installation and workmanship for the Work, and for performance of related systems and services.

**“Subcontractor”**: Any person or entity that has a direct contract with Contractor, including any trade contractor or specialty contractor, and/or with any other Subcontractor at any tier to provide labor or materials for the Work.

**“Subcontractor’s Direct Costs”**: Actual costs incurred by a Subcontractor for labor, materials, equipment, insurance, bonds, lower-tier Subcontractors and supervision.

**“Substantial Completion”**: Completion of the Work or designated portion thereof in accordance with the Contract Documents to a point sufficient to allow Intermountain to occupy and use the Work for its intended purposes, including without limitation all systems shall be fully functional and operate as designed, and the A/E’s certification that Contractor has achieved Substantial Completion of the Work. The date of Substantial Completion is the date certified as such by the A/E in accordance with the Contract Documents.

**“Work”**: All labor, materials, tools, equipment, construction and services required by the Contract Documents.

## **1.2 Correlation and Intent of Contract Documents.**

- 1.2.1 The intent of the Contract Documents is to require Contractor to provide all labor, materials, equipment, construction, and services necessary for the proper execution and completion of the Work. The Contract Documents are complementary and what is required by any one will be as binding as if required by all. Contractor will perform the Work in accordance with the requirements expressly set forth in or reasonably inferable from the Contract Documents.

- 1.2.2 The organization of the Contract Documents is not intended to control Contractor in dividing the Work among Subcontractors or to establish the extent of the Work to be performed by any trade.
- 1.2.3 Words used in the Contract Documents that have well known technical or trade meanings are used therein in accordance with such recognized meanings.
- 1.2.4 In the interest of brevity, the Contract Documents may omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

**1.3 Ownership and Use of Contract Documents.** The Drawings, the Project Manual, and copies thereof are the property of Intermountain. Contractor will not use these documents on any other project. Contractor may retain one copy of the Drawings and the Project Manual as a contract record set and will return or destroy all remaining copies following final completion of the Work.

**1.4 Public Statements Regarding Project.** Contractor will not make any statements or provide any information to the media about the Project without the prior written consent of Intermountain. If Contractor receives any requests for information from media, Contractor will refer such requests to Intermountain.

**1.5 Ownership and Use of Renderings and Photographs.** Renderings representing the Work are the property of Intermountain. All photographs of the Work, whether taken during performance of the Work or at completion, are the property of Intermountain. Intermountain reserves all rights including copyrights to renderings and photographs of the Work. No renderings or photographs will be used or distributed without written consent of Intermountain.

**1.6 Confidentiality / Property Rights.**

- 1.6.1 All Drawings, Specifications and other documents prepared by A/E are and will remain the property of Intermountain, and Intermountain will retain all common law, statutory and other reserved rights with respect thereto. These documents were prepared and are intended for use as an integrated set for the Project which is the subject of the Contractor's Agreement and constitute works made for hire. Contractor will not modify or use Contract Documents on any other project without the prior written consent of Intermountain. Intermountain may withhold its consent in its absolute discretion. Any non-permissive use or modification, by Contractor, Contractor's Subcontractors at any tier or anyone for whose acts Contractor is liable, will be at Contractor's sole risk. Contractor will hold harmless and indemnify Intermountain from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by Contractor. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by A/E or Intermountain appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license will bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by A/E or Intermountain. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of Intermountain's copyright or other reserved rights.
- 1.6.2 In addition, Contractor will ensure that Contractor, Subcontractors, and the employees, agents and representatives of Contractor and its Subcontractors maintain in strict confidence, and will use and disclose only as authorized by Intermountain all Confidential Information of Intermountain that Contractor receives in connection with the performance of the Contract. Notwithstanding the foregoing, Contractor may use and disclose any information to the extent required by an order of any court or authority having jurisdiction, but only after it has notified Intermountain and Intermountain has had an opportunity to obtain reasonable protection for such information in connection with such disclosure. For purposes of the Contract, "Confidential Information" means:
- 1.6.3 The name or address of any affiliate, customer or contractor of Intermountain or any information concerning the transactions of any such person with Intermountain;

- 1.6.4 Any information relating to contracts, agreements, business plans, budgets or other financial information of Intermountain to the extent such information has not been made available to the public by Intermountain; and
- 1.6.5 Any other information that is marked or noted as confidential by Intermountain at the time of its disclosure.

**1.7 Comply with Intellectual Property Rights of Others.** Contractor represents and warrants that no Work (with its means, methods, goods, and services attendant thereto), provided to Intermountain will infringe or violate any right of any third party and that Intermountain may use and exploit such Work, means, methods, goods, and services without liability or obligation to any person or entity (specifically and without limitation, such Work, means, methods, goods, and services will not violate rights under any patent, copyright, trademark, or other intellectual property right or application for the same).

## **2. INTERMOUNTAIN.**

### **2.1 Information and Services Required of Intermountain.**

- 2.1.1 Intermountain Representative. Intermountain will designate an Intermountain Representative authorized to act in Intermountain's behalf with respect to the Project. Intermountain or such authorized representative will furnish to Contractor information or services Intermountain is required to furnish under the Contract Documents within a reasonable time in order to avoid a delay in the orderly and sequential progress of the Work.
- 2.1.2 Specialists and Inspectors. Intermountain reserves the right (but without obligation to provide building inspection services. This may include 'routine' and 'special' inspections. Intermountain may assign an inspector or specialist to note deviations from, or necessary adjustments to, the Contract Documents or to report deficiencies or defects in the Work. The inspector or specialist's activities in no way relieve Contractor of the responsibilities set forth in the Contract Documents.
- 2.1.3 Inspections. Intermountain and its representatives will have the right to inspect any portion of the Work wherever located at any time; provided that in no event will Intermountain be deemed to have assumed any obligation or liability whatsoever as a result of any such observation.
- 2.1.4 Surveys and Legal Description. Intermountain will furnish surveys describing the property lines and benchmarks for grading. Contractor will review this information, including the surveys and any provided geotechnical studies, and compare such information with observable physical conditions and the Contract Documents.
- 2.1.5 Prompt Information and Services. Upon receipt of a written request from Contractor, Intermountain will furnish information or services under Intermountain's control with reasonable promptness to avoid delay in the orderly progress of the Work.
- 2.1.6 Copies of Drawings and Project Manuals (for Construction). Unless otherwise provided in the Contract Documents, Contractor will be furnished electronic copies of Drawings and Project Manuals for Contractor's use in connection with the execution of the Work for the Project. Contractor will be responsible for making any further needed copies of the Construction Documents, subject to the copyright requirements.

### **2.2 Construction by Intermountain or By Separate Contractors.**

- 2.2.1 Intermountain's Right to Perform Construction and to Award Separate Contracts.
  - a. *In General.* Intermountain reserves the right to perform construction or operations related to the Project with Intermountain's own forces, and to award separate contracts related to the Project or other construction or operations on the site.
  - b. *Coordination and Revisions.* Intermountain will provide for coordination of the activities of Intermountain's own forces and of each separate contractor with the Work of Contractor, who will cooperate with them. Contractor will promptly notify in writing if any such independent

action will in any way compromise Contractor's ability to meet Contractor's responsibilities under the Contract. Contractor will participate with other separate contractors and Intermountain in reviewing their construction schedules when directed to do so. Contractor will make any revisions to the construction schedule and Contract Sum deemed necessary after a joint review and agreement by Intermountain. The construction schedules will then constitute the schedules to be used by Contractor, separate contractors and Intermountain until subsequently revised.

#### 2.2.2 Mutual Responsibility.

- a. *Contractor Coordination.* Contractor will afford Intermountain and separate contractor(s) a reasonable opportunity for delivery and storage of their materials and equipment and performance of their activities and will connect and coordinate Contractor's construction and operations with theirs where applicable.
- b. *Reporting Problems to Intermountain.* If part of Contractor's Work depends on work by Intermountain or a separate contractor, Contractor will, before proceeding with that portion of the Work, inspect and promptly report in writing to Intermountain apparent discrepancies or defects in workmanship that would render it unsuitable for proper execution, performance, or results. Failure of Contractor to so inspect and make this report will constitute an acceptance and acknowledgment that Intermountain's or separate contractors completed or partially completed construction is fit and proper to receive Contractor's Work, except as to defects in workmanship not then reasonably discoverable.
- c. *Costs.* Costs caused by delays or by improperly timed activities or Defective construction will be borne by the responsible party in accordance with the procedures and provisions of the Contract Documents.
- d. *Contractor Remedial Work.* Contractor will promptly remedy damage caused by Contractor or any Subcontractor to completed or partially completed work of Intermountain or of separate contractors or to the property of Intermountain or separate contractors and subcontractors.
- e. *Intermountain's Right to Clean Up.* If a dispute arises among Contractor and separate contractors as to the responsibility under their separate contracts for maintaining the Project free from waste materials and rubbish, Intermountain may clean the Project, allocate the cost among those responsible as Intermountain and A/E determine to be just, and withhold such cost from any amounts due or to become due to Contractor.

### 3. A/E.

#### 3.1 A/E's Administration of the Contract.

- 3.1.1 In General. A/E assists Intermountain with the administration of the Contract as described in the Contract Documents.
- 3.1.2 Site Visits. Site visits or inspections by A/E, Intermountain or any Intermountain representative will in no way limit or affect Contractor's responsibility to comply with all the requirements and the overall design concept of the Contract Documents as well as all applicable laws, statutes, ordinances, resolutions, codes, rules, regulations, orders and decrees. A/E will promptly submit to Intermountain a written report subsequent to each site visit.
- 3.1.3 Communications Facilitating Contract Administration. Except as authorized by Intermountain or as otherwise provided in the Contract Documents, including these General Conditions, A/E and Contractor will communicate through the Intermountain Representative on issues regarding the timing of the Work, cost of the Work, and scope of the Work. Contractor will comply with communication policies agreed upon at any pre-construction meeting with Intermountain. Communications by and with A/E sub-consultants will be through A/E. Communications by and with



Subcontractors will be through Contractor. Communications by and with separate contractors will be through Intermountain.

3.1.4 A/E May Reject Work, Order Inspection, Tests. A/E will have the authority to reject Work which, based upon A/E's knowledge or what may be reasonably inferred from A/E's site observations and review of data, does not conform to the Contract Documents or is damaged or rendered unsuitable. Whenever A/E considers it necessary or advisable for implementation of the intent of the Contract Documents, A/E will have the authority to require additional inspections or testing of the Work in accordance with the provisions of the Contract Documents, whether or not such Work is fabricated, installed or completed. However, neither this authority of A/E nor a decision made in good faith either to exercise or not to exercise such authority will give rise to a duty or responsibility of A/E to Contractor, Subcontractors, their agents or employees or other persons performing portions of the Work, including separate contractors.

3.1.5 A/E Review Contractor's Submittals.

- a. Contractor will submit shop drawings, product data, and samples and other submittals required by the Contract Documents to A/E as required by the approved submittal schedule.
- b. A/E will review and approve or take other appropriate action upon Contractor's submittals such as Shop Drawings, Product Data and Samples, but only for the purpose of checking for conformance with the information and design concepts expressed in the Contract Documents. A/E action taken on a submittal will not constitute a Modification of the Contract.
- c. A/E's action will be taken no later than fifteen (15) Days following A/E's receipt of the submittal, unless agreed to otherwise by Contractor and Intermountain.
- d. 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 Contractor as required by the Contract Documents.
- e. A/E's review of Contractor's submittals will not relieve Contractor of the obligations under the Contract Documents.
- f. A/E's review will not constitute approval of safety precautions or, unless otherwise specifically stated by A/E, of any construction means, methods, techniques, sequences or procedures.
- g. A/E's approval of a specific item will not indicate approval of an assembly of which the item is a component.
- h. When professional certification of performance characteristics of materials, systems or equipment is required by the Contract Documents, A/E will be entitled to rely upon such certifications to establish that the materials systems or equipment will meet the performance criteria required by the Contract Documents.

**3.2 Ownership and Use of A/E's Drawings, Specifications and Other Documents.** All Drawings, Specifications and other documents prepared by A/E are and will remain the property of Intermountain, and Intermountain will retain all common law, statutory and other reserved rights with respect thereto. These documents were prepared and are intended for use as an integrated set for the Project which is the subject of the Contractor's Agreement and constitute works made for hire. Contractor will not modify or use Contract Documents on any other project without the prior written consent of Intermountain. Intermountain may withhold its consent in its absolute discretion. Any non-permissive use or modification, by Contractor, Contractor's Subcontractors at any tier or anyone for whose acts Contractor is liable, will be at Contractor's sole risk. Contractor will hold harmless and indemnify Intermountain from and against any and all claims, actions, suits, costs, damages, loss, expenses and attorney fees arising out of such non-permissive use or modification by Contractor. Contractor and Subcontractors are granted a limited license to use and reproduce applicable portions of the Drawings, Specifications and other documents prepared by

A/E or Intermountain appropriate to and for use in the execution of their Work under the Contract Documents. All copies made under this license will bear the statutory copyright notice, if any, shown on the Drawings, Specifications and other documents prepared by A/E or Intermountain. Submittals or distributions necessary to meet official regulatory requirements or for other purposes relating to completion of the Project are not to be construed as a publication in derogation of Intermountain's copyright or other reserved rights.

4. **CONTRACTOR.** Contractor's duties include the professional services of a business, administrative and management consultant to Intermountain; including all budget, scheduling, quality, safety and all other services related to assuring compliance with the Contract Documents.

**4.1 Review of Contract Documents and Field Conditions by Contractor.** By executing the Contractor's Agreement, Contractor represents that it has visited the Project site, familiarized itself with the local conditions under which the Work is to be performed, and correlated its own observations with the requirements of the Contract Documents.

4.1.1 Reviewing Contract Documents, Information, Reporting Errors, Inconsistencies or Omissions.

- a. Contractor will carefully study and compare the Contract Documents with each other and with information available relating to the Project or furnished by Intermountain before commencing and during performance of each portion of the Work and will at once report to Intermountain and A/E any errors, inconsistencies or omissions it discovers. If Contractor performs any construction activity without such notice to Intermountain and A/E and before the resolution of the error, inconsistency or omission, Contractor will assume responsibility for such performance and will bear the attributable costs for correction.
- b. Contractor will give Intermountain and/or A/E notice of any additional drawings, specifications, or instructions required to define the Work in greater detail, or to permit the proper progress of the Work, sufficiently in advance of the need for information so as not to delay the Work.
- c. It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with requirements of applicable laws, statutes, ordinances, building codes, rules and regulations. However, if Contractor observes that portions of the Contract Documents are at variance with those requirements, Contractor will immediately notify Intermountain and/or A/E in writing. Contractor will not proceed unless Intermountain and/or A/E effects Modifications to the Contract Documents required for compliance with such requirements. Contractor will be fully responsible for any work knowingly performed contrary to such requirements and will fully indemnify Intermountain against loss and bear all costs and penalties arising therefrom.

4.1.2 Field Conditions.

- a. Contractor will take field measurements and verify field conditions and will carefully compare such field measurements and conditions and other information known to Contractor, or information which a Contractor of ordinary skill and expertise for the type of Work involved would have known, before commencing activities. Errors, inconsistencies or omissions discovered will be reported to Intermountain and A/E at once. If Contractor performs any construction activity without such notice to Intermountain and A/E and before the resolution of the error, inconsistency or omission, Contractor will not be entitled to any compensation for additional costs attributable to correction or otherwise to Contractor resulting from field measurements or conditions different from those anticipated by Contractor which would have been avoided had Contractor taken field measurements and verified field conditions before ordering the materials or commencing construction activities.
- b. If site conditions indicated in the Contract Documents or other information provided by Intermountain or A/E to Contractor differ materially from those Contractor encounters in performance of the Work, Contractor will immediately notify Intermountain and/or A/E in writing of such differing site conditions.

- 4.1.3 Perform in Accordance with Contract Documents and Submittals. Contractor will perform the Work in accordance with the Contract Documents and submittals approved in accordance with the Contract Documents. Should Contractor or any of its Subcontractors become aware of any question regarding the meaning or intent of any part of the Contract Documents before commencing that portion of the Work about which there is a question, Contractor will request an interpretation or clarification from Intermountain and/or A/E before proceeding. Contractor proceeds at its own risk if it proceeds with the Work without first making such a request and receiving an interpretation or clarification from Intermountain and/or A/E.
- 4.1.4 Performance to Produce the Complete System and Intended Results. Performance by Contractor will be required to the extent consistent with the Contract Documents and reasonably inferable from the Contract Documents as being necessary to allow the system to function within its intended use.
- 4.1.5 Intent and Hierarchy. The Contract Documents should be read as a whole and wherever possible, the provisions should be construed in order that all provisions are operable. The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by Contractor. The Contract Documents are complimentary, and what is required by one Document or provisions thereof will be as binding as if required by all the Documents or provisions thereof. In case of an irreconcilable conflict between provisions within a Contract Document or between Contract Documents, the following priorities will govern as listed below:
- a. A particular Modification will govern over all Contract Document provisions or Modifications issued before this particular Modification.
  - b. A particular Addendum will govern over all other Contract Document provisions issued before this particular Addendum. Subsequent Addenda will govern over all prior Addenda.
  - c. The Supplementary Conditions will govern over the General Conditions.
  - d. The Agreement and these General Conditions will govern over all other Contract Documents except for the Supplementary Conditions, Addenda, Modifications.
  - e. The drawings and specifications will not govern over any of the documents listed above. The specifications take precedence over the drawings.
  - f. Within the Drawings, larger scale drawings take precedence over smaller scale drawings, figured dimensions over scaled dimensions, and noted materials over graphic indications.
  - g. In case of a conflict or ambiguity within the same level of hierarchy of described documents, Intermountain reserves the right to select the most stringent requirement unless the preponderance of the contract indicates the less stringent requirement.
- 4.1.6 Dividing Work and Contractor Representation. Organization of the specifications into divisions, sections and articles, and arrangement of Drawings, will not control Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade. Contractor represents that the Subcontractors, Sub-subcontractors, manufacturers and suppliers engaged or to be engaged by it are and will be familiar with the requirements for performance by them of their obligations. Where the Contract Documents require Contractor to provide professional services for architecture or engineering, Contractor will cause such services to be performed by appropriately licensed professionals.
- 4.1.7 Planning and Priority. Contractor will plan and schedule its work to facilitate the Project and will maintain a work schedule to place proper priority to sequence work to complete the project timely.
- 4.1.8 Prior to Contractor taking control over any area in any existing facility or on any project site, Contractor will provide prior written notice to Intermountain with sufficient time (no less than 30 Days) to allow Intermountain's Asset Recovery Team to remove, secure, and otherwise address existing materials, furniture, fixtures, equipment, and other assets located thereon.

## **4.2 Supervision and Construction Procedures.**

### **4.2.1 Supervision and Control.**

- a. Contractor will utilize its best skill, efforts, and judgment to provide efficient business administration and supervision, to furnish at all times an adequate supply of workers and materials, and to perform the Work in an expeditious and economical manner consistent with the interests of Intermountain.
- b. Contractor will supervise and direct the Work. Contractor will be solely responsible for all construction means, methods, techniques, sequences and procedures and for coordinating all portions of the Work.
- c. All loss, damage, liability, or cost of correcting Defective work arising from the use of any construction means, methods, techniques, sequences or procedures will be borne by Contractor, notwithstanding that such construction means, methods, techniques, sequences or procedures are referred to, indicated or implied by the Contract Documents, unless Contractor has given timely notice to Intermountain and A/E in writing that such means, methods, techniques, sequences or procedures are not safe or suitable, and Intermountain has then instructed Contractor in writing to proceed at Intermountain's risk.

4.2.2 **Responsibility.** Contractor will be responsible to Intermountain for acts and omissions of Contractor's employees, Subcontractors, and their agents and employees, and other persons performing portions of the Work under a contract with Contractor or on behalf of Contractor.

4.2.3 **Not Relieved of Obligations.** Contractor will not be relieved of obligations to perform the Work in accordance with the Contract Documents either by activities or duties of Intermountain or its agents in Intermountain's administration of the Contract, or by tests, inspections or approvals by Intermountain, A/E, or their consultants, or as required or performed by persons other than Contractor or for those that Contractor is liable.

### **4.2.4 Inspections and Approvals.**

- a. Contractor is responsible for requesting inspections for various stages and portions of the Work required under the Contract Documents in a timely manner.
- b. Contractor will be responsible for inspection of portions of the Work already completed to determine that such portions are in proper condition to receive subsequent portions of the Work.
- c. If any of the Work is required to be inspected or approved by the terms of the Contract Documents by any public authority, Contractor will timely request such inspection or approval to be performed in accordance with Article 9. Except as provided in Article 9, work will not proceed without any required inspection and the associated authorization to proceed. Contractor will promptly notify Intermountain if the inspector fails to appear at the site.

## **4.3 Labor and Materials.**

4.3.1 **Payment by Contractor.** Except to the extent it is otherwise stated in the Contract Documents, Contractor will provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities, supplies, consumables and services necessary for the proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

4.3.2 **Discipline and Competence.** Contractor will enforce strict discipline and good order among Contractor's employees, Subcontractors, agents, representatives and other persons performing under the Contract Documents. Contractor will not permit employment of unfit persons or persons not skilled in tasks assigned to them.

4.3.3 **Phased Construction / Accommodations for Facilities to Stay Operational.** Contractor and all Subcontractors will direct and perform the Work, phase and coordinate all construction and related

activities and timing, in a manner to preserve ongoing patient care and safety to all and to accommodate in every instance Intermountain's ongoing business operations such that facilities stay fully functioning, operational, and in compliance with applicable laws and regulations at all times.

**4.4 Taxes and Other Payments to Government.** Intermountain will pay all taxes and assessments on the real property comprising the Project site. Contractor will pay all applicable sales, consumer, use, payroll, workers compensation, unemployment, old age pension, surtax, and employment-related and similar taxes related to performance of the Work or portions thereof provided by Contractor which are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect, and will comply with the laws and regulations regarding the payment of Sales and/or Use Tax and any applicable exemptions.

**4.5 Permits, Fees, Notices, Labor and Materials.**

**4.5.1 Permits and Fees.**

- a. Intermountain will obtain and pay for all zoning and use permits and permanent easements necessary for completion of the Work.
- b. Contractor will obtain and pay for the building permit, and all other permits, governmental fees, licenses and inspections necessary for the proper execution and completion of the Work.
- c. Contractor will secure any certificates of inspection and of occupancy required by authorities having jurisdiction over the Work. Contractor will deliver these certificates to A/E before issuance of the Certificate of Substantial Completion by A/E.

**4.5.2 Compliance with Law, Public Authorities, Notices.** Contractor will comply with all applicable federal, state and local laws, statutes, ordinances, resolutions, rules, regulations, codes, and lawful orders of public authorities.

**4.5.3 Correlation of Contract Documents and Enactments.**

- a. It is not Contractor's responsibility to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, resolutions, building codes, and rules and regulations. Notwithstanding this, if Contractor observes, or if such is readily observable to a Contractor of ordinary skill and expertise for the type of Work involved, that a portion of the Contract Documents is at variance therewith, Contractor will promptly notify A/E and Intermountain in writing, and necessary changes will be accomplished by appropriate Modification.
- b. Contractor will coordinate and supervise the work performed by Subcontractors so that the Work is carried out without conflict between trades and so that no trade, at any time, causes delay to the general progress of the Work. Contractor and all Subcontractors will at all times afford each trade, any separate contractor, or Intermountain, reasonable opportunity for the installation of Work and the storage of materials.
- c. Contractor is fully responsible for the Project and all materials and work connected therewith until Intermountain has accepted the Work in writing. Contractor will replace or repair at its own expense any materials or work damaged or stolen, regardless of whether it has received payment for such work or materials from Intermountain.
- d. Contractor will remedy all damage or loss to any property caused in whole or in part by Contractor, any Subcontractor, or by anyone for whose acts any of them may be liable.
- e. Intermountain may elect to purchase materials required for the Work. In that event, Contractor will comply with the procedures set forth in the Contract Documents relating to such materials.

**4.5.4 Failure to Give Notice.** If Contractor, or any Subcontractor thereof performs Work without complying with the requirements of this Article 4.5 hereinabove, Contractor will assume appropriate responsibility for such Work and will bear the appropriate amount of the attributable costs.

#### 4.5.5 Intermountain-Purchased Materials and Equipment.

- a. In addition to Contractor's other obligations with respect to separate Intermountain provided work or materials, Contractor's obligations and duties with respect to Intermountain-purchased materials, equipment, and work include:
  - (i) Scheduling: The Contractor shall furnish Intermountain with a schedule of dates on which the Contractor requires delivery of Intermountain-purchased materials. Intermountain will arrange for the materials to be delivered to the construction site or picked up by Contractor on or before the specified dates. If delivery or pick up dates are changed, rescheduled, or otherwise varied from the original schedule, the Contractor shall notify Intermountain in writing of delivery or pick up date rescheduling and the Contractor shall coordinate the delivery or pick up of the Intermountain-purchased materials or equipment directly with the supplier.
  - (ii) Equipment / Vehicles: If Intermountain buys equipment or vehicles for Contractor's use on the Project, Contractor will (in addition to all other obligations herein relative to such equipment or vehicles) be fully and solely responsible for such equipment and vehicles as well as the use and use consequences thereof for any and all purposes (including without limitation to protect, secure, inspect, upkeep and make repairs, and insure such equipment and vehicles as well as to monitor, guide, direct, oversee, protect, and control the use and use consequences of such equipment and vehicles) until completion of the Project and Contractor's return of such equipment and/or vehicles to Intermountain.
  - (iii) Pre-Installation Inspection: The Contractor shall be responsible for receiving, inspecting and storing all Intermountain- purchased materials and equipment until the materials or equipment are needed for installation or use by the Contractor. Regardless of any inspection performed by Intermountain of the Intermountain-purchased materials or equipment, the Contractor shall be responsible for inspecting the Intermountain-purchased materials and equipment to determine suitability, quality and conformance with specifications before installation or use or at such other times as the Contractor may desire in order to avoid interruptions and delays in the progress of the Project. The Contractor shall reject any material which does not meet specifications or which appears to have any defect which may make the material unsuitable for use in the Project. The Contractor shall notify Intermountain and the manufacturer or supplier of all defects and assist Intermountain in arranging for the repair, replacement or correction of the defective condition. The Contractor shall not be entitled to an extension of any deadline or completion date which results from failure to discover defects which the Contractor should have discovered through an inspection.
  - (iv) Defective Materials: The Contractor acknowledges that use of improper or defective material may result in costs and damages to Intermountain in excess of the value of the materials; that after use in the Project it may be difficult or impossible to inspect the material to determine the cause of any failure; and that in the event of the failure of material there may be a question as to the cause of the failure. Because the Contractor's employees will be the last to handle and inspect material prior to incorporation into the Project, the Contractor will be liable to Intermountain for damages resulting from failure of Intermountain- purchased materials during the Contractor's warranty period specified herein from any cause whatsoever unless the Contractor provides clear and convincing proof that (1) the entire loss from a failure is covered by a valid manufacturer's or supplier's warranty, or (2) the Contractor could not have prevented the failure by complying with the requirements of this Section concerning Intermountain-purchased materials.
  - (v) Claims: The Contractor agrees to assist Intermountain to present claims to manufacturers and suppliers for defects in Intermountain-purchased materials. Where there is any question as to the division of liability between the Contractor and a manufacturer or vendor, the

Contractor shall provide all relevant information in the Contractor's possession which may aid Intermountain in determining the division of responsibility. Intermountain shall have final approval of any proposed adjustment or settlement of warranty claims.

- (vi) Implied Warranties: The benefit of contractual and implied warranties with respect to Intermountain-purchased materials and equipment shall run to Intermountain and not to the Contractor.
  - (vii) Unloading: Except as otherwise provided herein, the Contractor shall be responsible for unloading all Intermountain-purchased materials and equipment and for verifying delivery amounts to Intermountain.
  - (viii) Custody and Security: The Contractor shall secure and protect Intermountain-purchased materials and equipment from loss, deterioration, damage, theft, vandalism or destruction. If any Intermountain-purchased materials or equipment are damaged, stolen, or lost, Contractor will timely replace such at Contractor's sole cost and expense. In such event, Contractor will not be entitled to any modification in Contract Time or Contract Sum.
  - (ix) Reports: At Intermountain's request, the Contractor shall furnish reports to the Intermountain Representative demonstrating the Contractor's compliance with this Section.
  - (x) Retained Ownership: All materials and equipment purchased by Intermountain which remain after completion of the Project shall be the property of Intermountain. If Intermountain does not wish to retain or dispose of surplus Intermountain-purchased materials or equipment, the Contractor shall remove and dispose of them.
- b. None of the foregoing duties of the Contractor with respect to Intermountain-purchased materials shall prevent Intermountain from exercising any prerogative of ownership of the materials or equipment.

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

#### **4.7 Time and Contractor's Construction Schedules.**

##### **4.7.1 Progress and Completion.**

- a. *Time Is of The Essence; Complete Within Contract Time.* Time is of the essence. By executing the Contractor's Agreement, Contractor confirms that the Contract Time is adequate to perform the Work. Contractor will proceed expeditiously with adequate forces to achieve Substantial Completion within the Contract Time.
- b. *Notice to Proceed and Insurance.* Contractor will not prematurely commence operations on the site or elsewhere before the issuance of a Notice to Proceed by Intermountain and in no event before the effective date of insurance required by Article 10 to be furnished by Contractor. In addition and without limitation of the foregoing, Contractor will not proceed with further Work or services after performing preconstruction services until Contractor receives a subsequent Notice to Proceed.

4.7.2 Schedule Preparation. Contractor, promptly after being awarded the Contract, will prepare and submit for Intermountain's and A/E's review a reasonably detailed CPM schedule for the Work. The schedule will indicate the order, sequence, and interdependence of all items known to be necessary to complete the Work including construction, procurement, fabrication, and delivery of materials and equipment, submittals and approvals of samples, shop drawings, procedures, or other documents.

Work items of Intermountain, other Contractors, utilities and other third parties that may affect or be affected by Contractor will be included. If Intermountain is required, by the Contract Documents, to furnish any materials, equipment, or the like, to be incorporated into the Work by Contractor, Contractor will submit, with the first schedule submittal, a letter clearly indicating the dates that such items are required at the Project site. The critical path should be identified, including the critical paths for interim completion dates and milestones. The CPM schedule will be developed using Primavera, MS Project, or Suretrack unless otherwise authorized by Intermountain Representative. Contractor's schedule will be updated at least once per month and submitted with each pay request. Contractor will maintain an original baseline schedule and will provide Intermountain monthly written reports indicating Contractor's compliance or noncompliance with the original schedule.

- 4.7.3 Initial Contract Time. Unless otherwise specified in the bidding documents, the initial Contract Time is the time identified in the Contractor's Agreement.
- 4.7.4 Interim Completion Dates and Milestones. The schedule must include contractually specified interim completion dates and milestones. The milestone completion dates indicated are considered essential to the satisfactory performance of this Contract and to the coordination of all Work on the Project. The milestone dates listed are not intended to be a complete listing of all Work under this Contract or of interfaces with other Project contractors.
- 4.7.5 Schedule Content Requirements. The schedule will indicate an early completion date for the Project that is no later than the Project's required completion date. The schedule, including all activity duration's will be given in calendar days. The Schedule will also indicate all of the following:
- a. Interfaces with the work of outside contractors (e.g., utilities, power and with any separate Contractor);
  - b. Description of activity including activity number/numbers;
  - c. Estimated duration time for each activity;
  - d. Early start, late start, early finish, late finish date, and predecessor/successors including stop-start relationships with lead and lag time for each activity;
  - e. Float time available to each path of activities;
  - f. Actual start date for each activity begun;
  - g. Actual finish date for each activity completed;
  - h. The percentage complete of each activity in progress or completed;
  - i. Identification of all critical path activities;
  - j. The critical path for the Project, with this path of activities being clearly and easily recognizable on the time-scaled network diagram. The path(s) with the least amount of float time must be identified. Unless otherwise authorized by Intermountain Representative, no more than 40% of all activities may be identified as critical path items. The relationship between non-critical activities and activities on the critical path will be clearly shown on the network diagram;
  - k. Unless otherwise authorized by Intermountain Representative, all activities on the schedule representing construction on the site may not have duration longer than fourteen (14) Days. Construction items that require more than fourteen (14) Days to complete must be broken into identifiable activities on the schedule with durations less than fourteen (14) Days. The sum of these activities represents the total length required to complete that construction item; and
  - l. Additional requirements as specified in the Supplemental General Conditions.



- 4.7.6 Intermountain's Right to Take Exceptions. Intermountain reserves the right to take reasonable exception to activity duration, activity placement, construction logic or time frame for any element of the Work to be scheduled.
- 4.7.7 Float Time. Float time is defined as the amount of time between the earliest start date and the latest start date or between the earliest finish date and the latest finish date of a chain of activities on the Schedule. By a proposal request or modification delivered to Contractor, Intermountain has the right to use the float time for non-critical path activities until Contractor has reallocated such time on a newly submitted schedule.
- 4.7.8 Initial Schedule Submission. No progress payments will be approved until Contractor has submitted a Project detailed CPM schedule for the entire project.
- 4.7.9 Updates. Before any approval of a pay request, Intermountain, A/E and Contractor will review Contractor's schedule compared to the Work completed. Intermountain approves the amount of Work completed as supported by the schedule of values and as verified by the determination of Work completed. If necessary, Contractor will then update and submit to Intermountain the schedule with the pay request; all of which in accordance with Intermountain's approval. All updates will be provided in electronic and hard copy formats. At each scheduled meeting with Intermountain Representative, Contractor will provide at minimum a "three week look ahead" with long lead items identified.
- 4.7.10 Schedule of Submittals. Contractor will prepare and keep current, for A/E's and Intermountain's review, a schedule of submittals required under the Contract Documents which is coordinated with Contractor's construction schedule and allows A/E a reasonable time to review the submittals. This submittal schedule is to be included as part of the construction schedule. Submittals requiring expedited review must be clearly identified as such in the schedule of submittals.
- 4.7.11 Schedule Recovery. If the Work represented by the critical path falls behind by more than seven (7) Days, the project schedule will be redone within fourteen (14) Days showing how Contractor will recover the time. A narrative that addresses the changes in the schedule from the previously submitted schedule will be submitted along with the schedule in both hard copy (appropriate report formats to be determined by Intermountain Representative) and electronic copy. Contractor will comply with the most recent schedules.
- 4.7.12 Schedule Changes and Modifications.
- a. *Contract Time Change Requires Modification.* The Contract Time may only be shortened or extended by a Modification fully executed by Intermountain.
  - b. *Contractor Changing Activity Durations.* Should Contractor, after approval of the complete detailed construction schedule, desire to change his plan of construction, he will submit his requested revisions to Intermountain and A/E along with a written statement of the revisions including a description of the sequence and duration changes for rescheduling the work, methods of maintaining adherence to intermediate milestones and the contract completion date and the reasons for the revisions. If the requested changes are acceptable to Intermountain, which acceptance will not be unreasonably withheld, they will be incorporated into the Schedule in the next reporting period. If after submitting a request for change in the Contract Schedule, Intermountain does not agree with the request, Intermountain will schedule a meeting with Contractor to discuss the differences.
  - c. *Changes in Contract Time.* The critical path schedule as the term is used in the provisions herein will be based on the current version of Contractor's schedule for the Project and accepted by Intermountain just before the commencement of the modification, asserted delay, suspension or interruption. If Contractor believes it is entitled to an extension of Contract Time under the

Contract Documents, Contractor will submit a PCO in accordance with Article 7.2 to A/E and Intermountain Representative accompanied by an analysis of the requested time adjustment.

4.7.13 Extensions of Time.

- a. If Substantial Completion of the Project is delayed because of any of the following causes, then the Contract Time will be extended by Modification for a period of time equal to such delay:
  - (i) Labor strikes or lock-outs;
  - (ii) Unusual delay in transportation;
  - (iii) Unforeseen governmental requests or requirements;
  - (iv) A Change in the Work resulting from an instruction by Intermountain or A/E to Contractor subject to the conditions set forth in Section 7.1.5;
  - (v) Unforeseen Subsurface Condition subject to the conditions set forth in Section 7.1.6; or
  - (vi) Any other event or circumstance caused by the willful or negligent act or omission of Intermountain or A/E subject to the conditions set forth in Section 7.1.6.
- b. Contractor will not be entitled to any compensation for delay described in Section 4.7.13, Paragraph a, subparagraphs (i), (ii), and (iii).
- c. In no event will any time extension or cost adjustment be given on account of delay which reasonably should have been anticipated by the Contractor or in circumstances where performance of the Work is, was, or would have been, delayed by any other cause for which the Contractor is not entitled to an extension.
- d. Adverse Weather delays. Completion time will not be extended for normal bad weather or any weather that is reasonably foreseeable at the time of entering into the contract. The time for completion as stated in the contract documents includes due allowance for calendar days on which Work cannot be performed due to weather conditions. The Contractor acknowledges that it may lose days due to weather conditions. Notwithstanding, the Contract Time may be extended (but at no cost to Intermountain) if all of the following are established by the Contractor:
  - (i) That the weather prevented Work from occurring that is on the critical path for the project based upon a critical path schedule previously submitted to Intermountain and to the extent accepted by Intermountain;
  - (ii) There are no concurrent delays attributed to the Contractor;
  - (iii) The Contractor took all reasonable steps to alleviate the impact of the weather and took reasonable attempts to prevent the delay and despite such reasonable actions of Contractor, the weather impacted the critical path as described above; and
  - (iv) One of the following occurred:
    1. The weather was catastrophic, such as a tornado, hurricane, severe wind storm, severe hail storm; or
    2. Based on the full history of information published from the closest station as indicated from the Western Regional Climate Center (Desert Research Institute 2215 Raggio Parkway Reno, Nevada 89512, and as may be described on the website at <http://www.wrcc.dri.edu/summary/>), one or more of the following occurred:
      - a. For any day between November 1 and March 31, the minimum temperature fell below the average minimum temperature plus the extreme low temperature recorded for the month divided by 2.
      - b. For any day between November 1 and March 31, the maximum temperature fell below the monthly average for the minimum temperature.

- c. The daily precipitation exceeded 75% of the historical one day maximum for the month.
- d. The snowfall for the month exceeded 175% of the historical average snow fall for the month.

Contractor will not be entitled to any compensation for Adverse Weather.

4.7.14 Time Extension Request. Unless a shorter time period is set forth herein or in other Contract Documents, any time extension will be requested by Contractor within twenty-one (21) Days after Contractor knew or should have known about the delay and will be supported by the critical path schedule analysis.

4.7.15 Delay in Completion of the Work.

- a. *Prior to Substantial Completion*. For each Day after the expiration of the Contract Time that Contractor has not achieved Substantial Completion, Contractor will pay Intermountain the amount set forth in the Agreement as liquidated damages for Intermountain's loss of use of the Project and the added administrative expense to Intermountain to administer the Project during the period of delay. In addition, Contractor will reimburse Intermountain for any additional Consultant's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Intermountain as a result of the delay. The parties have agreed on this liquidated damages provision because actual damages which will result from a delay in Substantial Completion cannot readily be ascertained at the time of execution of the Agreement and the parties wish to fix such damages as a their reasonable estimate of such actual damages, and not as a penalty. Intermountain may deduct any liquidated damages or reimbursable expenses from any money due or to become due to Contractor. If the amount of liquidated damages and reimbursable expenses exceeds any amounts due to Contractor, Contractor will pay the difference to Intermountain within ten (10) Days after receipt of a written request from Intermountain for payment
- b. *After Substantial Completion*. For each Day that Contractor exceeds the time allowed for completion of the remaining items set forth in the Certificate of Substantial Completion, Contractor will pay to Intermountain as liquidated damages for additional administrative expenses the amount set forth in the Agreement. In addition, Contractor will reimburse Intermountain for any additional Consultant's fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses incurred by Intermountain as a result of the delay in completing such items.
- c. *No Waiver of Intermountain's Rights*. Permitting Contractor to continue any part of the Work after the time fixed for completion or beyond any authorized extension thereof, will in no way operate as a waiver or estoppel on the part of Intermountain of any of its rights under the Contract Documents, including the right to liquidated damages or any other remedies or compensation.

**4.8 Documents and Samples at the Site; Certifying "As-Built"**. Contractor will maintain at the site for Intermountain, one record copy of the Drawings, Specifications, Addenda, Change Orders and other Modifications, in good order and marked weekly to record changes and selections made during construction, as well as approved Shop Drawings, Product Data, Samples and similar submittals. These items will be available to A/E and will be delivered to A/E for submittal to Intermountain upon completion of the Work, or upon completion of any phase of the Work as agreed to by the parties, signed by Contractor, certifying that they show complete and exact "as-built" conditions and location, stating sizes, kind of materials, vital piping, conduit locations and similar matters. All notes of encountered or changed conditions will be included.

#### **4.9 Shop Drawings, Product Data and Samples.**

- 4.9.1 Not Contract Documents. Shop Drawings, Product Data, Samples and similar submittals are not Contract Documents. The submittal will demonstrate, for those portions of the Work for which the submittal is required, the way Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents.
- 4.9.2 Promptness. Contractor will review, approve and submit to A/E, Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work, or the activities of Intermountain or separate contractors.
- 4.9.3 Not Perform Until A/E Approves. Contractor will 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 in writing by A/E. Such Work will be in accordance with the approved submittals.
- 4.9.4 Representations by Contractor. By approving and submitting Shop Drawings, Product Data, Samples and similar submittals, Contractor represents that Contractor has determined and verified materials, field measurements and field construction criteria related thereto, and has checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.
- 4.9.5 Contractor's Liability. Contractor will not be relieved of responsibility for deviations from the requirements of the Contract Documents by A/E's approval of Shop Drawings, Product Data, Samples or similar submittals unless Contractor has specifically informed A/E in writing of such deviation at the time of the submittal and A/E has given written approval to the specific deviation. Contractor will not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by A/E's review and comment.
- 4.9.6 Direct Specific Attention to Revisions. Contractor will direct specific attention in writing to all revisions on resubmitted Shop Drawings, Product Data, Samples or similar submittals, except those requested by A/E and indicated on previous submittals.
- 4.9.7 Informational Submittals. Informational submittals upon which A/E is not expected to take responsive action may be so identified in the Contract Documents.
- 4.9.8 Reliance on Professional Certification. When professional certification of performance criteria of materials, systems or equipment is required by the Contract Documents, Intermountain and A/E will be entitled to rely upon the accuracy and completeness of such calculations and certifications. If a professional stamp is required, the professional will be licensed in the State in which the Project is located unless otherwise approved by Intermountain in writing. Likewise, Contractor is entitled to rely upon the accuracy and completeness of the calculations made by A/E in developing the Contract Documents, unless a Contractor of ordinary skill and expertise for the type of Work involved would know that such is inaccurate or incomplete and therefore must immediately notify Intermountain in writing.

#### **4.10 Use of Project Site.**

- 4.10.1 In General.
- a. Intermountain may, in Intermountain's discretion, permit Contractor to occupy or otherwise use portions of the Project site or, if applicable and available, other Intermountain property within the vicinity of the Project, for general office, staging, or other purposes as more particularly provided in the Project Specifications. As used herein, the term "Project site" or "site" will be deemed to refer to any other Intermountain property used by Contractor in connection with the Project, in addition to the actual Project site. Intermountain may, in its discretion, require Contractor to enter into a separate license agreement, on Intermountain's standard form, with

respect to Contractor's occupancy or other use of Intermountain space at the actual Project site or within other Intermountain property.

- b. Contractor will confine operations at the site to areas permitted by the Contract Documents, law, ordinances, resolutions, rules and regulations, and permits and will not unreasonably encumber the site with materials or equipment. Contractor will take all reasonable means to secure the site, protect the site and protect the Work from any damage. The site will be left free and clear of refuse, equipment, materials, etc. and the site will not be subject to spilled liquids and chemicals, toxic or otherwise. Should such an incident occur while Contractor has control of the site, Contractor will be responsible to clean, repair, or restore the site and pay all associated costs, fines and penalties. Contractor will indemnify and hold Intermountain harmless from and against any and all loss, cost, damage, injury or expense, including claims for death or injury to person or damage to property, and including without limitation attorney's fees and court costs, to the extent arising out of or in connection with use of the site by Contractor or its contractors, employees, or invitees. Notwithstanding the foregoing, Contractor is not responsible for any damage to the site or the Work to the extent caused by Intermountain or Intermountain's agents.
- c. Contractor recognizes that the Project site and the surrounding area is frequently visited by the public and is important to Intermountain's image and function and will maintain the premises free from debris and waste materials resulting from Construction. At the completion of Construction, Contractor will promptly remove construction equipment, tools, surplus materials, waste materials and debris.

4.10.2 Access to Neighboring Properties. Contractor will not, except as provided in the Contract Documents or with Intermountain's advance written consent when necessary to perform the Work, interfere with access to properties neighboring the Project site by the owners of such properties and their respective tenants, agents, invitees and guests.

**4.11 Access to Work.** Contractor will provide Intermountain and A/E access to the Work in preparation and progress, wherever located.

**4.12 Royalties and Patents.** Contractor will pay all royalties and license fees. Contractor will defend suits or claims for infringement of patent rights and will hold Intermountain and A/E harmless from loss on account thereof, but will 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 Contractor has reason to believe that the required design, process or product is an infringement of a patent, Contractor will be responsible for such loss unless such information is promptly furnished to Intermountain in writing.

**4.13 Indemnification.**

4.13.1 To the fullest extent permitted by law, Contractor will indemnify and hold harmless Intermountain and its affiliates, subsidiaries, officers, employees, agents, authorized volunteers (hereinafter the above listing of entities and persons is referred to as "indemnitees") from and against every kind and character of claims, liabilities, damages, losses, settlements, and expenses, including but not limited to attorneys' fees, consultant fees, expert fees, and other costs and expenses, and including without limitation those events covered under the blanket Contractual Liability Coverage required under the Contract Documents, arising out of or resulting from performance of the Work, including without limitation the work of all the Subcontractors and their employees, except to the extent that such liability arises out of the negligence of Intermountain, its representatives, agents, and employees. This indemnity includes, without limitation, indemnification of Intermountain from all losses or injury to Intermountain's property, except to the extent that such loss or injury arises out of the negligence of Intermountain, its representatives, agents, and employees. This indemnity applies, without

limitation, to include Claims occurring both during performance of the Work and/or subsequent to completion of the Work. In the event that any Claim is caused in part by a party indemnified hereunder, that party will bear the cost of such Claim to the extent it was the cause thereof. In the event that a claimant asserts a Claim for recovery against any party indemnified hereunder, the party indemnified hereunder may tender the defense of such Claim to Contractor. If Contractor rejects such tender of defense and it is later determined that the negligence of the party indemnified hereunder did not cause all of the Claim, Contractor will reimburse the party indemnified hereunder for all costs and expenses incurred by that party in defending against the Claim. Contractor will not be liable hereunder to indemnify any party for damages resulting from the sole negligence of that party. Notwithstanding, Intermountain will have the right, at its option, to participate in the defense of any such action without relieving Contractor of any obligation hereunder.

- 4.13.2 In addition to the foregoing, Contractor will be liable to defend Intermountain in any lawsuit filed by any Subcontractor relating to the Project. Where liens have been filed against Intermountain's property, Contractor (and/or its bonding company which has issued bonds for the Project) will obtain lien releases and record them in the appropriate county and/or local jurisdiction and provide Intermountain with a title free and clear from any liens of Subcontractors. In the event that Contractor and/or its bonding company are unable to obtain a lien release, Intermountain in its absolute discretion may require Contractor to provide a bond around the lien or a bond to discharge the lien, at Contractor's sole expense.
- 4.13.3 In addition to the foregoing, Contractor will indemnify and hold Intermountain harmless from any claim of any other contractor resulting from the performance, nonperformance or delay in performance of the Work by Contractor.
- 4.13.4 The indemnification obligation under this Article 4.13 will not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for Contractor or Subcontractor under workers' or workmen's compensation acts, disability benefits acts or other employee benefit acts.
- 4.13.5 Intermountain and Contractor waive all rights against each other for damages to the Work during construction to the extent covered by the applicable Builder's Risk Policy, except such rights as they may have to the proceeds of such insurance as set forth in the Contract. Contractor will require similar waivers from its Subcontractors, subconsultants, and agents, at any tier.

**4.14 Additional Services/Work.** It is understood and agreed by the parties hereto that no money will be paid to Contractor for additional labor or materials furnished unless a new contract in writing or a Modification hereof in accordance with the General Conditions and the Contract Documents for such additional labor or materials has been executed. Intermountain specifically reserves the right to modify or amend the Contract and the total sum due hereunder, either by enlarging or restricting the scope of the Work.

**4.15 Building Information Modeling.** Contractor will perform, throughout the Project, as requested by Intermountain and/or as otherwise required to execute the Project, building information modeling ("BIM") services and coordination among trades. Such BIM services are included in Contractor's Work and services and shall be provided by Contractor and Subcontractors without additional fee or charge to Intermountain. Contractor will provide BIM services using software acceptable to Intermountain.

## **5. SUBCONTRACTORS.**

### **5.1 Award of Subcontracts and Other Contracts for Portions of the Work.**

#### **5.1.1 Approval Required.**

- a. Listing of Subcontractors will be as stated in the Contract Documents, including but not limited to the "Intermountain Subcontractors List Form".

- b. Contractor will not contract with a proposed person or entity to whom Intermountain has made a reasonable and timely objection. Contractor will not be required to contract with anyone to whom Contractor has made reasonable objection.
- 5.1.2 Business and Licensing Requirements. All Subcontractors used by Contractor will comply with all applicable business and licensing requirements.
- 5.1.3 Subsequent Changes. After the bid opening, Contractor may change its listed Subcontractors only in accordance with the Contract Documents and with written approval of the Director.
- a. Intermountain will pay the additional costs for an Intermountain requested change in Subcontractor if all of the following are met:
    - (i) If Intermountain in writing requests the change of a Subcontractor;
    - (ii) The original Subcontractor is a responsible Subcontractor that meets the requirements of the Contract Documents; and
    - (iii) The original Subcontractor did not withdraw as a Subcontractor on the project.
  - b. In all other circumstances, Contractor will pay the additional cost for a change in a Subcontractor.
- 5.1.4 Bonding of Subcontractors. Subcontractors as identified by Intermountain in the procurement documents, may be required to submit performance and payment bonds to cover the full extent of their portion of the Work. This provision does not in any way limit the right of Contractor to have Subcontractors at any tier be required to have a performance and/or payment bond.
- 5.1.5 Unrelated Subcontractors / Contractor Self-Performed Work.
- a. Contractor will procure bids for subcontract work from at least three (3) qualified bidders unless Intermountain waives such requirement in writing. Except as provided in the following section, Contractor will enter into contracts with Subcontractors not owned, related to or controlled by Contractor to perform all portions of the Work. Subcontracts will contain payment provisions consistent with the Contract Documents and will not be awarded on the basis of cost plus a fee without the prior written consent of Intermountain.
  - b. If Contractor wishes to self-perform any portion of the Work or subcontract such portion of the Work to an entity owned or controlled by or related to Contractor, Contractor will:
    - 1) Advise Intermountain at least thirty (30) Days in advance of bid opening that Contractor wishes to self-perform such Work or subcontract it to an entity owned, controlled by or related to Contractor and request Intermountain's written approval thereof;
    - 2) Submit to Intermountain Contractor's or such related entity's bid at least seventy-two (72) hours prior to bid opening;
    - 3) Procure bids for such subcontract Work from at least three qualified bidders unless Intermountain waives such requirement in writing; and
    - 4) Abide by Intermountain's determination as to whether Contractor or another subcontractor will be used to perform such Work.
  - c. If Intermountain both approves Contractor to self-perform Work and approves Contractor proceeding without obtaining bids from other Contractors, then Contractor's overhead and profit on Work performed by Contractor's crews will not be more than the percentage fee, if any, stated in the Contractor's Agreement or such fee as agreed by Intermountain and Contractor by

a written Modification executed prior to Contractor's commencing the applicable self-performed Work.

## **5.2 Subcontractual Relations.**

- 5.2.1 Comply with Contract Documents. By appropriate enforceable agreement, and to the extent it can be practically applied, Contractor will require each Subcontractor to be bound to Contractor by the terms of the Contract Documents, and to assume toward Contractor all the obligations and responsibilities which Contractor, by these Documents, assumes towards Intermountain and A/E.
- 5.2.2 Rights. Each Subcontractor agreement will preserve and protect the rights of Intermountain and A/E 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 will allow to the Subcontractor, unless specifically provided otherwise in the Subcontractor agreement, the benefit of all rights and remedies against Contractor that Contractor, by the Contract Documents, has against Intermountain.
- 5.2.3 Sub-Subcontractors. Contractor will require each Subcontractor to enter into similar agreements with its Subcontractors which complies with the requirements of Paragraphs 5.2.1 and 5.2.2 hereinabove.
- 5.2.4 Document Copies. Contractor will make available to each proposed Subcontractor, before execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound. Subcontractors will similarly make copies of applicable portions of the Contract Documents available to their respective proposed Subcontractors.

**5.3 Contingent Assignment of Subcontracts.** Each subcontract agreement for a Subcontractor, at any tier for a portion of the Work, is hereby assigned by Contractor to Intermountain provided that the assignment is effective only after termination of the Contract by Intermountain for cause pursuant to Article 12.2 or stoppage of the Work by Intermountain pursuant to Article 12.5, and only for those subcontract agreements which Intermountain accepts by notifying the Subcontractor in writing. The subcontract will be equitably adjusted to meet the new conditions of the work.

## **6. PROTECTION OF PERSONS AND PROPERTY.**

### **6.1 Safety of Persons and Property.**

- 6.1.1 Contractor Responsibility. Contractor will be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the performance of the Contract. Contractor will take all reasonable precautions for the safety of, and will provide reasonable protection to prevent damage, injury or loss to:
  - a. Employees on the Work and other persons who may be affected thereby;
  - b. The Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody or control of Contractor or a Subcontractor; and
  - c. 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.
- 6.1.2 Safety Program, Precautions. Contractor will institute a safety program at the start of construction to minimize accidents. This program will continue to the final completion of the Project and conform to applicable laws and regulations including the Utah Occupational Safety and Health Rules and Regulations as published by the Utah Industrial Commission - UOSH Division. Contractor will post signs, erect barriers, and provide those items necessary to implement the safety program. As soon as Contractor proceeds with the Work, Contractor will have all workers and all visitors on the site wear safety hard hats, as well as all other appropriate safety apparel such as safety glasses and shoes, and obey all safety rules and regulations and statutes. Contractor will post a sign in a conspicuous location indicating the necessity of wearing hard hats and Contractor will loan such hats to visitors.



- 6.1.3 Compliance with Safety Laws. Contractor will give notices and comply with applicable laws, ordinances, rules, codes, regulations and lawful orders of public authorities bearing on safety of persons or property or their protection from damage, injury or loss.
- 6.1.4 Erect and Maintain Safeguards. Contractor will erect and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including effective fences, posting danger signs and other warnings against hazards, promulgating safety regulations and notifying owners and users of adjacent sites and utilities.
- 6.1.5 Utmost Care. When use or storage of explosives or other hazardous materials or equipment or unusual methods are necessary for execution of the Work, Contractor will exercise utmost care and carry on such activities under supervision of properly qualified personnel.
- 6.1.6 Prompt Remedy. Contractor will promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Paragraph 6.1.1 of these General Conditions caused in whole or in part by Contractor, a Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which Contractor is responsible under this Paragraph 6.1.1, except to the extent such damage or loss is directly due to errors in the Contract Documents or caused by agents or employees of A/E or Intermountain. The foregoing obligations of Contractor are in addition to Contractor's obligations under the Contract Documents.
- 6.1.7 Safety Designee. Contractor will designate a responsible member of Contractor's organization at the site whose duty will be the prevention of accidents, damage, injury or loss. This person will be Contractor's superintendent unless otherwise designated by Contractor in writing to Intermountain and A/E.
- 6.1.8 Load Safety. Contractor will not load or permit any part of the construction or site to be loaded so as to endanger its safety.
- 6.1.9 Off-Site Responsibility. In addition to its other obligations under this Article 6, Contractor will, at its sole cost and expense, promptly repair any damage or disturbance to walls, utilities, streets, ways, sidewalks, curbs and the property of Intermountain and third parties (including municipalities and other governmental agencies) resulting from the performance of the Work, whether by it or by its Subcontractors at any tier. Contractor will not cause materials, including soil and debris, to be placed or left on streets or ways.
- 6.1.10 Emergencies. In an emergency affecting safety of persons or property, Contractor will act, at Contractor's discretion, to prevent threatened damage, injury or loss. Contractor will promptly notify Intermountain Representative of the action taken.
- 6.2 Hazardous Materials.** In the event Contractor encounters on the site material reasonably believed to be asbestos or polychlorinated biphenyl (PCB) or any other hazardous waste or substance which may endanger the health of those persons performing the Work or being on the site, Contractor will immediately stop Work in the area affected and immediately report the condition to Intermountain Representative and A/E by phone with a follow-up document in writing. The Work in the affected area will be resumed when written direction is provided by Intermountain Representative. Except to the extent provided otherwise in the Contract Documents or if the presence of hazardous materials is due to the fault of Contractor, Contractor will not be required to perform without Contractor's consent, any Work relating to asbestos, polychlorinated biphenyl (PCB) or any other hazardous waste or substance. Intermountain will procure a licensed abatement contractor qualified to remove the hazardous material. The abatement contractor will submit notification of demolition to the Utah Division of Air Quality. Abatement contractor will pay the notification fee. A copy of the hazardous material survey report will be available to all persons who have access to the construction site.

**6.3 Historical and Archeological Considerations.** In the event Contractor knows or should have known of any cultural, historical or archeological material that is either recognized as an item to be protected under Federal, State, or local law or regulation, or is an item of obvious value to Intermountain, Contractor will cease any work that would interfere with such discovery and immediately report the condition to Intermountain Representative and A/E by phone with a follow-up document in writing. Work will resume based upon the direction of Intermountain Representative. Contractor cooperation with any Intermountain recognized archaeologist or other cultural/historical expert is required.

**6.4 Contractor Liability.** If Contractor fails in any of its obligations in Articles 6.1 through 6.3 above, Contractor will be liable to any damages to Intermountain or any third party resulting from such noncompliance. Contractor will also be liable for any mitigation or restoration effort resulting from such noncompliance. To the extent all the following is met, Contractor may treat the discovery of such material similarly to an unforeseen condition:

- 6.4.1 The discovery of such material is reasonably unforeseeable given the site conditions that Contractor should have been aware;
- 6.4.2 The presence of such material was not identified in any part of the Contract Documents;
- 6.4.3 Contractor has undertaken all proper action to mitigate any impact of such discovery on the critical path or monies related to the Project;
- 6.4.4 The discovery affects the critical path or contract price from that which was contemplated by the Contract Documents; and
- 6.4.5 The requirements of 7.1.5 and the Contract documents are met.

## **7. MODIFICATIONS, REQUEST FOR INFORMATION, PROPOSED CHANGE ORDER, AND CLAIMS PROCESS.**

### **7.1 Modifications: In General.**

- 7.1.1 Types of Modifications and Limitations. Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or ASI, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents. Contractor must have a written Modification executed by Intermountain under this Article 7 before proceeding with any Work sought to be an extra.
- 7.1.2 By Whom Issued. A Change Order or Construction Change Directive will be issued by Intermountain Representative. An ASI is issued by A/E. A/E will prepare Change Orders and Construction Change Directives with specific documentation and data for Intermountain's approval and execution in accordance with the Contract Documents, and may issue ASIs not involving an adjustment in the Contract Sum or an extension of the Contract Time which are not inconsistent with the intent of the Contract Documents.
- 7.1.3 Contractor to Proceed Unless Otherwise Stated. Changes in the Work will be performed under applicable provisions of the Contract Documents, and Contractor will proceed promptly, unless otherwise provided in the Change Order, Construction Change Directive or ASI.
- 7.1.4 Adjusting Unit Prices. If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are so changed in a PCO or Construction Change Directive that application of such unit prices to quantities of Work proposed will cause a substantial inequity to Intermountain or Contractor, the applicable unit prices may be equitably adjusted.
- 7.1.5 Changes in the Work Resulting From An Instruction by Intermountain or A/E to Contractor.
  - a. If Intermountain or A/E gives Contractor an instruction that modifies the requirements of the Contract Documents or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If compliance with the instruction

affects the cost to Contractor to perform the Work, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in cost subject to the conditions set forth in Section 7.1.5, subparagraphs b through g. If compliance with the instruction delays Substantial Completion, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in Section 7.1.5, subparagraphs b through g and Section 4.7.13.

- b. If Contractor receives an instruction from Intermountain or A/E that Contractor considers to be a Change in the Work, Contractor, before complying with the instruction, will notify A/E in writing that Contractor considers such instruction to constitute a Change in the Work. If A/E agrees that compliance with the instruction will constitute a Change in the Work, Contractor will furnish a proposal for a Modification in accordance with Section 7.1.5 subparagraphs c and d. within ten (10) Days.
- c. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) as a result of an instruction by Intermountain or A/E, Contractor will furnish a proposal for a Change Order containing a price breakdown itemized as required by Intermountain. The breakdown will provide sufficient detail to allow Intermountain to determine any increase or decrease in Direct Costs as a result of compliance with the instruction. Any amount claimed for subcontracts will be supported by a similar price breakdown and will itemize the Subcontractor's profit and overhead charges. Profit and overhead will be subject to the markup limits for additional work, changes, or other Modification set forth in the Contractor's Agreement. Amounts due Intermountain as a result of a credit change will be the actual net decrease in the Contractor's Direct Costs to perform the Work as a result of the Change in the Work. Overhead and profit for the Modification will be calculated based on the net increase or decrease in Contractor's Direct Costs resulting from the Change in the Work.
- d. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an instruction from Intermountain or A/E, Contractor will include in its proposal justification to support Contractor's claim that compliance with the instruction will delay Substantial Completion.
- e. Upon receipt of Contractor's proposal for Modification, A/E and Intermountain will determine whether to proceed with the Change in the Work. If A/E and Intermountain determine to proceed with the Change in the Work, they will execute a Change Order, a Construction Change Directive or a Field Change as appropriate.
- f. Contractor agrees that if it complies with an instruction from Intermountain or A/E without first giving written notice to A/E as provided in Section 7.15, subparagraph b, and receiving a Change Order, Construction Change Directive or Field Change, Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim therefor.
- g. If Contractor is instructed to perform work which it claims constitutes a Change in the Work but which Intermountain and A/E do not agree constitutes a Change in the Work, Contractor will comply with the instruction. Contractor may submit its claim for adjustment to the Contract Sum, the Contract Time, or both as a dispute pursuant to Section 7.7 within twenty-one (21) Days after compliance with the instruction. Contractor agrees that if it fails to submit its claim for resolution pursuant to Section 7.7 within twenty-one (21) Days after compliance with the instruction, then Contractor will not be entitled to any adjustment in the Contract Sum or the Contract Time as a result of the instruction and waives any claim therefor.

- h. Contractor agrees that it is responsible for submitting accurate cost and pricing data to support its Change Order Proposals. Intermountain will have the right to examine the Contractor's records to verify the accuracy and appropriateness of the pricing data used to price change order proposals.

7.1.6 **Change in the Work Resulting From An Event or Circumstance.**

- a. If an event or circumstance other than an instruction from Intermountain or A/E affects the cost to Contractor of performing the Work or delays Substantial Completion, Contractor may be entitled to an adjustment in the Contract Sum and/or the Contract Time. If the circumstance or event affects the cost to Contractor to perform the Work and is caused by a willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, the Contract Sum will be adjusted to reflect the reasonable increase or decrease in Contractor's cost to perform the Work resulting from the event or circumstance, subject to the conditions set forth in Section 7.1.6, subparagraphs b through f. If the event or circumstance delays Substantial Completion and is described in Section 4.7.13, the Contract Time will be extended for a period of time commensurate with such delay subject to the conditions set forth in such section. If the circumstance or event delays Substantial Completion and is caused by a willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, then Contractor will be compensated for costs incident to the delay in accordance with Section 7.1.6, subparagraphs b through g and Section 4.7.13.
- b. Contractor will not be entitled to any adjustment to the Contract Sum or other damages from Intermountain as a result of any event or circumstance unless the event or circumstance results from a willful or negligent act or omission of Intermountain or A/E.
- c. If a Change in the Work results from any event or circumstance caused by the willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface Condition, Contractor will give Intermountain Written Notice of such event or circumstance within twenty-four (24) hours after commencement of the event or circumstance so that Intermountain can take such action as is necessary to mitigate the effect of the event or circumstance. Contractor will not be entitled to any adjustment in either the Contract Time or the Contract Sum based on any damages or delays resulting from such event or circumstance during a period more than twenty-four (24) hours prior to Contractor giving such Written Notice to Intermountain.
- d. Contractor will submit in writing any claims for an adjustment in the Contract Time and/or the Contract Sum resulting from an event or circumstance within the time limits set forth below. In the event that Contractor fails to submit its claim in writing within the time limits set forth below, then Contractor agrees it will not be entitled to any adjustment in the Contract Time or the Contract Sum or to any other damages from Intermountain due to the circumstance or event and waives any claim therefor.
  - (i) Claims for an adjustment in the Contract Time due to Adverse Weather will be made within twenty-one (21) Days of the first Day of the occurrence of the Adverse Weather event in which the delay occurred.
  - (ii) Claims for an adjustment in the Contract Time and/or the Contract Sum due to any other circumstance or event will be submitted within seven (7) Days after the occurrence of the circumstance or event.
- e. If Contractor claims that it is entitled to an adjustment in the Contract Sum (including without limitation costs related to a time extension) because of an event or circumstance resulting from the willful or negligent act or omission of Intermountain or A/E or an Unforeseen Subsurface

Condition, Contractor will furnish a proposal for a Change Order containing a price breakdown as described in Section 7.1.5, subparagraph c. Any amount claimed for increased labor costs as a result of the event or circumstance must be supported by a certified payroll. Any claim for rented equipment or additional material costs must be supported by invoices.

- f. If Contractor claims that it is entitled to an adjustment in the Contract Time as a result of an event or circumstance, Contractor will include with its claim copies of daily logs, letters, shipping orders, delivery tickets, Project schedules, and other supporting information necessary to justify Contractor's claim that the event or circumstance delayed Substantial Completion.
- g. Within thirty (30) Days after receipt of Contractor's claim, A/E will either deny the claim or recommend approval to Intermountain. If Intermountain approves the claim, the adjustment in the Contract Time and/or Contract Sum will be reflected in a Change Order pursuant to Section 7.4 or a Construction Change Directive pursuant to Section 7.5. If Intermountain or A/E denies Contractor's claim, Contractor may submit its claim as a dispute pursuant to Section 7.7 within twenty-one (21) Days of receipt of the denial of the claim. If Contractor fails to submit its claim for resolution pursuant to Section 7.7 within the twenty-one (21) Day time period, then Contractor agrees it is not entitled to any adjustment in the Contract Time and/or Contract Sum or any other damages as a result of the event or circumstance and waives any claim therefor.

## **7.2 Contractor Initiated Requests.**

- 7.2.1 The Request for Information, RFI, Process and Time to File. Contractor may file an RFI with A/E regarding any concern which will assist Contractor in the proper completion of the Work including, but not limited to issues related to the Contract Documents, plans and specifications. The RFI will be filed with A/E in a timely manner so as not to prejudice Intermountain as to the quality, time or money related to the Work.
- 7.2.2 Proposed Change Order. Unless a shorter time period is set forth herein or in other Contract Documents, within twenty-one (21) Days after Contractor knows or should have known of a situation or concern where Contractor is going to request additional monies or time, Contractor must file a PCO with Intermountain Representative, or Contractor will be deemed to waive any right to claim additional monies or time related to such situation or concern. The PCO will include all available documentation supporting the PCO available to Contractor at the time of filing and Contractor will thereafter diligently pursue the supplementation(s) of such documentation and promptly deliver such supplementation(s) to Intermountain Representative.
  - a. *Intermountain Representative Response.* One of the following may occur after a PCO is filed with Intermountain Representative:
    - (i) Intermountain Representative, after considering any input by A/E, may reach an agreement with Contractor and issue a Change Order.
    - (ii) Intermountain, after considering any input by A/E, may issue a Construction Change Directive.
    - (iii) If Intermountain Representative, after considering any input by A/E, disagrees with Contractor's PCO, Intermountain representative may seek additional information or verification from Contractor, A/E or other sources, may negotiate with Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive. A/E must continually work with Intermountain in providing data, documentation and efforts to resolve the issues related to the PR.

**7.3 Proposal Request Initiated by Intermountain.** Intermountain may file a Proposal Request with Contractor seeking information, data and/or pricing relating to a change in the Contract Time and or monies owing for particular scope changes or other modifications to the Contract Documents. The PR will provide a time limit

for Contractor to file a response with A/E and Intermountain Representative. If a proposal is not timely provided by Contractor, Intermountain may calculate the Change Order under Article 7.4.2 below. Upon such timely receipt of the proposal, one of the following will occur:

- 7.3.1 If Agreement, Change Order Issued. Intermountain Representative, after considering any input by A/E, may reach an agreement with Contractor and issue a Change Order.
- 7.3.2 If Disagreement. If Intermountain Representative disagrees with Contractor's proposal, after considering any input from A/E, Intermountain representative may seek additional information or verification from Contractor or other sources, may negotiate with Contractor, may issue a Change Order upon such later agreement, may retract the PR, or may issue a Construction Change Directive. If a Construction Change Directive is issued which identifies Intermountain representative's position in regard to the subject contract sum and/or time adjustment, Contractor must initiate the Claim resolution process provided for herein within twenty-one (21) Days of Contractor's receipt of the Construction Change Directive, or Contractor will be deemed to waive any such request for additional time or money as a result of the issuance of the Construction Change Directive. Such waiver will entitle Intermountain to convert the Construction Change Directive into a Change Order, whether or not executed by Contractor. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the time period for initiating the Claim resolution process will not accrue until such time as Intermountain has conveyed to Contractor a position as to the time and money owing as a result of the directed change.

#### **7.4 Evaluation of Proposal for Issuing Change Orders.**

- 7.4.1 Adjusting Sum Based Upon Agreement. If the Change Order provides for an adjustment to the Contract Sum, the adjustment will be based on the mutual agreement of Contractor and Intermountain, including any terms mandated by unit price agreements or other terms of the Contract Documents.
- 7.4.2 Intermountain Resolution of Sum and Standards in the Absence of an Agreement Under Paragraph 7.4.1. In the absence of an agreement under Paragraph 7.4.1 above, the adjustment will be based on an itemized accounting of costs and savings supported by appropriate data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Paragraph will be limited to the following:
  - a. All direct and indirect costs of labor; including workers compensation insurance, social security and other federal and state payroll based taxes, and payroll based fringe benefits paid by Contractor so long as they are reasonable and no higher than that charged to other clients;
  - b. Costs of materials, on-site temporary facilities, supplies and equipment (except hand tools) required for or incorporated into the work;
  - c. Rental costs of machinery, equipment, tools (except hand tools), and on-site temporary facilities, whether rented from Contractor or others;
  - d. Costs of permits and other fees, sales, use or similar taxes related to the Work (with no markup);
  - e. Additional costs of field supervision and field office personnel directly attributable to the change; and
  - f. Overhead and profit by the markup limits in the Agreement for additional services or modifications which is not a penalty but a reasonable calculation agreed upon at the time of execution of the Agreement, and provided therein due to the fact that the actual amount due for this overhead and profit cannot easily be ascertained at the time of such execution. The markups set forth in the Agreement are to cover additional payment and performance bond premiums, insurance premiums, home office and on-site overhead and profit. Overhead and profit includes, but is not limited to Contractor's Project Manager and Cost Estimator. Each request for pricing will stand on its own and not be combined with other requests for pricing in determining the

allowed markup. A particular request for pricing will include all items reasonably related together and determinable at the time of the request. If several unrelated requests for pricing are grouped together in a single Change Order, each request for pricing will be considered separately for purposes of calculating the markup.

- 7.4.3 Credits. The amount of credit to be allowed by Contractor to Intermountain for a deletion or change which results in a net decrease in the Contract Sum will be actual net cost as confirmed to Intermountain based upon corroboration by an appropriate source.

## **7.5 Construction Change Directives.**

- 7.5.1 When Used and Contractor's Right to Challenge. A Construction Change Directive may be issued by Intermountain Representative in the case of a need for the Work to commence. If the Construction Change Directive leaves open the determination of additional time or money related to the directed change, then the Construction Change Directive will indicate the timeframe(s) in which further information is to be provided to resolve the matter. At any time that Intermountain and Contractor agree upon the time and money related to a Construction Change Directive, a Change Order will be executed by the parties. Additionally, the Construction Change Directive may be converted to a Change Order under Paragraph 7.2.2 or Article 7.3 above.
- 7.5.2 Proceed with Work and Notify Intermountain about Adjustment Method. Upon receipt of a Construction Change Directive, Contractor will promptly proceed with the change in the Work involved.
- 7.5.3 Interim Payments by Intermountain. Pending the final determination of the total cost of the Construction Change Directive, Intermountain will pay any undisputed amount to Contractor.

**7.6 A/E's Supplemental Instruction (Commonly referred to as an "ASI")**. A/E may at any time that is consistent with maintaining the quality, safety, time, budget and function of the Work, issue to Contractor a supplemental instruction ("ASI") after approval from Intermountain Representative is obtained. Contractor must file with Intermountain Representative a PCO under Paragraph 7.2.2 above, within twenty-one (21) Days of Contractor's receipt of the ASI, or the Contractor will be deemed to have waived any right to additional time or monies as a result of such ASI.

**7.7 Resolution of Disputes**. If a dispute arises between the Parties regarding the Contract Documents which is not resolved by agreement between the parties, before a party may proceed with judicial action, the dispute must be submitted in writing to Intermountain's Vice President of Financial Strategy, Growth and Development, at 36 South State Street, Salt Lake City, Utah 84111. Upon receipt of such written submission, Intermountain will schedule within seven (7) Days an initial conference or meeting, and if necessary within an additional ten (10) Days thereafter a further conference or meeting, as set forth in the escalation process herein below.

- 7.7.1 Escalation Process. The Parties will arrange in-person meetings or telephone conferences at mutually convenient times and places, according to the levels and time schedules set forth below. The Parties will use reasonable and good faith efforts in this escalation process to respond promptly and to resolve the dispute. Such meetings or conferences will constitute settlement negotiations and any settlement proposal made pursuant to such meetings or conferences will not be admissible as evidence of liability.

Levels and Representatives

Allotted Time Period from Notice  
or from Previous Level

Level 1

Contractor's Director level employee,  
and Intermountain's Director

7 Days

Level 2

Vice President or higher level executive

10 Days

7.7.2 Judicial Action. In the event that the parties do not resolve their dispute pursuant to the escalation process, either party may commence legal action to resolve the dispute. Any such action must be commenced within six (6) months from the first day of the initial Level 1 conference/meeting or be time barred. Submission of the dispute under the escalation process as outlined above is a condition precedent to the right to commence legal action to resolve any dispute. In the event that either party commences legal action to adjudicate any dispute without first submitting the dispute under the escalation process, the other party will be entitled to obtain an order dismissing the litigation without prejudice and awarding such other party any costs and attorney fees incurred by that party in obtaining the dismissal, including without limitation copy costs, and expert and consultant fees and expenses. Any such legal action must be brought exclusively in the state courts of the State of Utah or in the federal courts of the United States which are located in Salt Lake County, Utah. The Parties hereto hereby agree to submit to the exclusive jurisdiction and venue of such courts for the purposes hereof.

7.7.3 Continuation of Performance During Proceedings. Pending final resolution of a dispute hereunder, Contractor will proceed diligently with the performance of its obligations under the Contract Documents.

**7.8 Payment of Claim.**

7.8.1 When a standalone component of a Claim has received a final determination, and is no longer subject to review or appeal, that amount will be paid in accordance with the payment provisions of the Contract Documents or judicial order.

7.8.2 When the entire Claim has received a final determination, and is no longer subject to review or appeal, the full amount will be paid within thirty-one (31) Days of the date of the final determination unless the work or services has not been completed, in which case the amount will be paid in accordance with the payment provisions of the Contract Documents to the point that the work or services is completed.

7.8.3 The final determination date is the earlier of the date upon which the claimant accepted the settlement in writing with an executed customary release document and waived its rights of appeal, or the expiration of the appeal period, with no appeal filed, or the determination made resulting from the final appeal.

7.8.4 Any final determination where Intermountain is to pay additional monies to Contractor will not be delayed by any appeal or request for judicial review by another party brought into the process by Intermountain as being liable to Intermountain.

7.8.5 Notwithstanding any other provision of the Contract Documents, payment of all or part of a Claim is subject to any set-off, claims or counterclaims of Intermountain.

7.8.6 Payment to Contractor for a Subcontractor issue (Claim) deemed filed by Contractor, will be paid by Contractor to the Subcontractor in accordance with the contract between Contractor and the Subcontractor.



- 7.8.7 The execution of a customary release document related to any payment may be required as a condition of making the payment.

**7.9 Allocation of Costs of Claim Resolution Process.**

- 7.9.1 Except for attorneys' fees and expert fees, and unless otherwise agreed to by the parties to the Claim, the costs of resolving the Claim will be allocated among the parties on the same proportionate basis as the determination of financial responsibility for the Claim. The costs of resolving the Claim that are subject to allocation include the claimant's filing fee, the costs of any person(s) evaluating the Claim, the costs of making any required record of the process, and any additional testing or inspection procured to investigate and/or evaluate the Claim.
- 7.9.2 The prevailing party in any Claim, judicial action or other proceeding is entitled to recover its reasonable attorneys' fees, expert and other fees, and costs incurred in the proceeding, in addition to any other relief to which that party may be entitled.

**7.10 Alternative Procedures.** To the extent otherwise permitted by law, if all parties to a Claim agree in writing, a protocol for resolving a Claim may be used that differs from the process described in this Article 7.

**8. PAYMENTS AND COMPLETION.**

**8.1 Schedule of Values.** With the first Application for Payment, Contractor will submit to A/E and Intermountain Representative a schedule of values allocated to all the various portions of the Work. The Schedule of Values will be submitted on the form approved and provided by Intermountain. A/E will make recommendations to Intermountain Representative regarding the Schedule of Values including any suggested modifications. When approved, including any approved modifications, by Intermountain Representative, it will be the basis for future Contractor Applications for Payments. Contractor will not be entitled to payment until receipt and acceptance of the Schedule of Values.

**8.2 Applications for Payment.**

- 8.2.1 In General. The following general requirements will be met:
- a. Not more than once a month, Contractor will submit to A/E an itemized Application for Payment for Work completed in accordance with the schedule of values and that reflects retainage as provided for in the Contractor's Agreement. Contractor's Applications for Payment will include conditional or final lien waivers (as applicable), in the forms attached to Contractor's Agreement for itself and from each Subcontractor requesting payment, covering all payments requested in the Application for Payment. The Application for Payment will be on a form provided by Intermountain.
  - b. Such application will be supported by such data substantiating Contractor's right to payment as Intermountain or A/E may require. This data may include, but is not limited to, copies of requisitions from Subcontractors.
  - c. Such applications may include requests for payment pursuant to approved Change Orders or Construction Change Directives.
  - d. Such applications may not include requests for payment for portions of the Work performed by a Subcontractor when Contractor does not intend to pay to a Subcontractor because of a dispute or other reason.
  - e. In executing the Application for Payment, Contractor will attest that Subcontractors involved with prior applications for payment have been paid, unless Contractor provides a detailed explanation why such payment may not have occurred. Intermountain reserves the right to require Contractor to submit a payment waiver from one or more Subcontractors.
- 8.2.2 Payment for Material and Equipment. Unless otherwise provided in the Contract Documents, payments will 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 Intermountain and A/E, 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 will be conditioned upon compliance by Contractor with procedures satisfactory to Intermountain to establish Intermountain's title to such materials and equipment or otherwise protect Intermountain's interest, and will include applicable insurance, storage and transportation to the site for such materials and equipment stored on or off the site. Intermountain may require copies of invoices or other suitable documentation.

8.2.3 Warranty of Title. Contractor warrants that title to all Work covered by an Application for Payment will pass to Intermountain no later than the time for payment. 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 Intermountain will, to the best of Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of Contractor, Subcontractors, or other persons or entities making a claim by reason of having provided labor, materials and/or equipment relating to the Work.

8.2.4 Retainage and Holdback by Intermountain.

- a. *Holdback by Intermountain.* Notwithstanding anything to the contrary contained in the Contract Documents, Intermountain may, as a result of the Claim resolution process, withhold any payment to Contractor hereunder if and for so long as Contractor fails to perform any of its obligations hereunder or otherwise is in default under any of the Contract Documents.
- b. *Intermountain's Right to Withhold and Use Funds.* Intermountain may withhold from payment to Contractor such amount as, in Intermountain's judgment, may be necessary to pay just claims against Contractor or Subcontractors at any tier for labor and services rendered and materials furnished in and about the Work. Intermountain may apply such withheld amounts for the payment of such claims in Intermountain's discretion. In so doing, Intermountain will be deemed the agent of Contractor and payment so made by Intermountain will be considered as payment made under the Contract by Intermountain to Contractor. Intermountain will not be liable to Contractor for any such payment properly made. Such withholdings and payments may be made without prior approval of Contractor and may also be made before any determination as a result of any dispute, Claim or litigation. However, Contractor will be notified before any such withholding and will be given an opportunity to inform Intermountain as to any reason why the withholding will not occur.
- c. *Statutory Retainage.* Notwithstanding and in addition, retainage in the amount of 5% will be withheld from each payment to Contractor for any Work under the Contract. The retainage, including any additional retainage imposed and the release of any retainage, will be in accordance with Intermountain policies, including restrictions of retainage regarding Subcontractors and the distribution of interest earned on the retention proceeds. After Contractor achieves Substantial Completion and submits its payment request for retained funds and provides statutory Conditional Waiver and Release documents executed by all subcontractors and suppliers having claim against the retained funds, Intermountain will pay any unpaid statutory retention, less any offsets or withholdings for specific deficiencies or disputes, within forty-five (45) Days. Notwithstanding the foregoing, Intermountain may (but is not obligated to), in its sole discretion, release from time to time any portion of retention funds for early completing subcontractors and/or otherwise reduce the overall retention funds withheld.
- d. *Intermountain Not Responsible for Contractor's Retention Requirements.* Intermountain will not be responsible for enforcing Contractor's obligations under Utah law in fulfilling the retention law requirements with Subcontractors at any tier.

8.2.5 Reimbursement to Intermountain. Notwithstanding any other provision of the Contract, Contractor will reimburse Intermountain for the portion of any expenses paid by Intermountain to Contractor,

which is attributable to Contractor's breach of its duties under the Contract, including the breach of any duty by any Subcontractor or supplier at any tier or anyone for whom Contractor may be liable.

### **8.3 Certificates for Payment.**

- 8.3.1 Issued by A/E. A/E will within ten (10) Days after receipt of Contractor's Application for Payment, either issue to Intermountain a Certificate for Payment, with a copy to Contractor, for such amount as A/E determines due, or notify Contractor and Intermountain in writing of A/E's reasons for withholding certification in whole or in part as provided in Paragraph 8.4.1. If A/E fails to act within this ten (10) Day period, Contractor may file the Application for Payment directly with Intermountain Representative and Intermountain will thereafter have thirty-one (31) Days from the date of Intermountain's receipt to resolve the amount to be paid and to pay the undisputed amount. The accuracy of Contractor's Applications for Payment will be Contractor's responsibility, not A/E's.
- 8.3.2 A/E's Representations. A/E's issuance of a Certificate for Payment will constitute a representation to Intermountain that to the best of A/E's knowledge, information and belief, based upon A/E's observations at the site, the data comprising the Application for Payment, and what is reasonably inferable from the observations and data, that the Work has progressed to the point indicated in the Application for Payment and that the quality of the work is in accordance with the Contract Documents. The foregoing representations are subject to minor deviations from the Contract Documents correctable before completion and to specific qualifications expressed by A/E. The issuance of a Certificate for Payment will further constitute a representation that Contractor is entitled to payment in the amount certified. However, the issuance of a Certificate for Payment will not be a representation that A/E has (a) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work, (b) reviewed construction means, methods, techniques, sequences or procedures, (c) reviewed copies of requisitions received from Subcontractors and material suppliers and other data requested by Intermountain to substantiate Contractor's right to payment, (d) ascertained how or for what purpose Contractor used money previously paid on account of Contract Sum, or (e) any duty to make such inquiries.
- 8.3.3 Contractor Respond to Financial Responsibility and Related Requests, Waivers, Releases, Bonds. Contractor will respond immediately to any inquiry in writing by Intermountain as to any concern of financial responsibility and Intermountain reserves the right to request any waivers, releases or bonds from Contractor in regard to any rights of Subcontractors (including suppliers) at any tier or any third-party before any payment by Intermountain to Contractor.

### **8.4 Decisions to Withhold Certification.**

- 8.4.1 When Withheld. A/E may decide not to certify payment and may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect Intermountain, if in A/E's judgment the representations to Intermountain required in Paragraph 8.3.2 above cannot be made. If A/E is unable to certify payment in the amount of the Application, A/E will notify Contractor and Intermountain as provided in Paragraph above. If Contractor and A/E cannot agree on a revised amount, A/E will promptly issue a Certificate for Payment for the amount to which A/E makes such representations to Intermountain. A/E may also decide not to certify payment or, because of subsequently discovered evidence or observations, may nullify the whole or part of a Certificate for Payment previously issued, to such extent as may be necessary in A/E's opinion to protect Intermountain from loss because of:
- a. Defective Work not remedied;
  - b. Third party claims filed or reasonable evidence indicating probable filing of such claims;
  - c. Failure of Contractor to make payments properly to Subcontractors or for labor, materials or equipment;
  - d. Reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;

- e. Damage to Intermountain or another contractor;
  - f. 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
  - g. Failure to carry out the Work in accordance with the Contract Documents.
- 8.4.2 Certification Issued When Reasons for Withholding Removed. When the reasons stated in Paragraph 8.4.1 for withholding certification are removed, certification will be made for such related amounts.
- 8.4.3 Continue Work Even If Contractor Disputes A/E's Determination. If Contractor disputes any determination by A/E or the result of the Claim resolution process with regard to any Certification of Payment, Contractor nevertheless will expeditiously continue to prosecute the Work.
- 8.4.4 Intermountain Not in Breach. Intermountain will not be deemed to be in breach of this Contract by reason of the withholding of any payment pursuant to any provision of the Contract Documents provided Intermountain's action or such withholding is consistent with the results of the dispute resolution process.

## **8.5 Progress Payments.**

- 8.5.1 In General, Interest on Late Payments.
- a. Except as provided in Paragraph 8.3.1, Intermountain will pay any undisputed amount within thirty-one (31) Days of satisfaction of the following requirements: (i) Contractor has submitted the application for payment; (ii) A/E has issued to Intermountain a Certificate recommending payment; (iii) Contractor has obtained conditional or unconditional waiver and release documents executed by all of Subcontractors performing work and/or providing materials covered by the Contractor's payment request; and (iv) Contractor has provided all "as-built" drawings to A/E sufficient for A/E to compile and provide a final set of Record Drawings for each completed phase and for all portions of the Project for which a certificate of occupancy is issued. In no event will Intermountain be required to pay any disputed amount.
  - b. Except as otherwise provided by law, if any payment is made more than sixty (60) Days after receipt by Intermountain of the applicable invoice (with any required supporting documentation), the late payment will bear interest from the due date until payment is made at the rate of five percent (5%) per annum.
- 8.5.2 Contractor and Subcontractor Responsibility. Contractor will promptly pay each Subcontractor, upon receipt of payment from Intermountain, out of the amount paid to Contractor on account of such Subcontractor's portion of the Work, the amount to which this Subcontractor is entitled. Contractor will, by appropriate agreement with each Subcontractor, require each Subcontractor to make payment to its Subcontractors in a similar manner.
- 8.5.3 Information Furnished by A/E Or Intermountain to Subcontractor. A/E or Intermountain will, on request, furnish to the Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by Contractor and action taken thereon by A/E and Intermountain on account of portions of the Work done by such Subcontractor.
- 8.5.4 Intermountain and A/E Not Liable. Neither Intermountain nor A/E will have an obligation to pay, monitor or enforce the payment of money to a Subcontractor, except to the extent as may otherwise be required by law.
- 8.5.5 Certificate, Payment or Use Not Acceptance of Improper Work. A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by Intermountain will not constitute acceptance of Work that is not in accordance with the Contract Documents.

**8.6 Payment upon Substantial Completion.** Upon Substantial Completion of the Work or designated portion thereof and upon application by Contractor and certification by A/E, Intermountain will make payment, reflecting adjustment in retainage, if any, for such Work or portion thereof as provided in the Contract Documents. To the extent allowed by law, Intermountain may retain up to 200% of the fair market value of the work that has not been completed in accordance with the Contract Documents.

**8.7 Partial Occupancy or Use.**

8.7.1 In General. Intermountain 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 Contractor, 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 Intermountain 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 the warranties required by the Contract Documents. When Contractor considers a portion to be substantially complete, Contractor will prepare and submit a list to A/E as previously provided for herein. Consent of Contractor to partial occupancy or use will not be unreasonably withheld. Contractor will have continuing responsibility to protect the unoccupied portions of the site and the Work during such partial occupancy and will be responsible for damage except to the extent caused solely by Intermountain during such partial occupancy or use.

The stage of progress of the Work will be determined by written agreement between Intermountain and Contractor.

8.7.2 Inspection. Immediately before such partial occupancy or use, Intermountain, Contractor and A/E will 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.

8.7.3 Record Drawings. Contractor will provide all “as-built” drawings to A/E and A/E will then provide to Intermountain within forty-five (45) Days of any partial occupancy a final set of Record Drawings for the occupied phase or portion of the Project.

8.7.4 Not Constitute Acceptance. Except to the extent it is agreed upon in writing by Intermountain, partial occupancy or use of a portion or portion of the Work will not constitute acceptance of Work not complying with the requirement of the Contract Documents.

**8.8 Final Payment.**

8.8.1 Certificate for Payment. A/E’s final Certificate for Payment will constitute a further representation that the conditions listed in Paragraph 8.8.2 as precedent to Contractor’s being entitled to final payment have been fulfilled.

8.8.2 Conditions for Final Payment. Neither final payment nor any remaining retained percentage will become due until Contractor submits to A/E the following to the extent required by Intermountain Representative:

- a. A final payment request;
- b. Waiver and release upon final payment documents executed by all of the Subcontractors performing work and/or providing materials covered by the Contractor’s final payment request;
- c. An executed Substantial Completion form, which includes remaining Project items to be completed, Final Certificate of Occupancy from the applicable municipality, fire clearance(s) from Fire Marshal, Approval(s) from applicable State Dept. of Health, and any other permits/approvals for occupancy of Project as required by authorities with jurisdiction over the Project;
- d. Evidence satisfactory to Intermountain that all required utilities are installed, commissioned, and operating consistent with the Specifications;

- e. Confirmation of completion of any review or, if applicable, audit of Contractor's Payment Applications and reconciliation, as required by Intermountain;
- f. All manufacturers' and other guaranties and warranties, properly signed and endorsed to Intermountain, that are required by the Contract Documents that extend for a period beyond one year after substantial completion. (Delivery of such guaranties and warranties will not relieve Contractor for any obligation assumed under any other provision of the Contract Documents.);
- g. An affidavit that payrolls, bills for material and equipment, and other indebtedness connected with the Work for which Intermountain's property might be responsible or encumbered (less amounts withheld by Intermountain) have been paid or otherwise satisfied;
- h. A current or additional certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) Days prior written notice, by certified mail, return receipt requested, has been given to Intermountain;
- i. A written statement that Contractor knows of no substantial reason that the insurance will not be renewable to cover the period required by the Contract Documents;
- j. If requested by surety in a timely manner or by Intermountain, consent of surety, to final payment;
- k. Up to date "as-built" Drawings certified by Contractor as accurate and complete, Specifications, Addenda, Change Orders and other Modifications maintained at the site; the warranties, instructions, operation and maintenance manuals, and training videos required to be furnished by the Contract Documents;
- l. 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 Intermountain. If a Subcontractor refuses to furnish a release or waiver required by Intermountain, Intermountain may require consent of surety to the final payment. If such liens, claims, security interests or encumbrances remain unsatisfied after payments are made, Contractor will refund to Intermountain all money that Intermountain may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees; and
- m. A written statement demonstrating how Contractor will distribute interest earned on retention to Subcontractors as required by Section 13.8.5, U.C.A.

In addition, A/E must declare to Intermountain in writing that the Work is complete and provide a final set of Record Drawings. If the aggregate of previous payments made by Intermountain exceeds the amount due Contractor, Contractor will reimburse the difference to Intermountain within ten (10) Days of Intermountain's request.

- 8.8.3 Waiver of Claims: Final Payment. The making of final payment will not constitute a waiver of Claims or other rights by Intermountain.
- 8.8.4 Waiver by Accepting Final Payment. Acceptance of final payment by Contractor or a Subcontractor will constitute a waiver of Claims by that payee except those Claims previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.
- 8.8.5 Time of Repose and Waiver. In addition and notwithstanding, claims and invoices for work, equipment, services, or materials that are not submitted to Intermountain within one (1) year of Substantial Completion of the Project are completely void and unenforceable as against Intermountain. Contractor and all Subcontractors hereby waive all rights and claims against Intermountain attendant such claims and invoices, and Contractor will contractually obligate each Subcontractor to waive all rights and claims against Intermountain attendant such claims and

invoices. This provision imposes an absolute cut off on the timing for submitting such claims and invoices; this provision does not lengthen any timing requirements in the Contract Documents.

## **9. TESTS AND INSPECTIONS, SUBSTANTIAL AND FINAL COMPLETION, UNCOVERING, CORRECTION OF WORK, AND GUARANTY PERIOD.**

### **9.1 Tests and Inspections.**

- 9.1.1 In General. Tests, inspections and approvals of portions of the Work required by the Contract Documents or by laws, ordinances, rules, regulations, resolutions or orders of public authorities having jurisdiction will be made at an appropriate time. Unless otherwise specifically set forth in the Contract Documents or agreed to by Intermountain in writing, Intermountain will contract for such tests, inspections and approvals with an independent entity, or with the appropriate public authority, and Intermountain will bear all related costs of tests, inspections and approvals except as provided below. If any of the Work is required to be inspected or approved by the terms of the Contract Documents or by any public authority, Contractor will, at least two working days before the time of the desired inspection, and following the procedures established by Intermountain, request such inspection or approval to be performed. Contractor will give A/E timely notice of when and where tests and inspections are to be made so that A/E may observe such procedures.
- 9.1.2 Failure of An Inspector to Appear. Work will not proceed without any required inspection and the associated authorization by Intermountain to proceed unless the following procedures and requirements have been met:
- a. The inspection or approval was requested in a timely manner as provided in Paragraph 9.1.1;
  - b. Contractor received written confirmation from the inspection entity that the inspection was scheduled;
  - c. Contractor has contacted or attempted to contact the inspector to confirm that the inspector is unable to perform the inspection as scheduled;
  - d. If the inspector has confirmed that it is unable to perform the inspection as scheduled or if Contractor is unable to contact the inspector, Contractor will attempt to contact Intermountain Representative for instruction; and Contractor has documented the condition of the work before being covered through photos or other means.
- 9.1.3 Nonconforming Work. If such procedures for testing, inspection or approval under Paragraph 9.1.1 reveal failure of portions of the Work to comply with the requirements established by the Contract Documents, Contractor will bear all costs made necessary by such failure including those of repeated procedures and compensation for Intermountain's expenses, including the cost of retesting for verification of compliance if necessary, until Intermountain accepts the Work in question as complying with the requirements of the Contract Documents.
- 9.1.4 Certificates. Required certificates of testing, inspection or approval will, unless otherwise required by the Contract Documents, be secured by Contractor and promptly delivered to A/E.
- 9.1.5 A/E Observing. If A/E is to observe tests, inspections or approvals required by the Contract Documents, A/E will do so with reasonable promptness and, where practicable, at the normal place of testing.
- 9.1.6 Promptness. Tests, inspections and arrangements for approvals conducted pursuant to the Contract Documents will be made promptly to avoid unreasonable delay in the Work.

### **9.2 Inspections: Substantial and Final.**

- 9.2.1 Substantial Completion Inspection. Before requesting a substantial completion inspection, Contractor will prepare a comprehensive initial punchlist, including unresolved items from prior inspections, for review by Intermountain and A/E to determine if the Project is ready for a substantial completion inspection. If Intermountain determines that the initial punchlist indicates that the Project is not

substantially complete, the initial punchlist will be returned to Contractor with written comments. If Intermountain determines that the initial punchlist indicates that the Project may be substantially complete, A/E will promptly organize and perform a Substantial Completion inspection in the presence of Intermountain and all appropriate authorities.

- a. If A/E reasonably determines that the initial punchlist prepared by Contractor substantially understates the amount of the Work remaining to be completed and the Project is not substantially complete, A/E will report this promptly to Intermountain, and upon concurrence of Intermountain, Contractor will be assessed the costs of the inspection and punchlist preparation incurred by A/E and Intermountain.
- b. When the Work or designated portion thereof is Substantially Complete, A/E will prepare a Certificate of Substantial Completion which will establish the date of Substantial Completion; will establish responsibilities of Intermountain and Contractor for security, maintenance, heat, utilities, damage to the work and insurance; and will fix the time within which Contractor will finish all items on the punchlist accompanying the Certificate. The Certificate of Substantial Completion will require approval by Intermountain Representative. If there is a punchlist, Contractor will proceed promptly to complete and correct items on the list. Failure to include an item on the punchlist does not alter the responsibility of Contractor to complete all Work in accordance with the Contract Documents.
- c. Warranties required by the Contract Documents will commence on the date of Substantial Completion of the Work or designated portion thereof except to the extent as provided otherwise in the Contract Documents or if such warranty is related to an item where the work is not complete. Such warranty documents will state the length of the warranty, which must comply with the Contract Documents.
- d. The Certificate of Substantial Completion will be submitted by A/E to Intermountain and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.
- e. Except to the extent Intermountain Representative otherwise approves in advance and in writing, Contractor will submit the following documents in order to achieve Substantial Completion: written warranties, guarantees, operation and maintenance manuals, and all complete "as-built" Drawings. Contractor must also provide or obtain any required approvals for occupancy, and deliver "as-built" drawings to A/E sufficient to enable A/E to compile and provide a final set of Record Drawings for each completed phase and for each area for which a certificate of occupancy is issued within forty-five (45) Days of such issuance. Contractor is responsible for the guaranty of all Work, whether performed by it or by its Subcontractors at any tier.

9.2.2 Final Completion Inspection. Before requesting a final inspection, Contractor will verify all punchlist items are corrected/completed. Once all punchlist items are corrected/completed Contractor will notify Intermountain and request a final inspection. Intermountain will notify A/E and perform a final inspection. Two final inspections may be allowed due to required weather changes required to complete some items. When all punchlist items are completed a final pay request will be provided by Contractor, authorized by A/E and processed by Intermountain.

### **9.3 Uncovering of Work.**

- 9.3.1 Uncover Uninspected Work. Except as provided in Paragraph 9.3.3, if a portion of the Work is covered before an Inspector's approval to proceed, it must, be uncovered for the Inspector's inspection and be replaced at Contractor's expense without change in the Contract Time.
- 9.3.2 Observation before Covering. Except as provided in Paragraph 9.3.3, if Intermountain or A/E has requested in writing to observe conditions before any Work being covered or if such observation is specified in the Contract Documents, and the Work is covered without such observation, Contractor will be required to uncover and appropriately replace the Work at Contractor's expense without change in the Contract Time. If Contractor requests an inspection and Intermountain or A/E, including



any inspector of each, does not appear, Contractor will immediately notify Intermountain of such lack of appearance, but will not cover the Work without such inspection.

- 9.3.3 When an Inspector Fails to Appear Or A/E Or Intermountain Did Not Make Prior Request. If Work is performed by Contractor without an inspection as provided in Paragraph 9.1.2 or if a portion of the Work has been covered which A/E or Intermountain has not specifically requested to observe before its being covered or such observation is not specified by the Contract Documents, A/E or Intermountain may request to see such Work and it will be uncovered by Contractor. If such Work is in accordance with the Contract Documents, costs of uncovering and replacement, will, by appropriate Change Order, be charged to Intermountain. If such Work is not in accordance with the Contract Documents, Contractor will pay such costs unless the condition was caused by Intermountain or a separate contractor in which event Intermountain will be responsible for payment of such costs.

#### **9.4 Correction of Work and Guaranty Period.**

- 9.4.1 Contractor Correct the Work. Contractor will correct Work rejected by A/E, Inspector or Intermountain, 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. Contractor will bear the costs of correcting such rejected Work, including additional testing and inspections and compensation for A/E's and Inspector's services and expenses made necessary thereby.
- 9.4.2 Guaranty and Correction after Substantial Completion. 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 Paragraph 9.2.1 or by terms of an applicable special warranty or guaranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, including failure to perform for its intended purpose, Contractor will correct it promptly after receipt of written notice from Intermountain to do so unless Intermountain has previously given Contractor a written acceptance of such condition. The period of one year will be extended with respect to portions of the Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual performance of the Work. This obligation of Contractor under this Paragraph 9.4.2 will be operative notwithstanding the acceptance of the Work under the Contract, the final certificate of payment, partial or total occupancy and/or termination of the Contract. Intermountain will give notice of observed defects with reasonable promptness, however, failure to give such notice will not relieve Contractor of its obligation to correct the Work at the cost that Contractor would have incurred if Intermountain did so report with reasonable promptness. All corrected Work will be subject to a one-year guaranty period the same in all respects as the original Work, except that such guaranty period will commence from the time of Substantial Completion of the corrected Work. This guaranty period does not affect Intermountain's right to pursue any available remedies against Contractor.
- 9.4.3 Removal of Work.
- a. Contractor will promptly remove from the premises all Work that Intermountain and/or A/E determines as being in nonconformance with the Contract Documents, whether incorporated or not.
  - b. Contractor will promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to Intermountain.
  - c. Contractor will bear the expense of correcting destroyed or damaged construction, whether completed or partially completed, of Intermountain or of other contractors destroyed or damaged by such removal or replacement.

- d. If Contractor does not remove such rejected Work within a reasonable time, fixed by written notice, Intermountain may have the materials removed and stored at the expense of Contractor.
- e. If Contractor does not correct the nonconforming Work within a reasonable time, fixed by written notice, Intermountain may correct it in accordance with Paragraph 12.2.2 of these General Conditions.

9.4.4 Not Limit Other Obligations. Nothing contained in this Article 9.4 will be construed to establish a period of limitation with respect to other obligations which Contractor may have under the Contract Documents. Establishment of the time period of one year as described in Paragraph 9.4.2 relates only to the specific obligation of 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 Contractor's liability with respect to Contractor's obligations other than specifically to correct the Work.

## **9.5 Additional Warranties.**

9.5.1 In General. In addition to any other provisions of this Article 9, the following warranties will apply:

- a. Contractor warrants to Intermountain that materials and equipment furnished under the Contract will be of good quality and new, except to the extent otherwise required or expressly permitted by the Contract Documents.
- b. Contractor also warrants to Intermountain that the Work will be free from defects not inherent in the quality required or permitted and that the Work will conform to the requirements of the Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered Defective at Intermountain's option.

9.5.2 Correction of Work.

- a. Contractor will promptly correct any portion of the Work which is rejected by A/E, the inspector, or Intermountain, or which fails to conform to the requirements of the Contract Documents, whether observed before or after Substantial Completion and whether or not fabricated, installed, or completed. Contractor will bear the cost of correcting such rejected Work, including additional testing and inspection costs, compensation for A/E's services, and any other expenses made necessary thereby. Such costs will in no way be payable by Intermountain and will not increase the Contract Sum.
- b. Contractor will remedy any Defects due to faulty materials, equipment, or workmanship which appear within a period of one (1) year from the date of Substantial Completion or within such longer period of time as may be prescribed by law or by the terms of any applicable special warranty required by the Contract Documents. Contractor will pay all costs of correcting faulty work, including additional A/E fees, attorney fees, expert fees, consultant fees, copy costs, and other expenses when incurred. Such costs will in no way be payable by Intermountain and will not increase the Contract Sum.
- c. Nothing in the Contract Documents will be construed to establish a period of limitation within which Intermountain may enforce the obligation of Contractor to comply with the Contract Documents. The one (1) year period specified in paragraph 9.5.2(2) has no relationship to the time within which Intermountain may enforce compliance with the Contract Documents, nor to the time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations.

9.5.3 Exclusion. Unless due to the negligent or intentional act or omission of Contractor or those under Contractor's control, or as otherwise stated in the Contract Documents, Contractor's guaranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

9.5.4 Furnish Evidence on Request. If requested by A/E or Intermountain, Contractor will furnish satisfactory evidence as to the type and quality of materials and equipment.

**9.6 Acceptance of Nonconforming Work.** If Intermountain prefers to accept Work which is not in accordance with the requirements of the Contract Documents, Intermountain may do so in writing instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment will be effected whether or not final payment has been made. Without limitation, usage by Intermountain or A/E of mechanical devices, machinery, apparatus, equipment, or other work or materials supplied under the Contract Documents before written acceptance by Intermountain, will not constitute Intermountain's acceptance.

## 10. INSURANCE AND BONDS.

**10.1 Insurance.** To protect against liability, loss and/or expense arising in connection with the performance of services described under the Contract Documents, Contractor will obtain and maintain in force as set forth below in section 10.1.9 without interruption, the following stated insurance, in a form and content satisfactory to Intermountain, from insurance companies authorized to do business in the State in which the Project is located with an A.M. Best's Rating of A- or better and Class VII or better. Contractor will require all Subcontractors to have and maintain similarly required policies. All of the following listed insurance coverages will be provided by Contractor.

10.1.1 Contractor's Commercial General Liability Insurance. Contractor will maintain coverage, with ISO Form CG 00 01 or other policy form satisfactory to Intermountain, on an occurrence basis, including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury, and Broad-Formed Property Damage (including coverage for Explosion, Collapse, and Underground hazards), which will provide primary coverage to the additional insureds (Intermountain and the A/E) in the event of any occurrence, claim, or suit, with per occurrence and annual aggregate policy limits of at least as follows:

\$2,000,000	General Aggregate;
\$2,000,000	Products-Completed Operations Aggregate;
\$1,000,000	Personal and Advertising Injury;
\$1,000,000	Each Occurrence.

Intermountain reserves the right to require additional coverage limits of liability from that stated above. Intermountain also reserves the right to require project specific insurance, and if such right has been exercised it will be indicated in the Contract Documents.

10.1.2 Excess and Umbrella Liability Insurance. Contractor will maintain excess and liability insurance with coverage at least as broad as the underlying liability insurance described in this section, written on an occurrence basis with per occurrence and annual aggregate policy limits based on the following chart, unless modified by mutual agreement of the parties,

Small Project (\$2,000,000 or less)
Minimum Commercial General Liability Coverage
\$1,000,000 each occurrence,
\$3,000,000 general aggregate
Medium Project (\$2,000,001 to \$10,000,000)
Minimum Commercial General Liability Coverage
\$5,000,000 each occurrence,
\$10,000,000 general aggregate
Large Project (Greater than \$10,000,000)
Minimum Commercial General Liability Coverage

\$10,000,000 each occurrence,  
\$20,000,000 general aggregate

For insurance purposes, the size of the Project will be specified in the Contractor's Agreement. Such excess or umbrella liability policy will follow form with the primary liability policies, and contain a drop-down provision in case of impairment of underlying limits.

- 10.1.3 Workers' Compensation Insurance and Employers' Liability Insurance. Worker's Compensation Insurance will cover full liability under the Worker's Compensation Laws of the jurisdiction in which the Project is located at the statutory limits required by this jurisdiction's laws. Contractor will also maintain Employer's Liability Insurance with limits of at least \$1,000,000 each accident, \$1,000,000 for bodily injury by accident, and \$1,000,000 each employee for injury by disease. Contractor will collect and keep on-file evidence that Contractor and all tiers of Subcontractors have current certificates of this Workers Compensation Insurance (as required by State statute) as well as Employer's Liability Insurance, and will produce them upon request by Intermountain.
- 10.1.4 Automobile. Automobile liability insurance for claims arising from the ownership, maintenance, or use of a motor vehicle. The insurance will be written on an "occurrence" form and will apply to "any auto" and will cover all owned, non-owned, and hired automobiles used in connection with the work, with the following minimum limits of liability: \$1,000,000 – Combined Single Limit Bodily Injury and Property Damage per Occurrence.
- 10.1.5 Pollution Liability Insurance. Pollution Liability Insurance covering Contractor's or appropriate Subcontractor's liability for bodily injury, property damage and environmental damage resulting from sudden, accidental, and gradual pollution and related cleanup costs incurred by Contractor, all arising out of the goods delivered or Work and services performed (including transportation risk) under this Contract, is required with limits of at least \$1,000,000 per claim and \$1,000,000 annual aggregate.
- 10.1.6 Aircraft Use. Contractor using its own manned or unmanned aircraft, or employing manned or unmanned aircraft in connection with the work performed under the Contract Documents will maintain Aircraft Liability Insurance with a combined single limit of not less than \$1,000,000 per occurrence. This certificate will state that the policy required by this paragraph has been endorsed to name Intermountain as an Additional Insured.
- 10.1.7 Policy Aggregate(s). Unless project specific insurance is required by Intermountain, the above insurance coverages will be written or endorsed under a policy to have general, per occurrence, and aggregate limits of liability applicable to this project only.
- 10.1.8 Certificates. Before the Contract Documents are executed, Contractor will submit certificates in form and substance satisfactory to Intermountain as evidence of the insurance requirements of this Article 10. Contractor will obtain copies of Additional Insured (Ongoing and Completed Operations), Waiver of Subrogation, and Primary and Non-Contributory Endorsements and/or policy clauses. The certificates will contain provisions that no cancellation, or non-renewal will become effective except upon thirty (30) Days prior written notice by US Mail to Intermountain as evidenced by return receipt, certified mail sent to Intermountain. Contractor will notify Intermountain within thirty (30) Days of any claim(s) against Contractor which singly or in the aggregate exceed 20% of the applicable required insured limits and Contractor will, if requested by Intermountain, use its best efforts to reinstate the policy within the original limits and at a reasonable cost. Intermountain will be named as an additional insured party, as primary coverage and not contributing, on all the insurance policies required by this Article, except the professional liability and workers' compensation policies, by endorsements satisfactory to Intermountain -- using a combination of ISO forms CG 20 10 (07/04), Additional Insured – Owners, Lessees or Contractors – Scheduled Person or Organization and CG 20 37 (07.04) Additional Insured – Owners, Lessees or Contractors – Completed Operations, or other forms acceptable to Intermountain, naming Intermountain and A/E as additional insureds. Intermountain reserves the right to request Contractor to provide a loss report from its insurance carrier. Contractor will collect and keep on-file evidence that Contractor and each Subcontractor has

current certificates of Commercial General Liability Insurance, Excess /Umbrella Liability Insurance, and other insurance required herein, and will produce them upon request by Intermountain.

- 10.1.9 Maintain throughout Contract Documents Term. Contractor will maintain, from commencement of the Work, insurance coverage required in Articles 10.1 and 10.2 as follows:
- a. Commercial General Liability Insurance through expiration of the statute of limitations/repose for completed operations, but in no event less than ten (10) years from completion of the Project; and
  - b. All other insurance through final payment.
- 10.1.10 Waivers of Subrogation. Contractor waives all rights against Intermountain and other additional insureds for recovery of damages to the extent the losses and damages are covered by existing insurance, including without limitation commercial general liability, commercial excess/umbrella liability, business auto liability, workers compensation or employer's liability insurance, and pollution liability insurance. Contractor will ensure that all insurance policies required herein will be endorsed to include waivers of subrogation in favor of Intermountain. Contractor hereby waives all rights of subrogation against Intermountain.
- 10.1.11 Excess Coverages. Any type of insurance or any increase of limits of liability not described in the Contract Documents which Contractor requires for its own protection or on account of any statute, rule or regulation, will be its own responsibility and at its own expense.
- 10.1.12 Not Relieve Contractor of Liability. The carrying of any insurance required by the Contract Documents will in no way be interpreted as relieving Contractor of any other responsibility or liability under the Contract Documents or any applicable law, statute, rule, regulation, or order.
- 10.1.13 Contractor Compliance with Policies. Contractor will not violate or permit to be violated any of the provisions of the insurance policies required under the Contract.
- 10.1.14 Deductible Liability. Any and all deductibles in the above described policies will be assumed by, for the account of, and at the sole risk of Contractor. The allowable deductible for any of the Contractor insurance policies required by these General Conditions shall be no less than \$1,000 or 0.1 percent of the Contract Amount, whichever is greater.

## **10.2 "Builder's Risk" Property Insurance.**

- 10.2.1 In General. Intermountain will provide through Substantial Completion "Builder's Risk" property insurance for the cost of the Project. The policy will be written on an all risk basis, with exclusions standard for the insurance industry, on policy forms currently and commercially available, with insurance carriers selected by Intermountain.
- 10.2.2 Deductible. The above described "Builder's Risk" policies shall be subject to a total deductible of \$5,000 per loss occurrence, which deductible shall be assumed by Contractor or Subcontractors, in proportion to their share of the total amount of an insured loss occurrence.
- 10.2.3 Waiver. To the extent damages are covered by the above described "Builder's Risk" policies, Contractor, including all Subcontractors and Material Suppliers, and Intermountain hereby waive all rights against each other for damages caused by perils insured against under the "Builder's Risk" insurance provided. Contractor will require similar waivers from each of their contractors, subcontractors, material suppliers, sub-consultants and agents, at any tier.
- 10.2.4 Policy Terms. Intermountain will provide a copy of the terms and conditions of the builders risk policy to Contractor upon Contractor's request. Contractor will comply with terms, conditions, and deadlines of the builders risk policy. The terms, conditions, and deadlines of the builders risk policy shall govern coverage. Contractor will cooperate with Intermountain and the builders risk commercial insurer in the investigation, documentation, and settlement of loss claims, including

without limitation promptly responding to all requests for information and documentation from the builders risk commercial insurer and/or Intermountain.

- 10.2.5 Special Hazards. Intermountain will bear the risk of loss, delay and/or damage due to earthquake and/or flood and may either insure or self-insure that risk.

**10.3 Performance Bond and Payment Bond.** If required by the Contract Documents, Contractor will before commencement of the Work or within ten (10) Days after signing the Agreement, whichever is earlier, submit and maintain in full force and effect as required by law and the Contract Documents, as part of the Construction Costs for the Project, written on Form AIA Document A312 (1984) or on other forms provided by Intermountain, and include as part of the quoted total all costs involved in securing and furnishing, a performance bond and a labor and material payment bond the bonds listed below, based on the completed cost of the Contract and effective upon execution of the Contract. These bonds will be from a surety company or companies licensed in the state in which the Project is located and holding valid certificates of authority under Sections 9304 to 9308, Title 31, of the United States Code as acceptable sureties or reinsurance companies on federal bonds, have a penal sum obligation not exceeding the authorization shown in the current revision of Circular #570 as issued by the United States Treasury Department, i.e. "Treasury List", and be accompanied by a certified copy of the power of attorney stating the authority of the attorney-in-fact executing the bonds on behalf of the surety.

- a. A full 100 percent performance bond covering the faithful execution of the Contract in accordance with the Contract Documents; and
- b. A full 100 percent payment bond covering payment of all obligations arising under the Contract Documents, for the protection of each person supplying labor, service, equipment, or material for the performance of the Work.

All Subcontractor performance and payment bonds will name Contractor and Intermountain as Obligee. Intermountain reserves the right to reject any surety company, performance bond, or labor and material payment bond with or without cause.

**10.4 Intermountain Self-Insurance.** Intermountain may, at its option, satisfy any insurance requirements applicable to Intermountain through its self-insurance and risk management program.

## **11. MISCELLANEOUS PROVISIONS.**

**11.1 A/E's Responsibilities.** These General Conditions are not intended to provide an exhaustive or complete list of A/E's responsibilities. A separate agreement between Intermountain and A/E incorporates these General Conditions by reference and includes additional design responsibilities.

**11.2 Successors and Assigns.** Intermountain and Contractor respectively bind themselves, to the other party in respect to covenants, agreements and obligations contained in the Contract Documents. Contractor will not assign the Contract, or any of its rights or obligations under the Contract, without the prior written consent of Intermountain, nor will Contractor assign any amount due or to become due as well as any rights under the Contract, without prior written consent of Intermountain. Intermountain may assign the Contract to an institutional lender providing financing for the Project. In such event, the lender will assume Intermountain's rights and obligations under the Contract. Contractor will execute all consents reasonably required to facilitate such assignment.

**11.3 Written Notice.** Written notice will be deemed to have been duly served if (a) 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 (b) delivered at or sent by registered or certified mail, return receipt requested, or (c) deposited for delivery with a nationally recognized overnight courier service, to the last business address known to the party giving notice.

**11.4 Rights and Remedies.**

- 11.4.1 **Not Limit.** Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder will be in addition to and not a limitation of duties, obligations, rights and remedies otherwise imposed or available by law.
- 11.4.2 **Not Waiver.** Except as expressly provided elsewhere in the Contract Documents, no action or failure to act by Intermountain, A/E or Contractor will constitute a waiver of a right or duty afforded them under the Contract Documents, nor will such action or failure to act constitute approval or acquiescence in a breach thereunder, except as any of the above may be specifically agreed to in writing. In no case will Contractor or any Subcontractors be entitled to rely upon any waiver of any of these General Conditions unless agreed to in writing by Intermountain.
- 11.5 Use of Intermountain Forms.** Unless otherwise specifically identified in the Contract, all references or requirements for use or submission of documents to Intermountain, to A/E, or to others must be on Intermountain's approved forms. These forms include, without limitation, pay application, requests for payment, proposed change orders, change orders, modifications, requests for information, continuation sheets, waiver and lien releases, verifications, and other project related documents. Notwithstanding, Intermountain may in its sole discretion accept alternate forms. However, Intermountain's acceptance of an alternate form in one instance does not waive or modify the requirements herein for subsequent submissions.
- 11.6 Governing Law, Jurisdiction and Venue.** To the maximum extent permitted by law, Utah laws, excluding its conflict-of-law provisions, govern the Contract and both Intermountain and Contractor submit to the exclusive jurisdiction and venue of state and federal courts located in Salt Lake County, Utah.
- 11.7 Interpretation.** In the interest of brevity, the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an", but the fact that a modification or an article is absent from the statement and appears in another is not intended to affect the interpretation of either statement.
- 11.8 Severability.** The invalidity of any part, paragraph, subparagraph, phase, provision or aspect of the Contract documents will not impair or affect in any manner the validity, enforceability or effect of the remainder of the Contract Documents.
- 11.9 Construction of Words.** Unless otherwise stated in the Contract Documents, words, which have well-known technical or construction industry meanings, will be construed as having such recognized meanings. Unless the context requires otherwise, all other technical words will be construed in accordance with the meaning normally established by the particular, applicable profession or industry. All other words, unless the context requires otherwise, will be construed with an ordinary, plain meaning.
- 11.10 No Third-Party Rights.** The Contract Documents will not be construed to create a contractual relationship of any kind (1) between A/E and Contractor, (2) between Intermountain and a Subcontractor or (3) between any persons or entities other than Intermountain and Contractor. Nothing contained herein will be deemed as creating third party beneficiary contract rights or other actionable rights or duties as between Contractor and A/E, or as between Intermountain, Contractor, or A/E on the one hand, and any other person or entity.
- 11.11 Change of Control.** If a third party acquires a controlling interest (i.e., 50% ownership or more) of Contractor, then (a) Contractor will notify Intermountain within fifteen (15) Days of that acquisition, and (b) upon that acquisition, Intermountain may terminate for cause the Contract immediately upon written notice to Contractor.
- 11.12 Entire Agreement and Amendment Limitation.** The Contract represents the entire and integrated agreement between Intermountain and Contractor and supersedes all prior negotiations, representations or agreements, either written or oral. The Contract may be amended or modified only by (1) a written amendment executed by both Intermountain and Contractor, or (2) by a Modification.

- 11.13 Notices.** Any notice required by the Contract will be served upon the recipient’s designated representative by hand delivery at the last known business address, or by mail or nationally recognized overnight courier service with “delivery confirmation” to the last known address.
- 11.14 No Publicity.** Without receiving prior written approval from an Intermountain vice president, Contractor will not distribute any publicity regarding the Contract.
- 11.15 Waivers.** No waiver by Intermountain or Contractor of any default will constitute a waiver of the same default at a later time or of a different default.
- 11.16 Waiver of Consequential Damages.** Intermountain and Contractor waive all claims against each other for any consequential damages that may arise out of or relate to the Contract. Intermountain waives damages including but not limited to is loss of use of the Project, any rental expenses incurred, loss of income, profit, or financing related to the Project, loss of business, the services of employees, or loss of reputation. Contractor waives damages including but not limited to the loss of business, loss of financing, principal office overhead and expenses, loss of profits not related to this Project, loss of bonding capacity or loss of reputation. This section may not be construed to preclude recovery of consequential damages when such damages are actually recovered from insurance policies required by the Contract Documents. The provisions of this section also apply to the termination of the Contract and survive such termination.
- 11.17 Compliance.**
- 11.17.1 Remuneration. Remuneration flowing between the parties is at fair market value for actual and necessary items furnished or services rendered, is based upon an arm’s-length transaction, and does not take into account, directly or indirectly, the value or volume of any past or future referral or other business generated between the parties (or of any referral or business of any principal, affiliate, or immediate family member - as those terms may be defined by applicable laws - of either party).
- 11.17.2 Financial Relationships. To its knowledge, Contractor (a) is not a physician-owned entity and (b) has no prohibited financial relationship with any physician who is in a position to generate business for Intermountain, or with an immediate family member of that physician. Intermountain defines a “physician-owned entity” as any entity in which a physician, or immediate family member of a physician, holds an ownership, investment, or royalty interest (if royalties are paid on any purchase resulting from the royalty holder’s order). The Code of Federal Regulations (CFR) defines “financial relationship” (in 42 CFR 411.354) and “immediate family member” (in 42 CFR 411.351).
- [Note: Physicians and their immediate family members may own investment securities of Contractor if that investment complies with 42 CFR 411.356(a) or (b), and may have a compensation arrangement that both complies with 42 CFR 411.357(p) and does not take into account the volume or value of referrals or other business generated for Intermountain by a physician or a physician’s immediate family members.]
- 11.17.3 Exclusion or Sanction. Contractor warrants that neither it, or any of its affiliates or employees, excluded from participation in, or sanctioned under, any state or federal healthcare program, including those set forth in 42 U.S.C. §1320a 7b(f). Contractor will notify Intermountain immediately in writing if the warranty in the preceding sentence is, or becomes, inaccurate during the Term.
- 11.17.4 Access to Books and Records. Intermountain is a provider under Federal Medicare programs and is subject to Section 952 of the Omnibus Reconciliation Act of 1980. That law requires Intermountain, as a provider, to include the following provision in its agreements with suppliers who receive \$10,000 or more under an agreement with Intermountain. If requested by the Secretary of HHS, by the U.S. Comptroller, or by an authorized representative of either of them, Contractor will make available to the requestor the Contract and Contractor’s books, documents, and records to allow the requestor to certify the nature and extent of the charges for services provided under the Contract and charged to Medicare. Contractor will continue to make those items available for four years after Contractor



furnishes the final products (or services) under the Contract. If Contractor contracts with another to carry out any of Contractor's duties under the Contract and the Subcontractor is to receive \$10,000 or more in value under that subcontract, then Contractor will obtain a written contractual commitment from the Subcontractor to comply with the obligations of this section of the Agreement. The obligations of this Section survive the expiration or other termination of the Contract.

11.17.5 Code of Ethics. In its dealings with Intermountain, Contractor has and will comply with all codes of ethics applicable to suppliers and their interactions with purchasers like Intermountain, including, without limitation, the AdvaMed Code of Ethics on Interactions with Health Care Professionals.

11.17.6 Facility Access Policy. All of Contractor's representative(s) entering any Intermountain facility must comply with Intermountain's Facility Access Policy. This policy requires each of these Contractor representatives to check in with Intermountain on each visit to an Intermountain facility to receive an identification badge; and as applicable, log onto: <https://intermountainhealthcare.org/supply-chain-organization/for-suppliers/for-current-suppliers/access-to-intermountain-facilities/> and complete the registration requirements. Please contact Intermountain representative with any questions.

11.17.7 Equal Opportunity. Affirmative Action. Intermountain is an equal opportunity employer and federal contractor. Consequently, the parties agree that, to the extent applicable, they will comply with the following, which are incorporated herein by reference: 41 CFR 60 1.4(a), 41 CFR 60 300.5(a), 41 CFR 60 741.5(a), and Executive Order 13496 (29 CFR Part 471, Appendix A to Subpart A), relating to the notice of employee rights under federal labor laws, specifically:

- a. Intermountain and Contractor will abide by the requirements of 41 CFR 60 300.5(a), as applicable. This regulation prohibits discrimination against qualified protected veterans, and requires affirmative action by covered prime contractors and Subcontractors to employ and advance in employment qualified protected veterans.
- b. Intermountain and Contractor will abide by the requirements of 41 CFR 60 741.5(a), as applicable. This regulation prohibits discrimination against qualified individuals on the basis of disability, and requires affirmative action by covered prime contractors and Subcontractors to employ and advance in employment qualified individuals with disabilities.

11.17.8 Remedies. If Contractor breaches any obligation of this section, Intermountain may immediately terminate for cause the Contract upon written notice to Contractor.

**11.18 Work Restrictions / Drug Testing**. Contractor will ensure that Contractor, its agents, employees, and all Subcontractors do not use or consume alcohol or cannabis, or illegally use drugs, upon Intermountain's property or enter upon or perform any work on Intermountain's property while under their influence. Contractor will obtain necessary consents and will conduct periodic inspections and drug testing to monitor and ensure compliance with these requirements. Contractor will bear the expenses of such inspections and drug testing and will hold Intermountain harmless from all claims arising out of or relative thereto. In addition, Contractor will ensure that Contractor and all Subcontractors do not smoke or vape anything upon Intermountain's property except and only within designated smoking areas approved by Intermountain.

**11.19 Utah State Sales Tax**. Contractors should be exempt on purchases of material installed or converted into real property to be used by Intermountain. The Contractor will furnish each vendor with Intermountain's Tax exemption number.

**11.20 Notice of Intent to Obtain Final Completion**. Contractor shall file with the Utah State Construction Registry, on its own behalf and/or on behalf of Intermountain, a notice of intent to obtain final completion at least forty-five (45) Days before the day on which Intermountain or Contractor files or could file a notice of completion under Utah statutes if: (1) the completion of performance time under the original contract for construction work is greater than one hundred twenty (120) Days; (2) the total

original construction contract price exceeds \$500,000; and (3) neither Contractor nor Intermountain has obtained a payment bond in accordance with Utah Code Ann. Section 14-2-1.

**11.21 Notice of Completion.** Within five (5) Days of final completion of the Project and in compliance with Section 38-1a-507 Utah Code Annotated, Contractor shall file with the Utah State Construction Registry, and copy to Intermountain, a notice of completion which shall include, without limitation, the following:

- a. The name, address, telephone number, and email address of the person filing the notice of completion;
- b. The name of the county in which the Project and/or Project site is located;
- c. The date on which final completion is alleged to have occurred;
- d. The method used to determine final completion; and
- e. One of the following:
  1. The tax parcel identification number of each parcel included in the Project and/or Project site;
  2. The entry number of a preliminary notice on the same project that includes the tax parcel identification number of each parcel included in the Project and/or Project site; or
  3. The entry number of the building permit issued for the Project.

Notwithstanding any other provision of the Contract Documents to the contrary, Contractor and Intermountain agree that any breach or failure to comply with this requirement by Contractor will constitute a breach of contract and the Contractor will be liable for any direct, indirect, or consequential damages to Intermountain flowing from this breach.

**11.22 Audit Rights.** Contractor will keep, maintain and preserve complete, current and accurate books, records, and accounts of the transactions contemplated by this Agreement and such additional books, records and accounts as are necessary to establish and verify Contractor's compliance with the Contract. All these books, records and accounts will be available for inspection and audit by Intermountain and/or an independent third party designated by Intermountain and approved by Contractor at any time during the Term and for two (2) years thereafter, but only during reasonable business hours and upon reasonable notice. In addition:

- a. Intermountain agrees that its routine audits will not be conducted more frequently than once in any consecutive twelve (12) month period.
- b. If, after any audit of Contractor, Intermountain requires additional information regarding the transactions contemplated by the Contract, Contractor will furnish to Intermountain or to the third-party audit firm any additional information Intermountain specifies that relates to the audit period to establish and verify Contractor's compliance with the Contract Documents.
- c. Intermountain's right to inspect and audit is without prejudice to any other or additional rights or remedies of either party.
- d. Contractor agrees to not unreasonably withhold approval of any independent third-party audit firm.
- e. If an audit reveals an overcharge incurred by Intermountain on this Project, Contractor will provide a written response explanation, correct any error and remit any monies due within ten (10) Days after receiving notice of the error or overcharge.

Intermountain may audit applications for payments or any other aspect of the Services and Work of Contractor and of the Subcontractor or suppliers at any tier. Contractor will cooperate with Intermountain in providing all necessary information for any Intermountain audit.

## **12. TERMINATION OR SUSPENSION OF THE CONTRACT.**

### **12.1 Termination by Contractor.**

- 12.1.1 In General. If the Work is stopped for a period of ninety (90) Days through no act or fault of Contractor or a Subcontractor, or their agents or employees or any other persons performing portions of the Work under contract with any of the above, Contractor, may terminate the Contract in accordance with 12.1.2 herein below for any of the following reasons:
- a. Because Intermountain has persistently failed to fulfill fundamental Intermountain's obligations under the Contract Documents with respect to matters important to the progress of the Work;
  - b. Issuance of an order of a court or other public authority having jurisdiction which necessitates such termination, except that where Contractor has standing, Contractor must cooperate in efforts to stay and/or appeal such order;
  - c. A governmental declaration of national emergency, making material unavailable; or
  - d. Unavoidable casualties or other similar causes as listed in Paragraph 12.2.2(2) herein below.
- 12.1.2 Notice. If one of the reasons for termination in Paragraph 12.1.1 hereinabove exist, Contractor may, upon ten (10) additional Days' written notice to Intermountain and A/E, and such condition giving cause for termination still not cured, terminate the Contract and recover from Intermountain payment for Work executed and for proven loss with respect to materials, equipment, tools, and construction equipment and machinery, including reasonable overhead, profit and damages associated only with work completed before the notice of termination.

### **12.2 Termination by Intermountain for Cause.**

- 12.2.1 In General. Intermountain may terminate the Contract if Contractor fails to cure any of the following within a period of ten (10) Days (or longer if Intermountain so approves in writing) after receipt of notice from Intermountain specifying the cause for termination:
- a. Contractor refuses or fails to supply enough properly skilled workers or proper materials;
  - b. Contractor fails to make payment to Subcontractors for materials or labor in accordance with the respective agreements between Contractor and the Subcontractors;
  - c. Contractor disregards laws, ordinances, or rules, regulations, resolutions or orders of a public authority having jurisdiction; or
  - d. Contractor fails to perform the Work within the time specified in the Contract Documents or any authorized extension thereof or Contractor fails to make progress with the Work as to endanger such compliance;
  - e. Contractor fails to perform the Work or is otherwise in breach of a provision of the Contract Documents;
  - f. Contractor fails to respond promptly to the financial responsibility inquiry herein;
  - g. As permissible by law for a reason to terminate, Contractor is adjudged bankrupt;
  - h. As permissible by law for a reason to terminate, Contractor should make a general assignment for the benefit to creditors;
  - i. As permissible by law for a reason to terminate, Contractor has or should have a receiver appointed on account of Contractor's insolvency; or
  - j. Contractor fails to follow the material safety requirements and precautions either as expressly provided in the Contract Documents or as consistent with the customary practices in the industry.

- 12.2.2 Intermountain's Right to Carry Out the Work. If Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten (10) Day period (or longer if approved by Intermountain in writing) after receipt of written notice from Intermountain to cure such default or neglect, Intermountain may without prejudice to other remedies Intermountain may have, correct such deficiencies, including taking over the Work and prosecuting the same to completion, by contract or otherwise, and may take possession of, and utilize in completing the Work, such materials, appliances, and facilities as may be on the site of the Work as well as the site as necessary for its proper completion. In such case, Intermountain will offset from payments then or thereafter due Contractor the cost of correcting such deficiencies, including compensation for A/E, Intermountain's staff and legal counsel's additional services and expenses made necessary by such default, neglect or failure. If payments then or thereafter due Contractor are not sufficient to cover such amounts, Contractor will pay the difference to Intermountain. Contractor will continue performance of the Contract to the extent not terminated.
- 12.2.3 Items Required to Be Transferred or Delivered. Intermountain may require Contractor to transfer title and deliver to Intermountain, in the manner and to the extent directed by Intermountain:
- a. Any completed portion of the Work; and
  - b. Any partially completed portion of the Work and any parts, tools, dies, jigs, fixtures, drawings, information, and contract rights (hereinafter called "construction materials") as Contractor has specifically produced or specifically acquired for the performance of such part of this Contract as has been terminated; and Contractor will, upon direction of Intermountain, protect and preserve property in the possession of Contractor in which Intermountain has an interest.
- 12.2.4 Payment. When Intermountain terminates the Contract for one or more of the reasons stated in Paragraph 12.2.1, Intermountain may withhold payment and/or pursue all available remedies.
- 12.2.5 Intermountain Protection If Lienable. When the subject property is lienable, Intermountain may withhold from amounts otherwise due Contractor for such completed Work or construction materials such sum as Intermountain determines to be necessary to protect Intermountain against loss because of outstanding liens or claims for former lien holders.
- 12.2.6 Credits and Deficits. If the unpaid balance of the Contract Sum exceeds the full cost of finishing the Work, including compensation for A/E's services and expenses made necessary thereby, such excess will be paid to Contractor. If such cost exceeds the unpaid balance, Contractor will pay the difference to Intermountain this obligation for payment will survive the termination of the Contract.
- 12.2.7 If Contractor Found Not in Default or Excusable. If, after notice of termination of the Contract under the provisions of this Article, it is determined for any reason that Contractor was not in default under the provisions of this Article, or that the default was excusable under the provisions of this Article, the rights and obligations of the parties will be the same as if the notice of termination had been issued pursuant to the termination for convenience provisions.
- 12.2.8 Rights and Remedies Not Exclusive. The rights and remedies of Intermountain provided in this Article 12.2 will not be exclusive and are in addition to any other rights and remedies provided by law or under this Contract.

### **12.3 Suspension, Delay or Interruption of Work by Intermountain for Convenience.**

- 12.3.1 By Intermountain in Writing. Intermountain may in writing and without cause, order Contractor to suspend, delay or interrupt the Work in whole or in part for such period of time as Intermountain may determine to be appropriate for the convenience of Intermountain.
- 12.3.2 Adjustments. Any adjustment in Contract Sum and Contract Time will be in accordance with Articles 3, 4, and 7.

## 12.4 Termination for Convenience of Intermountain.

- 12.4.1 In General. The performance of Work under this Contract may be terminated by Intermountain in accordance with this Article 12.4 in whole, or from time to time, in part, whenever Intermountain will determine that such termination is in the best interest of Intermountain or any person for whom Intermountain is acting under this Contract. Any such termination will be effected by delivery to Contractor of a notice of termination specifying the extent to which performance of Work under the Contract is terminated, and the date upon which such termination becomes effective.
- 12.4.2 Contractor Obligations. After receipt of a notice of termination, and except as otherwise directed by Intermountain in writing, Contractor will:
- a. Stop work under the Contract on the date and to the extent specified in the notice of termination;
  - b. Place no further orders or subcontracts for materials, services or facilities, except as may be necessary for completion of such portion of the Work under the Contract as is not terminated;
  - c. Terminate all orders and subcontracts to the extent that they relate to performance of Work terminated by the notice of termination;
  - d. Assign to Intermountain in the manner, at the times, and to the extent directed by Intermountain, all of the right, title and interest of Contractor under the orders and subcontracts so terminated, in which case Intermountain will have the right, in its discretion, to settle or pay any or all claims arising out of the termination of such orders and subcontracts;
  - e. Settle all outstanding liabilities and all claims arising out of such termination of orders and subcontracts, with the approval or ratification of Intermountain, which approval or ratification will be final for all the purposes of this Article 12.4;
  - f. Transfer title and deliver to Intermountain in the manner, at the times, and to the extent, if any, directed by Intermountain:
    - (i) The fabricated or unfabricated parts, work in process, completed work, supplies, and other material produced as a part of, or acquired in connection with the performance of the Work terminated by the notice of termination; and
    - (ii) The completed or partially completed drawings, information, and other property which, if the Contract had been completed, would have been required to be furnished to Intermountain;
  - g. Use best efforts to sell, in the manner, at the times, to the extent, and at the price or prices directed or authorized by Intermountain, any property of the types referred to in Paragraph 12.4.2.f above; provided, however, that Contractor:
    - (i) Will not be required to extend credit to any purchaser; and
    - (ii) May acquire any such property under the conditions prescribed by and at a price or prices approved by Intermountain; and provided further that the proceeds of any such transfer of or disposition will be applied in reduction of any payments to be made by Intermountain to Contractor under this Contract or will otherwise be credited to the Contract Sum or paid in such other manner as Intermountain may direct;
  - h. Complete performance of such part of the Work as will not have been terminated by the notice of termination; and
  - i. Take such action as may be necessary, or as Intermountain may direct, for the protection and preservation of the property related to this Contract which is in the possession of Contractor in which Intermountain has or may acquire an interest.

- 12.4.3 Agreed Upon Payment. Subject to the provisions of Paragraph 12.4.2 above, Contractor and Intermountain may agree upon the amount to be paid to Contractor by reason of the total or partial termination of Work pursuant to this Article 12.4.
- 12.4.4 Payment Not Agreed Upon. In the event of the failure of Contractor and Intermountain to agree, as provided in Paragraph 12.4.3, upon the whole amount to be paid to Contractor by reason of the termination of Work pursuant to this Article 12.4, Intermountain will pay to Contractor the portion of the Contract Sum requisite with the portion of the Work completed as determined by Intermountain as of the date of termination, subject to offsets if any.
- 12.4.5 Deductions. In arriving at the amount due Contractor under this Article 12.4, there will be deducted:
- a. All unliquidated advance or other payments on account theretofore made to Contractor, applicable to the terminated portion of this Contract;
  - b. Any Claim which Intermountain may have against Contractor in connection with this Contract; and
  - c. The agreed price for, or the proceeds of sale of, any materials, supplies, or other things acquired by Contractor or sold, pursuant to the provisions of this Article 12.4, and not otherwise recovered by or credited to Intermountain.
- 12.4.6 Partial Payments. Intermountain may, from time to time, under such terms and conditions as it may prescribe, make partial payments and payments on account against cost incurred by Contractor in connection with the terminated portion of this Contract whenever, in the opinion of Intermountain the aggregate of such payments will be within the amount to which Contractor will be entitled hereunder. If the total of such payments is in excess of the amount finally agreed or determined to be due under this Article 12.4, such excess will be payable by Contractor to Intermountain upon demand, together with interest at a rate of five percent (5%) per annum for the period until the date such excess is repaid to Intermountain; provided, however, that no interest will be charged with respect to any such excess payment attributable to a reduction in Contractor's claim by reason of retention or other disposition of termination inventory until ten (10) Days after the date of such retention or disposition, or such later date as determined by Intermountain by reason of the circumstances.
- 12.4.7 Preserve and Make Available Records. Unless otherwise provided for in this Contract, or by applicable law, Contractor will, from the effective date of termination until the expiration of three years after final settlement under this Contract, preserve and make available to Intermountain at all reasonable times at the office of Contractor, but without direct charge to Intermountain, all books, records, documents and other evidence bearing on the costs and expenses of Contractor under this Contract and relating to the Work terminated hereunder, or, to the extent approved by Intermountain Representative, photographs, micrographs, or other authentic reproductions thereof.
- 12.4.8 Intermountain's Right to Stop the Work. If Contractor fails to correct Work or fails to carry out Work, as required by the Contract Documents or fails to comply with all required and customary safety precautions; Intermountain, by written order signed personally or by an agent specifically so empowered by Intermountain in writing, may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of Intermountain to stop the Work will not give rise to a duty on the part of Intermountain to exercise this right for the benefit of Contractor or any other person or entity.

END OF DOCUMENT

**SECTION 01 10 00 - SUMMARY**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Work covered by the Contract Documents.
  - 2. Use of premises.
  - 3. Code compliance
  - 4. Dust control
  - 5. Protection of existing improvements
  - 6. Traffic Control
  - 7. Temporary Controls

## 1.3 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Remodel of existing shelled space at Primary Children's Hospital – OR Department to create a new 543 SQ. FT. operating room. New OR equipment by Steris to include two new anesthesia booms, surgical light, and monitor boom with their associated structural, electrical, mechanical, architectural work and new finishes as described in the construction documents.
- B. Project Location: Primary Children's Hospital  
Address: 100 Mario Capecchi Dr, Salt Lake City, UT 84113
- C.
  - 1. Owner: Intermountain Healthcare, 36 South State Street, 23rd Floor  
Salt Lake City, Utah 84111
  - 2. Owner's Representative: Jeremy Smith, Project Manager.
  - 3. Architect: NJRA Architects, 5272 College Drive, Suite 104, Murray, Utah 84123.
- D. The Work consists of the following:
  - 1. The Work includes: Architectural, mechanical, plumbing, electrical and structural work as defined on the contract documents.

- B. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

#### 1.5 CODE COMPLIANCE

- A. All work shall comply with current edition of codes including but not limited to the following:
  - 1. International Building Code
  - 2. International Mechanical Code
  - 3. International Plumbing Code
  - 4. NFPA
  - 5. National Electric Code
  - 6. OSHA Regulation
  - 7. Health and Safety Regulations
  - 8. Utility Company Regulations
  - 9. Police, Fire Department Rules
  - 10. Environmental Protection Regulations
  - 11. Americans with Disabilities Act
- B. Arrange for authorities having jurisdiction to inspect and test according to their requirements and for each temporary utility before use. Obtain required certifications and permits.
- C. Requirements of codes and regulations shall be considered as the minimum. Where the contract documents exceed (without violating) code and regulation requirements, contract requirements shall take precedence. Where codes conflict, the more stringent shall apply.

#### 1.6 DUST CONTROL

Temporary partitions should be constructed as called out on the Contract Documents and as mentioned in specification Section 024119 – Selective Demolition.

#### 1.7 PROTECTION OF EXISTING IMPROVEMENTS

- A. Take precautions necessary to protect all existing utilities, monitor wells, and other Site improvements to remain from damage due to the work of this Project.
- B. Provide restoration of damaged property if damage is a result of construction activities.

#### 1.8 TRAFFIC CONTROL

- A. Maintain control of vehicular and pedestrian traffic caused by, or resulting from, the work of this Project.
- B. Means of control shall be in accordance with the applicable regulations of the jurisdiction responsible for traffic safety.



1.9 TEMPORARY CONTROLS

- A. Conform to all applicable state and local ordinances and regulations. Obtain and pay for necessary permits and licenses as required by local jurisdictions.

END OF SECTION

**SECTION 01 29 00 – PAYMENT PROCEDURES**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes measurement and payment provisions for, but not limited to, the following:
  - 1. Materials Delivered but Not Yet Installed.
  - 2. Schedule of Values.
  - 3. Applications for Payment.
  - 4. Preliminary Progress Schedule.
  - 5. Construction Progress Schedule.
  - 6. Change Orders.

## 1.2 MATERIALS DELIVERED BUT NOT INSTALLED

- A. Exclude from Applications for Payment materials or equipment delivered and stored, but not yet incorporated into the Work, unless circumstances dictate acceptance (i.e. pre-purchase of equipment for early delivery to prevent delay of construction or subsequent facility opening date) and pre-payment is agreed to, in writing, by the Owner.
- B. If Owner has agreed to make early payment on account of materials or equipment not incorporated in the Work, but delivered and stored in conformance with the requirements of the Contract Documents, at the site, or at some other location agreed upon in writing, such pre-payment shall be conditioned upon approval by Contractor's Insurance Carrier, and Architect, in writing, prior to submission by Contractor of the applicable payment request.
- C. Pre-payment request shall contain substantiating documentation, including:
  - 1. Bill(s) of Sale.
  - 2. Evidence of insurance for the materials or equipment, covering the item(s) until completion of installation.
  - 3. Provision for transportation to the Project Site.
  - 4. Protection of Owner's interest under any circumstance (i.e. Owner's right to retrieve equipment or materials from storage area of a bankrupt company's property).
  - 5. Provision for inspection/testing at the stored location.
  - 6. Provision for security until completion of installation.

## 1.3 SCHEDULE OF VALUES

- A. Type schedule on AIA Document G703. Owner's Standard Invoice/Schedule of Values or Contractor's standard forms and automated printout equivalent to the AIA Document will be considered for approval by Owner 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. Schedule shall list the installed dollar value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. List each subcontract first using the Table of Contents of the Project Manual as the format.
1. Next list any allowances included in the contract amount.
  2. List each major section or portion of work to be performed by the Contractor.
  3. List Contractor's fee separately.
  4. List any contingencies.
  5. Identify each line item with the number and title of the respective major section of the specifications.
  6. Subdivide items to correspond with cost correlation requirements for construction progress schedule.
- D. For each major line item list sub-values of major products by building area or floor level or other operations under the item.
- E. For the various portions of the Work:
1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
  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.

- B. The sum of all values listed in the schedule shall equal the total Contract Sum.
- C. Refer to General Conditions, Article 12, for changes.

#### 1.4 APPLICATIONS FOR PAYMENT

- A. Format and Data Required:
  - 1. Submit applications typed on AIA Document G702/703, Application for Payment. Contractor's standard forms and automated print-out equivalent to the AIA Document will be considered for approval by Architect upon request by the Contractor.
  - 2. Submit 2 copies with "wet" signatures.
  - 3. Add provision for Inspector of Record's signature.
- B. Provide itemized data on continuation sheet:
  - 1. Format, schedules, line items and values: Those of the Schedule of Values accepted by Architect.
  - 2. Include Payment Application number.
- C. Preparation of Application for Each Progress Payment:
  - 1. Application Form:
    - a. Fill in required information, including that for Change Orders executed prior to date of submittal of application along with the number assigned to each Change Order.
    - b. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
    - c. Certification that the Project Record Documents are current with the progress status of the Project.
    - d. Execute certification with signature of a responsible officer of Contract firm.
  - 2. Continuation Sheets:
    - a. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.
    - b. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.
      - 1) Round off values to nearest dollar, or as specified for Schedule of Values, and percent of item completion.
    - c. List each Change Order executed prior to date of submission, at the end of the continuation sheets.

- 1) List by Change Order number, and description, as for an original component item of work.
- D. Substantiating Data for Progress Payments:
1. When Owner or Architect requires substantiating data, submit information, with a cover letter identifying:
    - a. Project.
    - b. Application number and date.
    - c. Detailed list of enclosures.
    - d. For stored products.
      - 1) Item number and identification as shown on application.
      - 2) Description of specific Material.
  2. Submit 1 copy of data and cover letter for each copy of application.
  3. Revised updated CPM schedule.
  4. Current period's General Contractor Conditional Waiver and the prior period's Unconditional Waiver.
  5. Waivers from Subcontractors.
  6. Copies of invoices for National Purchase Agreement (NPA) items.
  7. Corrections and updates to "as-built" documents.
- E. Preparation of Application for Final Payment:
1. Fill in application form as specified for progress payments.
  2. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 - CONTRACT CLOSEOUT.
- F. Submittal Procedure:
1. Submit Applications for Payment to Owner at the times stipulated in the Agreement.
  2. Number: 3 copies of each Application.
  3. When Owner, Inspector of Record, and Contractor agree on percentages to be requested, and when agreed and signed by them and Architect, Architect will transmit the Certificate for Payment to Owner.
  4. Approval and signing of the Application for Payment by Owner and Architect is contingent upon approval of the current status of the As-Built Drawings/Record Documents and submittal of updated CPM sch

edule.

1.5 CHANGE ORDERS

- A. Change Orders shall be processed by the Architect in accordance with the Conditions of the Contract, Supplementary Conditions of the Contract, and as herein specified.
- B. Coordination with Contractor's Submittals:
  - 1. Revise Schedule of Values and Application for Payment forms monthly to record each change as a separate item of Work, and to record the adjusted Contract Sum.
  - 2. Upon completion of work under a Change Order, enter pertinent changes in record documents.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

**SECTION 01 31 00 – PROJECT MANAGEMENT AND COORDINATION**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section describes the requirements for Project coordination.

## 1.2 DESCRIPTION OF REQUIREMENTS

- A. Minimum administrative and supervisory requirements necessary for coordination of Work shall be fulfilled collectively by the Contractor in coordination with subcontractors including, but not necessarily limited to, the following:

1. Coordination drawings.
2. Coordination meetings.
3. Administrative coordinating personnel.
4. Contractor's coordination of work.

## 1.3 COORDINATION MEETINGS

- A. Schedule and conduct meetings and conferences at project site, unless otherwise indicated.

## 1.4 ADMINISTRATIVE COORDINATION PERSONNEL

- A. Provide a General Superintendent and other administrative and supervisory personnel required for performance of the Work.
- B. Provide specific coordinating personnel for each subcontractor as reasonably required for interfacing Work with other work of total Project.
- C. Submittal of Staff Names, Duties: Within 7 days of Notice to Proceed submit to the Owner a listing of principal staff assignments and consultants, including names, addresses and telephone numbers.

## 1.5 CONTRACTOR'S COORDINATION OF WORK

- A. Provide and coordinate the following:
  1. General and special services and operations to furnish and install Work.
  2. Primary, major and accessory materials, and items necessary to complete the installation.
  3. Labor operations and material items reasonably incidental for finishing.
  4. Performance of work and delivery of materials in accordance with established construction schedules.

- B. Coordinate all aspects of construction operations, generally, and specifically as required to provide Owner with a complete, operable facility.
1. Resolve any dispute over coordination, or failure to coordinate, such that resolution is consistent with Contract Documents. When such resolution is not possible, refer to the General Conditions.
  2. Where proper execution of this Work depends on the work of any other contractor, inspect and promptly report to Architect any defects in such work that render it unsuitable for such proper execution and results.
  3. Cooperate with other contractors on the Project site and with Architect so that completion of all work can proceed with prudent speed.
    - a. Furnish other contractors, whose work is fitted to this work, detail and erection drawings giving full information regarding the fabrication and assembly of this Work.
    - b. So far as possible, drawings shall indicate checked field measurements.
    - c. Cooperate in timing this Work to join with the work of other contractors or the Owner.
  4. Check the drawings of other contracts for interferences with this Work and promptly report to Architect, in writing, any such interferences.
  5. Submit complete information, including Drawings, descriptions, sketches, marked prints, etc., as required for Architect's review and coordination of drawings by others which are a part of this Work.
- C. Mechanical, Electrical, and Related Systems Coordination: Prior to proceeding with the work, and before installation, coordinate and work out all "tight" conditions involving work of various Sections.
1. Before work proceeds in these areas, prepare supplemental drawings for review by the Architect.
  2. Provide all work necessary to coordinate tight conditions, including supplemental drawings in sufficient detail for showing that all work is coordinated in "tight" areas, and additional labor and materials necessary to overcome "tight" conditions at no increase in cost to the Owner.
  3. Coordination of "tight" conditions shall include:
    - a. Providing sufficient clear space around all equipment necessary for maintenance access and as required by Code.
    - b. Adjustments in depth, position, and elevation of underground and overhead utilities at points of conflict. Utility space conflicts shall be resolved by giving precedence to those utilities which are called out to be sloped. The term "utility" as used in this



paragraph includes: all piping, conduit, and ductwork.

## 1.6 COORDINATION DRAWINGS

- A. Submit plans and cross-sections in sufficient detail to show coordinated layout of all ducts, pipes, electrical work, access doors, above ceiling clearances, canopy rigging, acoustical curtains, and other related items. Plans and cross-sections shall be provided that include all underground ducts, electrical ductbanks, piping, and other underground utilities.
- B. Engage professional drafter to prepare these drawings to one-quarter scale on Auto-CAD with title blocks to match the Contract Drawings.
  - 1. These plans shall reflect existing dimensions as field-verified by the Contractor.
  - 2. Plans shall be uniform and identical and shall serve as backgrounds for preparation of shop or layout drawings required under Divisions 15 and 16 and ultimately for recording of as-built information required under these divisions.
  - 3. Where additional sheets of elevations, sections, details, and/or diagrams are required, such sheets shall match the Contract Drawings with respect to size and title block.
  - 4. Prior to beginning excavation for structural footings and utilities, submit a coordination plan showing all underground utilities including: all underground piping, underground ductwork, electrical and communication ductbanks.
    - a. The plan shall be a composite overlay of sheets each dedicated to a single underground utility using a common background and scale.
    - b. Dimensions shall be sufficient to clearly indicate the position and depth of each utility relative to structural footings, above grade structures, and finished grade.
    - c. At points where the plan indicates that utilities will cross each other, cross a structural footing, or run within six (6) feet parallel to either each other or a structural footing, provide a cross section drawing.
    - d. Cross section drawings shall clearly show the relative positions and depths of each utility and structural footing.
    - e. The composite plan and cross section drawing(s) shall be updated to "as-builts" and submitted with the Project Record (As-Built) Drawings.
- C. Do not commence work until the Architect has reviewed these Drawings.

## 1.7 MISCELLANEOUS PROVISIONS

- A. Prior to starting a particular type or kind of work:
1. Examine for relevant information, all Contract Documents and subsequent data issued;
  2. Check accepted submittals and verify dimensions at job site;
  3. Consult manufacturers for instructions applicable to conditions under which Work is to be installed;
  4. Inspect areas, surfaces or construction receiving the Work.
    - a. Start of work shall signify compliance with the above requirements and acceptance of previously placed construction or substrates as being in satisfactory condition to achieve proper installations and first quality workmanship as intended under these specifications.
    - b. Failure to so inspect and report shall constitute an acceptance of the other contractor's work.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

**SECTION 01 33 00 - SUBMITTAL PROCEDURES**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

## 1.3 SUBMITTAL PROCEDURES

- A. General: Electronic copies of CAD Drawings of the Contract Drawings will not be provided by Architect for Contractor's use in preparing submittals.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
- C. Submittals Schedule: Comply with requirements in Division 1 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities. Submittals should be submitted by contractor to architect **within 30 days from notice to proceed**.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow 10 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Resubmittal Review: Allow 10 days for review of each resubmittal.
- E. Identification: Place a permanent label or title block on each submittal for identification.
  - 1. Indicate name of firm or entity that prepared each submittal on label or title block.
  - 2. Include the following information on label for processing and recording action taken:
    - a. Project name.
    - b. Date.

- c. Name and address of Architect.
  - d. Name and address of Contractor.
  - e. Name and address of subcontractor.
  - f. Name and address of supplier.
  - g. Name of manufacturer.
  - h. Submittal number or other unique identifier, including revision identifier.
  - i. Number and title of appropriate Specification Section.
  - j. Drawing number and detail references, as appropriate.
  - k. Location(s) where product is to be installed, as appropriate.
- F. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form.
- G. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities.
1. Use for Construction: Use only final submittals with mark indicating "Approval notation from Architect's action stamp".

## PART 2 - PRODUCTS

### 2.1 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. Mark each copy of each submittal to show which products and options are applicable.
  2. Include the following information, as applicable:
    - a. Manufacturer's written recommendations.
    - b. Manufacturer's product specifications.
    - c. Manufacturer's installation instructions.
    - d. Standard color charts.
    - e. Manufacturer's catalog cuts.
    - f. Standard product operation and maintenance manuals.
    - g. Compliance with specified referenced standards.
  3. Submit Product Data concurrent with Samples.
  4. Number of Copies: Submit four copies of Product Data, unless otherwise indicated.
- C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

- a. Dimensions.
  - b. Identification of products.
  - c. Fabrication and installation drawings.
  - d. Roughing-in and setting diagrams.
  - e. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
  - f. Shopwork manufacturing instructions.
  - g. Schedules.
  - h. Design calculations.
  - i. Compliance with specified standards.
  - j. Relationship to adjoining construction clearly indicated.
2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches (215 by 280 mm) but no larger than 30 by 40 inches (750 by 1000 mm).
  3. Number of Copies: Submit four opaque copies of each submittal, Architect will retain two copies; remainder will be returned.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
    - a. Number of Samples: Submit one full set of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

### PART 3 - EXECUTION

#### 3.1 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

#### 3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval.
- B. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:

END OF SECTION

**SECTION 01 40 00 – QUALITY REQUIREMENTS**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section describes the requirements for Owner furnished testing and inspection services which include the following:
  - 1. Observation by Inspector of Record.
  - 2. Laboratory responsibilities.
  - 3. Laboratory reports.
  - 4. Limits on testing laboratory authority.
  - 5. Contractor responsibilities.
  - 6. Schedule of inspections and tests.
- B. These services are identified to indicate the requirement for cooperation and assistance needed by Owner's testing and inspection agency.

## 1.2 QUALITY ASSURANCE

- A. Testing and Inspection Agency Qualifications: A testing and inspection agency must have a minimum 5 years continuing experience preceding date of these Contract Documents, and be qualified in accordance with the following American Society for Testing and Materials (ASTM) publications:
  - 1. ASTM E 548-84 Standard Practice for Generic Criteria for use in the Evaluation of Testing and Inspection Agencies.
  - 2. ASTM E 699-79 (1984) Standard Criteria for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating Building Components in Accordance with Test Methods Promulgated by ASTM Committee E-6.
- B. Testing Equipment: Calibrated at intervals with devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

## 1.3 INSPECTION AND TESTING PERSONNEL AND FACILITIES

- A. Inspector of Record:
  - 1. The Owner will employ one or more qualified Inspectors of Record, acceptable to the Local Building Department issuing Permits who will be employed continuously at the construction site, working under the Owner Representative's general direction. The IOR(s) will observe progress of the work and to report to the Owner any non-conformance

with Contract Documents.

2. In compliance with the State Building Code, Part 1, Title 24 of the California Code of Regulations, Article 7-145, the Inspector of Record shall have personal knowledge, obtained by continuous inspection of all parts of the work of construction in all stages of its progress, to ensure that the work is in accordance with the approved contract documents.
3. Specific duties and limits of responsibilities include the following:
  - a. Observing and spot checking materials upon arrival at site, and work in progress, to determine conformance with Contract Documents. Reporting any defects immediately to the Owner.
  - b. Maintaining liaison with the Contractor and his Subcontractors only through Contractor's superintendent.
  - c. Evaluating Contractor's suggestions and reporting them with recommendations to the Owner for final decision.
  - d. Remaining alert to the Construction Schedule and immediately reporting any potential delays and problems to the Owner.
  - e. Maintaining a Daily Log of activities on site, pertinent to a continuous project report record.
  - f. Preparing a Verified Report every 3 months (or sooner if required for a specific project schedule).
  - g. Receiving Samples of construction materials at the jobsite.
  - h. Scheduling and accompanying regulatory inspectors through the project and reporting to the Owner the results of such inspection visits.
  - i. Being alert to conditions which could affect Hospital's existing operation.
  - j. Reviewing and verifying degree of work completion with that cited in Contractor's monthly payment request.
  - k. Maintaining Contract information and Shop Drawing files.
  - l. Preparing a Field Inspection Report of incomplete or unsatisfactory work at intervals throughout the work progress. Checking off such items when made complete and satisfactory by Contractor.
  - m. Attending project meetings in accordance with specifications Section 013100.
  - n. Enforcing Infection Control requirements.
  - o. Provide all coordination for independent Testing Laboratories.

- p. Participate in formation of Final Punch List.
- B. Local Permit Issuing Agency will approve the Inspector of Record for the project who shall be allowed access to the project site at any time.
- C. Geotechnical Engineer: Observation of all excavations and engineering control of all fills and backfills shall be by a Geotechnical Engineer.
  - 1. Owner will contract with the Geotechnical Engineer for observation and testing of all excavations and engineering control of all fills and backfills.
  - 2. The Geotechnical Engineer shall submit a Final Report verifying that Work has been performed in accordance with the requirements of the Contract Documents and Soils Investigation Report(s) prepared for this Project.
  - 3. The Geotechnical Engineer shall distribute the Final Report in accordance with Paragraph 1.4, B.
- D. Testing and Inspection Agency:
  - 1. The Owner will employ and pay for the services of an independent testing and inspection agency to perform the tests and inspections required herein except where noted otherwise.
    - a. Employment of the testing and inspection agency shall in no way relieve the Contractor's obligation to perform the work defined in the Contract Documents.
  - 2. Limitations of authority of the Testing and Inspection Agency:
    - a. Testing Agency is not authorized to:
      - 1) Release, revoke, alter, or enlarge on the requirements of the Contract Documents;
      - 2) Approve or accept any portion of the Work, or;
      - 3) Perform any duties of the Contractor.
  - 3. All work shall conform to the requirements of state and local applicable Codes.
  - 4. Testing and inspection agency shall perform tests and inspections as required by applicable regulation as indicated in the specification Sections, and as directed by the Owner and required by the Code.
  - 5. Testing and inspection agency shall prepare, cure, store, and transport job samples to the Laboratory.
  - 6. At the completion of the Project, verified reports shall be submitted as required by CCR, Title 22 and as directed.



#### 1.4 LABORATORY REPORTS

- A. After each inspection and test, promptly submit copies of laboratory report which includes:
1. Date issued,
  2. Project title and number,
  3. Name of Inspector from inspection agency,
  4. Date and time of sampling or inspection,
  5. Identification of product and specifications section,
  6. Location in the Project,
  7. Type of inspection or test,
  8. Date of test,
  9. Results of tests,
  10. Conformance with Contract Documents,
  11. Whether original test or re-test,
  12. State/local permit number,
- B. Reports shall be distributed to the following:
1. Architect of Record
  2. Inspector of Record (I.O.R.)
  3. General Contractor
  4. Owner.
  5. Applicable Consultant
  6. Local Jurisdiction where applicable

#### 1.5 LABORATORY RESPONSIBILITIES

- A. Provide qualified personnel at site. Cooperate with Architect/Inspector of Record and Contractor in performance of services.
- B. Perform specified inspecting, sampling, and testing of Products in accordance with specified standards.
- C. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- D. Promptly notify Architect, IOR and Contractor of observed irregularities or non

-conformance of Work or Products.

- E. Perform additional inspection and test required by Architect.
- F. Attend preconstruction meetings and progress meetings when requested.

#### 1.6 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with Inspector of Record and Testing and Inspection Agency and provide access to Work, including off-site manufacturer's or fabricator's operations.
  - 1. Provide required quantities of material samples to be tested.
  - 2. Samples will be selected and taken by representative of Testing and Inspection Agency.
- B. Furnish copies of product data and test reports as required.
- C. Furnish incidental labor and facilities:
  - 1. To provide access to work to be tested;
  - 2. To obtain and handle samples at the Project site, or at the source of the Product to be tested or inspected;
  - 3. To facilitate inspections and tests, and;
  - 4. For storage and curing of test samples at the Project site.
- D. Provide, on a weekly basis, a Short Interval Project Schedule with a minimum three-week duration which identifies upcoming testing requirements.
- E. Schedule the tests and inspections required by the Contract Documents and applicable codes and regulations with the Inspector of Record and the Testing and Inspection Agency, a minimum of 48 hours in advance.
  - 1. When tests or inspections cannot be performed after such notice, or if re-tests and re-inspections are required due to the fault of the Contractor, all costs for such re-work shall be deducted from the Contract Amount. If the remaining unpaid balance in the Contract is insufficient to cover the Change Order for this work, Contractor shall pay the difference directly to the Owner.
  - 2. Do not cover corrected Work until said Work has been re-tested and or re-inspected satisfactorily.
- F. Arrange with Owner's Testing and Inspection Agency and pay for additional samples and tests required for the Contractor's convenience when approved by Owner.

- G. Contractor shall pay costs for the following specified items:
1. Design mixes for:
    - a. Cast-in-Place concrete
    - b. Asphalt paving
  2. Redesign of mixes due to change in source of ingredients.
  3. Certified mill test reports.
  4. Pre-construction tests for masonry units.
  5. Preparation and delivery to laboratory of pre-construction masonry prisms for testing.
- H. Notification of Architect:
1. In addition to tests and inspections called for in this Section, notify applicable parties of inspections and testing called for in the individual Sections of the Specifications or on the Drawings.
  2. Notify 48 hours in advance, to assure inspections prior to covering up or closing in of work involved. Any work covered up before such required inspection or testing shall be uncovered or removed at the Contractor's expense.

PART 2 – PRODUCTS (Not Used)

PART 3 – EXECUTION (Not Used)

END OF SECTION

**SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

## 1.3 USE CHARGES

- A. General: Cost or use charges for temporary facilities shall be included in the Contract Sum. Allow other entities to use temporary services and facilities without cost.
- B. Water Service: Pay water service use charges for water used by all entities for construction operations.
- C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

## 1.4 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

## PART 2 - PRODUCTS

## 2.1 MATERIALS

## 2.2 TEMPORARY FACILITIES

- A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.
- B. Common-Use Field Office: Of sufficient size to accommodate needs of construction personnel. Keep office clean and orderly. Furnish and equip offices as follows:
  - 1. Furniture required for Project-site documents including file cabinets, plan tables, plan racks, and bookcases.
  - 2. Heating and cooling equipment necessary to maintain a uniform indoor temperature of 68 to 72 deg F.

3. Lighting fixtures capable of maintaining average illumination of 20 fc at desk height.

## 2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Heating Equipment: Unless Owner authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### 3.2 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
  1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- C. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- D. Heating: Provide temporary heating required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- E. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations.
- F. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

- G. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.
- H. Traffic Controls: Comply with requirements of authorities having jurisdiction.
  - 1. Protect existing site improvements to remain including curbs, pavement, and utilities.
  - 2. Maintain access for fire-fighting equipment and access to fire hydrants.
- I. Parking: Provide temporary parking areas for construction personnel.
- J. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.
  - 1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties nor endanger permanent Work or temporary facilities.
  - 2. Remove snow and ice as required to minimize accumulations.
- K. Project Identification and Temporary Signs: Provide Project identification sign. Install signs where indicated to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
- L. Waste Disposal Facilities: Provide waste-collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction. Comply with Division 1 Section "Cleaning" for progress cleaning requirements.
- M. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

### 3.3 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- B. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
  - 1. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
- C. Stormwater Control: Comply with authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- D. Site Enclosure Fence: Before construction operations, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

- E. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- F. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
  - 1. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  - 2. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.

### 3.4 OPERATION, TERMINATION, AND REMOVAL

- A. Maintenance: Maintain facilities in good operating condition until removal.
  - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- B. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

END OF SECTION

**SECTION 01 60 00- PRODUCT REQUIREMENTS**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: This Section contains definitions, product requirements and requirements for prior approved items.
- B. Delivery and storage of materials and equipment.
- C. Procedures for selecting products and approving substitutions.

## 1.2 DEFINITIONS

- A. General: Definitions are not intended to negate the meaning of other terms used in Contract Documents, including specialties, systems, structure, finishes, accessories, furnishings, special construction, and similar terms, which are self-explanatory and have recognized meanings in the construction industry.
- B. Products: Purchased items for incorporation into the Work, regardless of whether specifically purchased for Project or taken from Contractor's stock of previously purchased products.
- C. Materials: Products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work.
- D. Appliances, Equipment, and Fixtures: Products with operational parts, regardless of whether motorized or manually operated and particularly including products with service connections (wiring, piping, etc.).
- E. System: A unit of Work (i.e., structural system, vacuum system, etc.) shown or specified to include particular products, materials, appliances, equipment, or fixtures.
- F. Substitutions: Where products, materials, appliances, equipment, or fixtures are listed by trade name(s), manufacturer name(s), or catalog reference(s) or where these items are shown or specified as part of a system or systems, items or systems proposed for use by Contractor that are not listed or differ from those shown or specified as part of a system will be considered substitutions.
  - 1. Submit substitutions in accordance with requirements of this Section.
  - 2. The requirements for substitutions do not apply to specified Contractor options. Revisions to Contract Documents, where requested by Owner or Architect are changes, not substitutions.
  - 3. Contractor's determinations of and compliance with governing regulations and orders issued by governing authorities do not constitute substitutions, and do not constitute a basis for change orders; except as provided for under substitution procedures in this Section or elsewhere in Con



tract Documents.

- G. Prior -to-Bid Approvals: Products, materials, appliances, equipment, fixtures, or systems that have been proposed as substitutions and accepted by Owner prior to bid.

### 1.3 DESCRIPTION

- A. General: Specific products, materials, appliances, equipment, fixtures, accessories, manufacturers, and proprietary mentioned by name, grade, or brand, in Specifications or on Drawings have been selected for their particular fitness, availability, and desirability for use appropriate to Work of this Project and are intended to establish the standard of quality.
- B. Compliance: The compliance requirements, for individual products are multiple in nature and may include generic, descriptive, proprietary, performance, prescriptive, compliance with standards, compliance with codes, conformance with graphic details, and other similar forms and methods of indicating requirements.

### 1.4 PRODUCT REQUIREMENTS

- A. General: Provide products which comply with requirements, and which are undamaged and unused at time of installation, and which are complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and for intended use.
  - 1. Materials shall be new unless otherwise specified and unused, except for testing of current production models on date of order, undamaged, and un-deteriorated at time of use.
  - 2. Identify materials in accordance with accepted trade standards and requirements of this Section.
  - 3. Select and use methods or processes, including intermediate processes, which will produce the specified finished material or product.
  - 4. Ascertain that the Work, including materials, products, and equipment delivered and installed, is in full compliance with the Contract Documents and appropriate submittals.
  - 5. Standard Products: Where available, provide standard products of types which have been produced and used previously and successfully on other projects and in similar applications.
  - 6. Continued Availability: Where additional amounts of product, by nature of its application, are likely to be needed by Owner at a later date for maintenance and repair or replacement work, provide a standard, domestically produced product which is likely to be available to Owner at such later date.
- B. Nameplates: Except as otherwise indicated for required approval labels and operating data, do not permanently attach or imprint manufacturer's or produ

cer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on exterior of the Work.

1. Labels: Locate required labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.
2. Equipment Nameplates: Provide permanent nameplate on each item of service-connected or power-operated equipment. See sections specifying equipment requirements for specifics.

#### 1.5 QUALITY ASSURANCE

- A. Special Requirement: Due to certain Owner requirements, Owner will not consider substitutions on certain items. Therefore, substitutions will not be considered for items followed by the words: "no substitution(s)."
- B. Architect's Compensation:
  1. Except as limited by provisions of Owner-Architect or Owner-Contractor Agreements, Contractor shall reimburse Owner for compensation paid to Architect for evaluation of substitution proposals made during construction, whether or not substitution is accepted by Owner.
  2. Refer to Request for Substitution form at the end of this Section.
- C. Delays and Costs:
  1. Substitution proposals made during construction shall be in accordance with procedures outlined in this Section, and be made in sufficient time to allow for adequate time for Architect's review and evaluation.
  2. Delays and added costs associated with inadequate supportive data, necessary extended evaluations, or redesign work caused by substitutions shall be borne by Contractor.
  3. Cost changes resulting from proposed substitutions shall be clearly stated with the initial substitution proposal. Subsequently discovered costs resulting from the substitution shall be borne by Contractor.

#### 1.6 TRANSPORTATION AND HANDLING

- A. Transport products by methods to avoid product damage; deliver in undamaged condition in manufacturer's unopened containers or packaging, dry.
- B. Provide equipment and personnel to handle products by methods to prevent soiling or damage.
- C. Promptly inspect shipments to assure that products comply with requirements, quantities are correct, and products are undamaged.
- D. Deliver products in the manufacturer's sealed container or other packaging

system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

#### 1.7 STORAGE AND PROTECTION

- A. Store Products in accordance with manufacturer's instructions, with seals and labels intact and legible.
- B. Store sensitive products in weathertight enclosures; maintain within temperature and humidity ranges required by manufacturer's instructions.
- C. For exterior storage of fabricated products, place on sloped supports above ground. Cover products subject to deterioration with impervious sheet covering; provide ventilation to avoid condensation.
- D. Store loose granular materials on solid surfaces in a well-drained area; prevent mixing with foreign matter.
- E. Arrange storage to provide access for inspection, periodically inspect to assure products are undamaged and are maintained under required conditions.
- F. After installation, provide covering to protect products from damage from traffic and construction operations, remove when no longer needed.

#### 1.8 PROCEDURES

- A. Procedures for Selecting Products: Contractor's options for selecting products are limited by Contract Document requirements and governing regulations, and are not controlled by industry traditions or procedures experienced by Contractor on previous construction projects.
  - 1. Single Product/Manufacturer Name:
    - a. Provide product indicated. Do not offer to provide an unnamed product unless it has been accepted under substitution provisions listed below.
    - b. Except as otherwise indicated, "Named" is defined to mean manufacturer's name for product as recorded in latest issue of published product literature as of date of Contract Documents.
    - c. Refer to requests to use products of a later (or earlier) model to Architect for acceptance before proceeding.
  - 2. Two or More Product/Manufacturer Names:
    - a. Provide 1 of the named products, at Contractor's option.
    - b. Do not offer to provide an unnamed product unless it has been accepted under substitution provisions listed below.
  - 3. Performance Requirements:

- a. Provide products which comply with specific performances indicated and which are recommended by manufacturer (in published product literature or by individual certification) for application indicated.
  - b. Overall performance of a product is implied where product is specified for specific performances.
4. Standards, Codes, and Regulations: Where compliance with an imposed standard, code, or regulation is required, selection from among products which comply with requirements of those standards, codes, and regulations is Contractor's option.
  5. Prescriptive Requirements: Provide products which have been produced in accordance with prescriptive requirements, using specified ingredients and components, and complying with specified requirements for mixing, fabricating, curing, finishing, testing, and similar operations in manufacturing process.
  6. Visual Matching:
    - a. Where matching of an established sample is required, final judgment of whether a product proposed by Contractor matches sample satisfactorily is Architect's judgment.
    - b. Where no product exists within specified cost category, which matches sample satisfactorily and complies with requirements, comply with provisions concerning, substitutions and change orders for selection of an equivalent product.
  7. Visual Selection:
    - a. Where specified product requirements include "color(s), pattern(s), texture(s), etc. selected by Architect" or words of similar effect, selection of manufacturer and basic product (complying with requirements) is Contractor's option, and subsequent selection of color(s), pattern(s), and texture(s), etc. is Architect's selection.
    - b. Where specified product requirements include "color(s), pattern(s), texture(s), etc., to match Architect's sample" or words to that effect, selection of product (complying with requirements, and within established cost category) is Architect's selection, including designation of manufacturer where necessary to obtain desired color, pattern, or texture.

## 1.9 SUBSTITUTION PROCEDURES

- A. Prior (-to-Bid) Approvals: Substitute products, materials, appliances, equipment, fixtures, or systems will be considered by Architect.
  1. Any bidder, material supplier, or manufacturer desiring to propose substitution(s) shall:

- a. Submit in a sealed envelope catalog cuts, shop drawings, or other descriptive literature for products, materials, appliances, equipment, fixtures, or systems for proposed substitution.
  - b. Submit not later than 14 calendar days before bid opening
1. Make request to Architect in triplicate on copies of Request for Substitution form included at end of this Section.
2. Submittal(s) shall include a complete and adequate analysis showing point-for-point comparison to specified item(s) or system(s) and must prove equality or superiority.
3. Include related Section and Drawing number(s), and fully document compliance with requirements for substitutions.
4. Include product data/drawings, description of methods, samples.
  - a. Where applicable, statement of effect on construction time and coordination with other affected Work.
  - b. Cost information for proposal.
5. Include identification of previous use locally with dates and names of Architect and Owner.
6. Anything less will not be considered.
7. Equivalency:
  - a. The Architect will be the initial judge of equivalency of proposed substitution(s).
  - b. Architect will make written recommendation of acceptance or rejection to Owner.
8. Satisfaction:
  - a. Prior to proposing substitution(s), certify that item or system is equal to that specified.
  - b. That it will fit into space allocated.
  - c. That item affords comparable ease of operation, maintenance, and service.
  - d. That appearance, longevity, and suitability for climate and use are comparable to item specified.
  - e. That substitution is in Owner's interest.
9. Manufacturer's data which is readily available to Architect is not acceptable for establishing proof of quality.

- a. Provide laboratory test data performed by a nationally recognized independent testing laboratory known for its testing expertise.
  - b. Laboratory test shall include types of materials used in substitute item or system, including their thickness and strength, and a direct comparison to item or system specified for capacities, capabilities, coatings, functions, life cycle usage, and operations.
  - c. No change in Architect's design intent will be allowed where item or system will be exposed and where it will be used.
10. Proof: Burden of proof that a proposed substitution is equal or equivalent to a specified item or system shall be upon Contractor, who shall support his request with sufficient test data, samples, brochures, and other means to permit Architect to make a fair and equitable decision on merits of proposal.
  11. Based on Architect's written recommendation of acceptance or rejection, Owner will determine acceptability of proposed substitutions.
  12. Architect will notify Bidders of Owner's acceptance not later than 5 calendar days prior to bid opening via an addendum to the Contract Documents listing only accepted substitutions.
  13. Responsibility: Acceptance of substitutions shall not relieve Contractor from responsibility for complying with all other requirements of the Contract Documents and coordinating substitution(s) with adjacent materials and other affected equipment.
- B. During Construction:
1. Substitutions will not be considered when they are indicated or implied on submittals without separate written request prior to submittal, or when acceptance will require substantial revision of Contract Documents.
  2. Architect and Owner will consider requests from Contractor during construction for substitutions (following procedures outlined above for prior approvals) only under 1 or more of the following conditions:
    - a. Substitution is required for compliance with subsequent interpretation of code requirements or insurance regulations.
    - b. Shown or specified item or system cannot be provided within Contract Time or becomes unavailable due to no fault of Contractor.
    - c. Subsequent information disclosed inability of item(s) or system(s) to perform properly or to fit in designated space, or manufacturer(s) refuse(s) to certify or warrant performance as required.
    - d. When, in Architect's judgment, a substitution would be substantially in Owner's best interests in terms of cost (substantial credit), time, or other valuable considerations, after deducting offsetting responsibilities Owner may be required to bear, including additional compensation to Architect for evaluation and redesign ser

vices, increased cost of other work by Owner or separate contractors, and similar considerations.

PART 2 - PRODUCTS  
Not used.

PART 3 - EXECUTION  
Not used.

END OF SECTION

REQUEST FOR SUBSTITUTION

- A. Completed reproduction of this form shall accompany all requests for substitutions. Failure to submit form with request shall be cause for rejection. Substituted items or systems may be incorporated into the Work only after receipt of Owner's written approval. Fill in all applicable spaces and cross out all nonapplicable information bracketed ([]) or unbracketed.

[Subcontractor:] [Material Supplier:] [Manufacturer:] Date:  
 Requested Substitution:  
 Reference: Specification Section \_\_\_\_\_ Drawing Reference \_\_\_\_\_  
 Reason for Substitution: [Prior Approval] [During Construction]:

- B. Resulting Change to Contract Amount: [Add] [Deduct] \_\_\_\_\_  
 (Include supporting documentation.)

- C. For substitutions made during construction the Architect will, upon receipt of substitution proposal, fill in the following compensation information, add it to or deduct it from the Change to the Contract Amount and submit Net Change to Contract Amount to Owner for approval. Upon receipt of Owner's approval, Architect will proceed with substitution review.

D. Architect's Fee for Substitution Evaluation: \_\_\_\_\_

E. Architect's Fee for Changes to Contract: \_\_\_\_\_

- F. Documents Due to Substitution:  
 Net Change to Contract Amount (B + C + D): [Add] [Deduct]  
 Resulting Change to Contract Time: Add \_\_\_\_\_ Deduct \_\_\_\_\_  
 Summary of Related Work Requiring Coordination (if any): \_\_\_\_\_

(Contractor shall assume responsibility for complete coordination with Work of all trades involved if Substitution Request is approved.)

- G. Attached Documentation: The following is herewith attached to provide complete documentation of requested substitution:

[ ] Product Data [ ] Samples [ ] Shop Drawings  
 [ ] Test Reports [ ] Other:

- H. Contractor's Signature

Subcontractor's/Supplier's/Manufacturer's  
 Signature



**SECTION 01 76 00- GUARANTIES AND WARRANTIES**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This Section includes requirements for guaranties and warranties for contract closeout and during specified guaranty/warranty periods.

## 1.2 DESCRIPTION OF REQUIREMENTS

- A. General Limitations: It is recognized that specific guaranties and warranties are intended to protect Owner against failure of the Work to perform as required, and against deficient, defective, and faulty materials and workmanship, regardless of sources.
- B. Related Damages and Losses: When correcting guaranteed or warranted work which has failed, remove and replace other Work of Project which has been damaged as a result of such failure or which must be removed and replaced to provide access for correction of Work.
- C. Reinstatement of Guaranty or Warranty Period: In addition to requirements in the General Conditions, when Work covered by a special project guaranty or product warranty has failed and has been corrected by replacement or restoration, reinstate guaranty or warranty by written endorsement for 1 year starting on date of acceptance of replaced or restored Work.
- D. Replacement Cost, Obligations: Except as otherwise indicated, cost of replacing or restoring failing guaranties or warranted units or products is Contractor's obligation, without regard for whether Owner has already benefitted from use through a portion of anticipated useful service lives.
- E. Rejection of Warranties: Owner reserves the right, at time of Substantial Completion or thereafter, to reject coincidental product warranties submitted by Contractor, which in opinion of Owner detract from or confuse interpretation of requirements of Contract Documents.
- F. Contractor's Procurement Obligations: Do not purchase, subcontract for, or allow others to purchase or subcontract for materials or units of Work for Project where a special project guaranty, specified product warranty, certification, or similar commitment is required until it has been determined that entities required to sign or countersign such commitments are willing to do so.
- G. Specific Guaranty or Warranty Forms: Where a special project guaranty or specified project warranty is required, prepare a written document to contain terms and appropriate identification; ready for execution by required parties.
  - 1. A sample form is attached as the last article of this Section.
  - 2. Refer to individual sections of Divisions 2 through 33 for specific content and requirements.
  - 3. Submit draft to Owner for approval prior to final executions.

## 1.3 REQUIREMENTS INCLUDED

- A. Compile specified warranties.
- B. Compile specified service and maintenance contracts.
- C. Co-execute submittals when so specified.
- D. Review submittals to verify compliance with Contract Documents.
- E. Submit to Architect for review and transmittal to Owner.

## 1.4 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds, and service and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: 2 each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete index information for each item.
  - 1. Product or work item with index number to bound item.
  - 2. Firm, with name of principal, address, and telephone number.
  - 3. Scope.
  - 4. Date of beginning of warranty, bond or service and maintenance contract.
  - 5. Duration of warranty, bond, or service maintenance contract.
  - 6. Provide information for Owner's personnel:
    - a. Procedure to be followed in case of failure.
    - b. Circumstances which might affect the validity of warranty or bond.
  - 7. Contractor, name of responsible principal, address and telephone number.

## 1.5 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.
- B. Format:
  - 1. Size 8-1/2 x 11 inches on punched sheets for standard 3-ring binder.
    - a. Fold larger sheets to fit into binders.
  - 2. Warranty-Guaranty wording shall be as printed below.

3. Cover: Identify each packet with typed or printed title "GUARANTIES AND WARRANTIES". List:

- a. Title of Project.
- b. Name of Contractor.

C. Binders: Commercial quality, 3-ring, with durable and cleanable plastic covers.

#### 1.6 TIME OF SUBMITTALS

A. Make submittals within 10 days after date of Substantial Completion prior to final request for payment.

B. For items or work, where acceptance is delayed materially beyond Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing date of acceptance as start of warranty period.

#### 1.7 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in respective Sections of Specifications and as follows:

- 1. Provide when noted in individual Sections of the Project Manual Divisions 2 through 33.

#### 1.8 SAMPLE FORM OF WARRANTY-GUARANTY

A. Print or type Warranty-Guaranty on installing contractor's own letterhead.

B. Wording and signatures required.

#### PART 2 - PRODUCTS

Not used.

#### PART 3 - EXECUTION

Not used.

END OF SECTION

A. GUARANTEE-WARRANTY

When required by the specifications, warranties and/or guarantees other than one year shall be in the form of the following on the Contractor's own letterhead:

"GUARANTEE-WARRANTY FOR "Primary Children's Hospital – Hybrid OR"

We hereby warrant and the General Contractor and/or Material Manufacturer guarantee that the           (name of product, equipment or system)           that we have installed in the Primary Children's Hospital- Hybrid OR, has been done in accordance with the Contract Documents and that the work as installed will fulfill the requirements of the guaranty-warranty included in the specifications. We agree to repair or replace any or all of our work, together with any other adjacent work which may be displaced by so doing, that may prove to be defective in its workmanship or material within a period of    years from the date of Substantial Completion, without any expense whatsoever to the Owner, ordinary wear and tear and unusual abuse or neglect excepted.

In the event of our failure to comply with the above mentioned conditions within sixty (60) days after being notified in writing by the Owner, we collectively or separately do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and charges therefore upon demand.

Signed <u>  </u>	Countersigned <u>  </u>
(Subcontractor)	(General Contractor)
Name <u>  </u>	Name <u>  </u>
(Print)	(Print)
Company <u>  </u>	Company <u>  </u>
Address <u>  </u>	Address <u>  </u>
<u>  </u>	<u>  </u>

License No.    License No.   

Countersigned     
(Material Manufacturer)

Name     
(Print)

Company   

Address

**SECTION 01 78 23 – OPERATION AND MAINTENANCE DATA**

## PART 1 - GENERAL

## PART 2 - 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.

## 2.2 SUMMARY

- A. This Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
  - 1. Operation and maintenance documentation directory.
  - 2. Emergency manuals.
  - 3. Operation manuals for systems, subsystems, and equipment.
  - 4. Maintenance manuals for the care and maintenance of products, materials, and finishes.
- B. Related Sections include the following:
  - 1. Division 1 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
  - 2. Division 1 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
  - 3. Divisions 2 through 33 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

## 2.3 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

## 2.4 SUBMITTALS

- A. Final Submittal: Submit one copy one of each manual in final form at least 15 days before final inspection. Architect will return copy with comments within 15 days after final inspection.
  - 1. Correct or modify each manual to comply with Architect's comments. Submit 3 copies of each corrected manual within 15 days of receipt of Architect's comments.

## 2.5 COORDINATION

- A. Where operation and maintenance documentation includes information on installations by more than one factory-authorized service representative, assemble and coordinate information furnished by representatives and prepare manuals.

## PART 3 - OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Organization: Include a section in the directory for each of the following:
  - 1. List of documents.
  - 2. List of systems.
  - 3. List of equipment.
  - 4. Table of contents.
- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.
- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.
- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.
- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

## 3.2 MANUALS, GENERAL

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
  - 1. Title page.
  - 2. Table of contents.
  - 3. Manual contents.
- B. Title Page: Enclose title page in transparent plastic sleeve. Include the following information:
  - 1. Subject matter included in manual.
  - 2. Name and address of Project.
  - 3. Name and address of Owner.
  - 4. Date of submittal.
  - 5. Name, address, and telephone number of Contractor.
  - 6. Cross-reference to related systems in other operation and maintenance manuals.

- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.
1. Binders/Maintenance Manuals: Organize operation and maintenance data into suitable sets of manageable size. Binders shall be Red Buckram binders with easy view metal for sheet size 11" X 8 ½" with expandable metal capacity as required for the project, rivet through construction with library corners using #12 BB and lining with same materials as cover, front cover and back-bone foil stamped in white. Binders shall be as manufactured by Hiller Bookbinding or equal. The master index sheet and each tabbed index sheet shall be AICO Gold-Line indexes or equal. Mark appropriate identification on front spine of each binder. Include the following types of information:
    - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
    - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name, and subject matter of contents. Indicate volume number for multiple-volume sets.
  2. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
  3. Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
    - a. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
    - b. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents, and drawing locations.

### 3.3 EMERGENCY MANUALS

- A. Content: Organize manual into a separate section for each of the following:
1. Type of emergency.
  2. Emergency instructions.
  3. Emergency procedures.

- B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
1. Fire.
  2. Flood.
  3. Gas leak.
  4. Water leak.
  5. Power failure.
  6. Water outage.
  7. System, subsystem, or equipment failure.
  8. Chemical release or spill.
- C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.
- D. Emergency Procedures: Include the following, as applicable:
1. Instructions on stopping.
  2. Shutdown instructions for each type of emergency.
  3. Operating instructions for conditions outside normal operating limits.
  4. Required sequences for electric or electronic systems.
  5. Special operating instructions and procedures.

### 3.4 OPERATION MANUALS

- A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
1. System, subsystem, and equipment descriptions.
  2. Performance and design criteria if Contractor is delegated design responsibility.
  3. Operating standards.
  4. Operating procedures.
  5. Operating logs.
  6. Wiring diagrams.
  7. Control diagrams.
  8. Piped system diagrams.
  9. Precautions against improper use.
  10. License requirements including inspection and renewal dates.
- B. Descriptions: Include the following:
1. Product name and model number.
  2. Manufacturer's name.
  3. Equipment identification with serial number of each component.
  4. Equipment function.
  5. Operating characteristics.
  6. Limiting conditions.
  7. Performance curves.
  8. Engineering data and tests.
  9. Complete nomenclature and number of replacement parts.



- C. Operating Procedures: Include the following, as applicable:
  - 1. Startup procedures.
  - 2. Equipment or system break-in procedures.
  - 3. Routine and normal operating instructions.
  - 4. Regulation and control procedures.
  - 5. Instructions on stopping.
  - 6. Normal shutdown instructions.
  - 7. Seasonal and weekend operating instructions.
  - 8. Required sequences for electric or electronic systems.
  - 9. Special operating instructions and procedures.
- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

### 3.5 PRODUCT MAINTENANCE MANUAL

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Product Information: Include the following, as applicable:
  - 1. Product name and model number.
  - 2. Manufacturer's name.
  - 3. Color, pattern, and texture.
  - 4. Material and chemical composition.
  - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
  - 1. Inspection procedures.
  - 2. Types of cleaning agents to be used and methods of cleaning.
  - 3. List of cleaning agents and methods of cleaning detrimental to product.
  - 4. Schedule for routine cleaning and maintenance.
  - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

### 3.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUAL

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.
- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
  1. Standard printed maintenance instructions and bulletins.
  2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
  3. Identification and nomenclature of parts and components.
  4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
  1. Test and inspection instructions.
  2. Troubleshooting guide.
  3. Precautions against improper maintenance.
  4. Aligning, adjusting, and checking instructions.
  5. Demonstration and training videotape, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
  1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
  2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
  1. Include procedures to follow and required notifications for warranty claims.

## EXECUTION

## 3.7 MANUAL PREPARATION

- A. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.
- B. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- C. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.
  - 1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
  - 2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.
- D. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.
  - 1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.
- E. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in Record Drawings to ensure correct illustration of completed installation.
  - 1. Do not use original Project Record Documents as part of operation and maintenance manuals.
  - 2. Comply with requirements of newly prepared Record Drawings in Division 1 Section "Project Record Documents."
- F. Comply with Division 1 Sections for schedule for submitting operation and maintenance documentation.

## END OF SECTION

**SECTION 01 78 39 – PROJECT RECORD DOCUMENTS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes administrative and procedural requirements for Project Record Documents, including the following:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
- B. Related Sections include the following:
  - 1. Division 1 Section for general closeout procedures.
  - 2. Division 1 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
  - 3. Divisions 2 through 33 Sections for specific requirements for Project Record Documents of the Work in those Sections.

## 1.3 SUBMITTALS

- A. Record Drawings: Comply with the following:
  - 1. Number of Copies: Submit one set(s) of marked-up Record Prints.
    - a. Final Submittal: Submit one set(s) of marked-up Record Prints showing modifications for trades involved in the project.
- B. Record Specifications: Submit one copy of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one copy of each Product Data submittal.
  - 1. Where Record Product Data is required as part of operation and maintenance manuals, submit marked-up Product Data as an insert in manual instead of submittal as Record Product Data.

## PART 2 - PRODUCTS

## 2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of blue- or black-line white prints of the Contract Drawings and Shop Drawings.
1. Preparation: Mark Record Prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to prepare the marked-up Record Prints.
    - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    - b. Accurately record information in an understandable drawing technique.
    - c. Record data as soon as possible after obtaining it. Record and check the markup before enclosing concealed installations.
  2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.
    - f. Revisions to electrical circuitry.
    - g. Actual equipment locations.
    - h. Duct size and routing.
    - i. Locations of concealed internal utilities.
    - j. Changes made following Architect's written orders.
    - k. Details not on the original Contract Drawings.
    - l. Field records for variable and concealed conditions.
  3. Mark the Contract Drawings or Shop Drawings, whichever is most capable of showing actual physical conditions, completely and accurately. If Shop Drawings are marked, show cross-reference on the Contract Drawings.
  4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
  5. Mark important additional information that was either shown schematically or omitted from original Drawings.
  6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

## 2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

## 2.3 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

## PART 3 - EXECUTION

### 3.1 RECORDING AND MAINTENANCE

- A. Recording: Maintain one copy of each submittal during the construction period for Project Record Document purposes. Post changes and modifications to Project Record Documents as they occur; do not wait until the end of Project.
- B. Maintenance of Record Documents and Samples: Store Record Documents and Samples in the field office apart from the Contract Documents used for construction. Do not use Project Record Documents for construction purposes. Maintain Record Documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to Project Record Documents for Architect's reference during normal working hours.

END OF SECTION

## **SECTION 01 79 00- CLEANING**

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Work Included: Requirements for periodic, general, and final cleaning of the project.
- B. Provide temporary and periodic clean-up of extra materials, waste and general debris during construction of the work, together with the final clean-up and cleaning, polishing and other "housekeeping" required to bring various surfaces to an acceptable condition prior to final inspection, or before additional work is done during construction.
- C. This Section includes requirements for Cleaning for all phases of the Project. Some requirements of this Section may not be applicable to individual project Phases.

#### 1.2 GENERAL REQUIREMENTS

- A. Maintain premises and public properties free from accumulations of waste, debris, and rubbish in accordance with applicable safety and insurance standards and local ordinances.
- B. The acceptable level of cleanliness of the Project shall be the decision of the Architect.
  - 1. Work necessary to achieve such acceptable state shall be performed when required.
- C. Burning: Burning of waste materials and/or rubbish on Site is not permitted.

#### 1.3 CLEAN-UP DURING CONSTRUCTION

- A. During construction, provide cleaning-up as follows:
  - 1. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
  - 2. Remove debris and rubbish from pipe chases, plenums, down spouts, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
  - 3. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
  - 4. Remove waste materials, debris, and rubbish from site weekly, or more often if needed, and dispose off-site in compliance with local regulations.
  - 5. Storage areas: Ensure that materials to be used for construction are sto

red in designated structures or areas by the appropriate trades. Maintain such areas or structures in a clean condition for the life of the Project.

6. Containers: Provide appropriate containers, such as dump containers, and locate on site for collection of waste materials and rubbish.
7. Supervision: Oversee all cleaning of areas by the trades using them. Ensure that resulting accumulations are deposited in appropriate containers.
8. Clean-up: Daily, weekly, or as necessary, clean-up floors and Site areas. Remove all loose materials, by sweeping if necessary.

#### 1.4 FINAL CLEANING

- A. Provide final clean-up and polishing just prior to final inspection and/or acceptance of the work of the Project.
- B. Preparation:
  1. Prior to final inspection, remove all loose material of any nature, except spare parts, loose furniture or furnishings, manuals, parts books, and similar items.
  2. Remove all temporary buildings, utility lines or pipes and other work of a temporary nature.
  3. Remove all temporary wrappings. Leave no trace of wrap or adhesive.
- C. Surface Cleaning:
  1. Special cleaning for specific units of Work as specified and as shown on Drawings.
  2. Provide final cleaning of the Work, at time indicated, consisting of cleaning each surface or unit of Work to normal "clean" condition expected for a first-class building cleaning and maintenance program.
  3. Comply with manufacturer's instructions for cleaning operations.
- D. The following are examples, but not by way of limitation, of cleaning levels required:
  1. Remove labels which are not required as permanent labels.
  2. Clean transparent materials, including mirrors and window/door glass, to a polished condition, removing substances which are noticeable as vision-obscuring materials. Replace broken glass and damaged transparent materials.
  3. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of dust, stains, films, and similar noticeable distracting substances.



- a. Except as otherwise indicated, avoid disturbance of natural weathering of exterior surfaces.
  - b. Restore reflective surfaces to original reflective condition.
4. Wipe surfaces of mechanical and electrical equipment clean, including elevator equipment and similar equipment; remove excess lubrication and other substances.
5. Remove debris and surface dust from limited-access spaces including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
6. Clean concrete floors in unoccupied spaces broom clean.
7. Vacuum clean carpeted surfaces and similar soft surfaces.
8. Clean plumbing fixtures to a sanitary condition, free of stains including those resulting from water exposure.
9. Clean light fixtures and lamps so as to function with full efficiency.
10. Clean Project Site (staging areas, Contractor Parking areas), including landscape development areas, of litter and foreign substances.
11. Sweep paved areas to a broom-clean condition; remove stains, petro-chemical spills, and other foreign deposits.
- E. Pest Control: Engage an experienced exterminator to make a final inspection of Project, and to rid Project of rodents, insects, and other pests.
- F. Removal of Protection: Except as otherwise indicated or requested by Hospital Representative, remove temporary protection devices and facilities which were installed during course of Work to protect previously completed Work during remainder of construction period.
- G. Compliances:
  1. Comply with safety standards and governing regulations for cleaning operations.
  2. Do not burn waste materials at site, or bury debris or excess materials on the property, or discharge volatile or other harmful or dangerous materials into drainage systems.
  3. Remove waste materials from site and dispose of in a lawful manner.
- H. Moving Parts: Lubricate moving parts as recommended by the parts manufacturer, or as directed by the Architect. Wipe clean, all surplus lubricants.
- I. Protection: Protect finished floors from damage due to traffic or other causes.

Intermountain Health  
Intermountain Health

Primary Children's Hospital  
Primary Children's Hospital  
Operating Room 17  
Operating Room 17

END OF SECTION

**SECTION 02 41 19 - SELECTIVE DEMOLITION**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Demolition and removal of selected portions of a building or structure.
  - 2. Repair procedures for selective demolition operations.

## 1.3 DEFINITIONS

- A. Remove: Carefully detach items from existing construction and legally dispose of them off-site, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.
- C. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

## 1.4 MATERIALS OWNERSHIP

- A. Except for items or materials indicated to be reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, demolished materials shall become Contractor's property and shall be removed from Project site.

## 1.5 SUBMITTALS

- A. Proposed Dust-Control and Noise-Control Measures: Submit statement or drawing that indicates the measures proposed for use, proposed locations, and proposed time frame for their operation. Identify options if proposed measures are later determined to be inadequate.

## 1.6 PROJECT CONDITIONS

- A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.
- B. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities.

1. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from authorities having jurisdiction.
- C. Owner assumes no responsibility for condition of areas to be selectively demolished.
1. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.
- D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.
1. If materials suspected of containing hazardous materials are encountered in the work, Contractor will be responsible for removal and disposal of all materials. A copy of an Asbestos Report will be provided to the Contractor prior to construction beginning. See Bid Proposal for unit price to remove hazardous materials.
- E. Storage or sale of removed items or materials on-site will not be permitted.
- F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.
1. Maintain fire-protection facilities in service during selective demolition operations.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.
- C. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

### 3.2 UTILITY SERVICES

- A. Existing Utilities: Maintain services indicated to remain and protect them against damage during selective demolition operations.
- B. Do not interrupt existing utilities serving occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and to authorities having jurisdiction.
  1. Provide at least 72 hours' notice to Owner if shutdown of service is required during changeover.

- C. Utility Requirements: Locate, identify, disconnect, and seal or cap off indicated utilities serving areas to be selectively demolished.

### 3.3 PREPARATION

- A. Temporary Enclosures: Provide temporary enclosures for protection of existing building and construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
  - 1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
- B. Temporary Partitions: Erect and maintain dustproof partitions and temporary enclosures to limit dust and dirt migration and to separate areas from fumes and noise.

### 3.4 SELECTIVE DEMOLITION

- A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:
  - 1. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
  - 2. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
  - 3. Dispose of demolished items and materials promptly.
- B. Existing Facilities: Comply with building manager's requirements for using and protecting building facilities during selective demolition operations.

### 3.5 DISPOSAL OF DEMOLISHED MATERIALS

- A. General: Promptly dispose of demolished materials. Do not allow demolished materials to accumulate on-site.
- B. Burning: Do not burn demolished materials.
- C. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

END OF SECTION

**SECTION 03 53 00- CONCRETE TOPPING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and install concrete toppings (cementitious underlayments), complete, as shown on Drawings and as specified, including:
  - 1. Miscellaneous tapers and warps for alignment of top-of-finish flooring at transitions between materials of different heights and thickness, including:
    - a. Section 093000 – Tile.
    - b. Section 096519 – Resilient Tile Flooring.
    - c. Section 096813 – Tile Carpeting
    - d. Concrete Floors without finish or painted finish.
  - 2. Remedial correction of interior floor slabs to provide specified floor flatness as specified in Section 033000 – Cast-in-Place Concrete; at no additional cost to Owner.
- B. Work Specified Elsewhere:
  - 1. Section 033000 – Cast-in-Place Concrete. Use concrete from this Section when the thickness is at least 2-inches.
  - 2. Section 093000– Tile; Polymer-modified mortars for tile assemblies sloped to drains.

## 1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Requirements.
- B. Product Data: Manufacturer's literature describing materials and specifications for mixing, placing, curing, and protecting.

## 1.3 QUALITY ASSURANCE

- A. Applicator: Approved and trained by manufacturer.
- B. Design Criteria:
  - 1. Compressive Strength: Minimum 4,100-PSI at 28 Days per ASTM C109.

## 1.4 PRODUCT HANDLING

- A. Delivery: Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

- B. Storage: Ensure storage facilities are weathertight and dry.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. General: Ardex Inc; Dependable Inc; or approved equal. Ardex products are specified as Basis-of-Design

### 2.2 MATERIALS

A. Concrete Topping Types:

1. Self-Leveling Type for Interior Applications: Ardex K-15, or approved equal; 4,100-PSI compressive strength, 16-hour curing time. Installs from feather-edge depth to 1 1/2-inch depth without aggregate; installs up to 5-inch depth with addition of aggregate per manufacturer's written instructions.
2. Trowelable Fast-Setting Patch Type for Interior Applications: Ardex SD-P, or equal; 4,200-PSI compressive strength, 1-hour curing time. Installs from feather-edge depth to 1-inch depth without aggregate; installs up to 3-inch depth with addition of aggregate per manufacturer's written instructions.
3. Fast-Setting, Self-Leveling Type for Interior Applications: Ardex SD-T, or equal; 6,100-PSI compressive strength, 2-hour curing time. Installs from 1/4-inch to 2-inch depth without addition of aggregate, and up to 5-inches depth with addition of aggregate per manufacturer's written instructions.
4. Weather-Resistant, Self-Leveling Type for Interior Applications: Ardex A-300, 3,200-PSI compressive strength. Installs from 1/4-inch depth to 1/2-inch depth without aggregate; installs up to 3/4-inch depth with addition of aggregate per manufacturer's written instructions.
5. Polymer-Reinforced, Weather-Resistant Type for Interior Applications: Ardex Poly-Top, 5,500-PSI compressive strength. Installs from 1/4-inch depth to 1-inch depth without aggregate; installs up to 2-inch depth with addition of aggregate per manufacturer's written instructions.
6. Trowelable Fast-Setting Patch Type for Interior Applications: Ardex CD, 4,000-PSI compressive strength. Installs from 1/16-inch depth to 1/2-inch depth without aggregate.

- B. Primer: Ardex P-51, or equal, and as recommended in writing by the topping manufacturer for the substrata to receive topping.

C. Aggregate:

1. Sand: 1/16-inch or less washed masonry sand, mortar sand, or plaster sand.

2. Gravel: 3/8-inch pea gravel.
- D. Water: Clean and potable, free from impurities detrimental to underlayment.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Examine substrate and verify that surfaces are free from debris and are reasonably clean and dry and that conditions are otherwise suitable to receive topping. Do not start Work until conditions are satisfactory.

#### 3.2 PREPARATION

- A. Cracks and Voids: Fill with trowelable fast-setting patch type concrete topping.

#### 3.3 MIXES

- A. General: Mix concrete toppings per manufacturer's recommendations.
- B. Aggregates: Add sand or gravel aggregates to topping mix per manufacturer's recommendations for topping thickness.

#### 3.4 INSTALLATION

- A. General: Prime substrates, mix materials, and place toppings per manufacturer's recommendations.
- B. Thickness: Install to thickness as shown or as required, spreading and screeding to smooth surface; abut level to existing surface.
- C. Edge Forms: Provide as required.
- D. Ramps and Slopes to Drains: Including other accommodations for level changes; form with trowelable fast-setting patch type cementitious underlayment.
1. Sloped-to-Drain Setting bed materials for Patient Bathrooms, Showers and Tub Rooms provided in 093000 – Tile.
- E. Finish: As recommended by flooring manufacturer for reception of specified finish materials.
- F. Exterior Work: Provide weather-resistant toppings at concealed locations or at the written direction of the Owner.
- G. Transitions between Floor Finishes of differing thickness:
1. General: Provide concrete topping as required to align top-of-finish floor where flooring materials of different thickness meet.
  2. Performance Criteria:



- a. Provide concrete topping as required so that all offsets between adjacent floor materials are 1/8-inch or less.
  - b. Warp-applied concrete topping with a slope no greater than 1 inch in 48 inches, or a length of slope no less than 18 inches, whichever produces the more gentle transition.
3. Locations: Provide at locations where transitions between the following floor finishes occur that result in a vertical offset of greater than 1/8-inch:
- a. Section 093000 – Tile.
  - b. Section 096519 – Resilient Flooring.
  - c. Section 096813 – Tile Carpeting.
  - d. Concrete Floors without finish or painted finish.

### 3.5 CURING

- A. General: Allow concrete topping to harden as recommended by manufacturer.
- B. Traffic: Do not permit traffic on topping during hardening period; minimum 2 hours or longer.
- C. Loading: Do not load floors until reasonable strength has been achieved. Evenly distribute any loading on topping and prohibit concentrated loading.
- D. Conditions: Maintain adequate ventilation and temperature above 50 degrees F. until topping is dry.

### 3.6 CLEANING AND REPAIR

- A. General: Repair concrete topping damaged after installation as a result of other trades prior to installation of scheduled floor finish, if any, at no additional cost to Owner.

END OF SECTION

**SECTION 05 05 00 – METAL FASTENERS**

## Part 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: This Section establishes general standards and requirements for metal fasteners utilized for attachment of items to the primary structure of the building and is incorporated in others Sections of these specifications where referenced, including:
  - 1. Expansion Bolts.
  - 2. Bolts, screws and other fasteners.
- B. Work Specified Elsewhere:
  - 1. Division 5 – Miscellaneous Metal Fabrications.
  - 2. Division 23 – Mechanical.
  - 3. Division 26 – Electrical.

## 1.2 SUBMITTALS

- A. Comply with provisions of Section 01 33 00 – Submittal Procedures.
- B. Product Data: Manufacturers' information on materials, fabrication, and installation. Include current ICC or IAPMO Reports and other information to substantiate compliance with Contract Documents.
- C. Substitutions: Include with requests for substitution of fastening device type, minimum embedment, length, load capacity for pull out and shear, and installation torque of fasteners and statement that fastening devices meet or exceed requirements specified in Contract Documents.

## 1.3 QUALITY ASSURANCE

- A. Field Quality Control:
  - 1. The Owner's Testing Lab will perform and report on tests and inspections as follows:
  - 2. Expansion Bolts:
    - a. Test 50 percent of drilled-in anchorages to 2.0 times the allowable load specified with special inspection in tension.
    - b. If any anchor fails testing, test all anchors of the same category installed that day until twenty consecutive anchors pass, then resume the initial testing frequency. Cost of this testing shall be borne by Contractor.

## Part 2 - PRODUCTS

## 2.1 MATERIALS

- A. Expansion Bolts: Hilti, Inc.'s Kwik Bolt TZ2 or E.O.R. approved equivalent. Provide stainless steel expansion bolts for exterior exposure.
- B. Sheet Metal Screws: John Wagner Associates' Grabber or equal: Unless otherwise noted on Drawings, type to suit stud, track, or channel gauge and as follows.
  - 1. Where Overlaid with Gypsum Board or Other Finish Material:
    - a. For Fastening to 20 Gauge and Lighter Material: No. 8 by 9/16-inch Wafer Head Streaker.
    - b. For Fastening to 18 Gauge and Heavier Material: No. 8 by 1/2-inch Wafer Head Self-Drilling.

2. Where Not Overlaid with Finish Material:
  - a. For Fastening to 20 Gauge and Lighter Material: No. 8 by 9/16-inch Hex Head Streaker.
  - b. For Fastening to 18 Gauge and Heavier Material: No. 8 by 1/2-inch Hex Head Self-Drilling.
- C. Nuts and Bolts: ASTM A365 and ASTM A307 with suitable nuts, in accordance with ASTM A563, and washers 1/4-inch diameter, unless otherwise noted.
- D. U-Bolts: Special sizes and shapes shown; material as specified for nuts and bolts.

## Part 3 - EXECUTION

### 3.1 INSTALLATION

- A. Expansion Bolts: Install in predrilled holes for fastening items into concrete.
  1. Install expansion bolts according to the manufacturer's instructions as to tools, torque and tightening procedure.
  2. Expansion bolt locations and spacings: As shown.
  3. Edge Distance: Not less than 10 bolt diameters.
  4. Unless otherwise noted, install expansion bolts with manufacturer's recommended minimum embedments. Embedment length is exclusive of thickness of floor coverings, grout pads or other overlays.
  5. Do not recess expansion bolts more than one-fourth of the nominal bolt diameter. Abandon overdrilled holes or partially fill with nonshrink grout and redrill when grout has set.
  6. Abandon holes if the axis of a drilled hole deviates more than 5 degrees from normal to the concrete surface.
  7. If a concrete reinforcing bar is encountered during drilling, immediately terminate drilling and notify the Architect. Subject to review and approval the SEOR, the Architect may authorize using one of the following procedures:
    - a. If the location may be shifted, fill abandoned hole with nonshrink grout and install expansion bolt with a minimum of 1/2 inch of sound concrete between the expansion bolt and the abandoned hole, or...
    - b. If the location may not be shifted, use a diamond core drill to cut the rebar and drill the hole beyond the reinforcing such that the whole wedge portion of the expansion bolt can be expanded below the bar, or...
    - c. If the location may not be shifted, core an oversize hole at the direction of the Architect and grout an acceptable anchor in place.
- B. Fasten Work tightly to prevent rattle or vibration except where expansion-contraction tolerances are required.
- C. When expansion bolts are installed through metal deck into concrete slab above, embedment shall not extend closer than 3/4-inch to top of concrete. Locate at center of bottom flute. Minimum embedment shall be 1-1/2-inches above top flute of decking.
- D. Expansion Bolt Test Values:
  1. Test Procedure: Apply proof test loads by means of hydraulic ram, calibrating spring loading device, or torque wrench without removing nut if possible. If not possible, remove nut and install a threaded coupler to same tightness as original nut using a torque wrench.
  2. Test Equipment: Calibrated by approved testing laboratory per standard industry procedures.

3. Expansion Bolts shall withstand following minimum test loads for specified wedge type anchors:

<u>Anchor Thread Size</u> (diameter in inches)	<u>Tension Test Load</u> (lbs.)	<u>Test Torque</u> (ft-lbs.)
1/4	800	10
3/8	1100	25
1/2	2000	50
5/8	2300	80
3/4	3700	150
1	5800	250

4. Acceptance Criteria:
- Hydraulic Ram Method: Expansion bolt is acceptable if there is no observable movement nor loosening of washer at application of tension test load.
  - Torque Wrench Method: Expansion bolt is acceptable if the test torque is reached within one-half turn of the nut.
5. Test Timing: Within 24 hours after expansion bolt installation and in the presence of the Inspector of Record.

END OF SECTION

**SECTION 05 12 00 - STRUCTURAL STEEL FRAMING**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:

- 1. Structural steel.

- B. Related Requirements:

- 1. Section 055000 "Metal Fabrications" for other steel items not defined as structural steel.

## 1.3 DEFINITIONS

- A. Structural Steel: Elements of the structural frame indicated on Drawings and as described in ANSI/AISC 303.

## 1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

## 1.5 ACTION SUBMITTALS

- A. Product Data:

- 1. Structural-steel materials.
  - 2. Shop primer.

- B. Shop Drawings: Show fabrication of structural-steel components.

- 1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
  - 2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.

- C. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide in accordance with AWS D1.1/D1.1M for each welded joint whether prequalified or qualified by testing, including the following:

1. Power source (constant current or constant voltage).
2. Electrode manufacturer and trade name, for demand-critical welds.

#### 1.6 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Mill test reports for structural-steel materials, including chemical and physical properties.
- C. Source quality-control reports.
- D. Field quality-control reports.

#### 1.7 QUALITY ASSURANCE

- A. Fabricator Qualifications: A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
- B. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.

#### 1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.
  1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.
- B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.
  1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
  2. Clean and relubricate bolts and nuts that become dry or rusty before use.
  3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F3125/F3125M, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.

### PART 2 - PRODUCTS

#### 2.1 STRUCTURAL-STEEL MATERIALS

- A. W-Shapes: ASTM A992/A992M.

- B. Round HSS: ASTM A500 Gr. C
- C. Plate and Bar: ASTM A36/A36M.
- D. Welding Electrodes: Comply with AWS requirements.

## 2.2 FABRICATION

- A. Structural Steel: Fabricate and assemble in shop to greatest extent possible. Fabricate in accordance with ANSI/AISC 303 and to ANSI/AISC 360.
  - 1. Identify high-strength structural steel in accordance with ASTM A6/A6M and maintain markings until structural-steel framing has been erected.
  - 2. Mark and match-mark materials for field assembly.
- B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
  - 1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.
- C. Bolt Holes: Cut, drill, or punch standard bolt holes perpendicular to metal surfaces.
- D. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.
- E. Cleaning: Clean and prepare steel surfaces that are to remain unpainted in accordance with SSPC-SP 3.
- F. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.
  - 1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

## 2.3 SHOP CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
  - 1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

## 2.4 SOURCE QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform shop tests and inspections.
  - 1. Allow testing agency access to places where structural-steel work is being fabricated or produced to perform tests and inspections.
  - 2. Welded Connections: Visually inspect shop-welded connections in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:

- a. Liquid Penetrant Inspection: ASTM E165/E165M.
  - b. Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
  - c. Ultrasonic Inspection: ASTM E164.
  - d. Radiographic Inspection: ASTM E94/E94M.
3. Prepare test and inspection reports.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated on Drawings.

#### 3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and in accordance with ANSI/AISC 303 and ANSI/AISC 360.
- B. Maintain erection tolerances of structural steel within ANSI/AISC 303.
- C. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
  1. Level and plumb individual members of structure. Slope roof framing members to slopes indicated on Drawings.
  2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
- D. Splice members only where indicated.
- E. Do not use thermal cutting during erection.
- F. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.



### 3.4 FIELD CONNECTIONS

- A. Weld Connections: Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
1. Comply with ANSI/AISC 303 and ANSI/AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
  2. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in ANSI/AISC 303 for mill material.

### 3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform the following special inspections:
1. Verify structural-steel materials and inspect steel frame joint details.
  2. Verify weld materials and inspect welds.
  3. Verify connection materials and inspect high-strength bolted connections.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
1. Welded Connections: Visually inspect field welds in accordance with AWS D1.1/D1.1M.
    - a. In addition to visual inspection, test and inspect field welds in accordance with AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      - 1) Liquid Penetrant Inspection: ASTM E165/E165M.
      - 2) Magnetic Particle Inspection: ASTM E709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration are not accepted.
      - 3) Ultrasonic Inspection: ASTM E164.
      - 4) Radiographic Inspection: ASTM E94/E94M.

END OF SECTION 05 12 00

**SECTION 05 40 00 - COLD-FORMED METAL FRAMING**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Exterior non-load-bearing wall framing.
  - 2. Ceiling joist framing.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
  - 1. Cold-formed steel framing materials.
  - 2. Exterior non-load-bearing wall framing.
  - 3. Vertical deflection clips.
  - 4. Single deflection track.
  - 5. Double deflection track.
  - 6. Drift clips.
  - 7. Ceiling joist framing.
  - 8. Post-installed anchors.
  - 9. Power-actuated anchors.
- B. Shop Drawings:
  - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
  - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Welding certificates.
- B. Product Certificates: For each type of code-compliance certification for studs and tracks.
- C. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.
5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

D. Research Reports:

1. For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.
2. For sill sealer gasket/termite barrier, showing compliance with ICC-ES AC380.

1.5 QUALITY ASSURANCE

- A. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- B. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Stud Manufacturers Association.
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
  1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
  2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design is provided in the structural drawings. Where deviations are made from the design in the structural drawings or to provide engineering for conditions not covered in the drawings, provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
  1. Design Loads: As indicated on Drawings.
  2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    - a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
    - b. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.
  3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or

- other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
    - a. Upward and downward movement of 1 inch.
  5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- B. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
1. Wall Studs: AISI S211.
  2. Headers: AISI S212.
- C. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

## 2.2 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
1. Grade: As indicated.
  2. Coating: G60, A60, AZ50, or GF30.
- B. Steel Sheet for Vertical Deflection Drift Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
1. Grade: As required by structural performance.
  2. Coating: G60.

## 2.3 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
  2. Flange Width: 1-5/8 inches.
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
1. Minimum Base-Metal Thickness: As indicated.
  2. Flange Width: 1-1/4 inches.

- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
  - 1. Minimum Base-Metal Thickness: As indicated.
  - 2. Flange Width: 1 inch plus the design gap for one-story structures.
- E. 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 loads and transfer them to the primary structure, and as follows:
    - a. Minimum Base-Metal Thickness: As indicated.
    - b. Flange Width: 1 inch plus the design gap for one-story structures.
  - 2. Inner Track: Of web depth indicated, and as follows:
    - a. Minimum Base-Metal Thickness: As indicated.
    - b. Flange Width: Insert dimension equal to sum of outer deflection track flange width plus 1 inch.
- F. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

#### 2.4 CEILING JOIST FRAMING

- A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:
  - 1. Minimum Base-Metal Thickness: As indicated.
  - 2. Flange Width: As indicated.

#### 2.5 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
  - 1. Supplementary framing.
  - 2. Bracing, bridging, and solid blocking.
  - 3. Web stiffeners.
  - 4. Anchor clips.

5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

## 2.6 ANCHORS, CLIPS, AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Post-Installed Anchors: AS indicated.
- C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
  1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- E. Welding Electrodes: Comply with AWS standards.

## 2.7 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780/A780M MIL-P-21035B or SSPC-Paint 20.

## 2.8 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
  1. Fabricate framing assemblies using jigs or templates.
  2. Cut framing members by sawing or shearing; do not torch cut.
  3. Fasten cold-formed steel framing members by welding or screw fastening. Wire tying of framing members is not permitted.
    - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.
  4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

- B. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
  - 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
  - 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

#### 3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.
  - 1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
  - 1. Cut framing members by sawing or shearing; do not torch cut.
  - 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

- a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
  - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Install insulation in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- H. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

#### 3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
1. Stud Spacing: As indicated on Drawings.
- C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.
- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
1. Install single deep-leg deflection tracks and anchor to building structure.
  2. Install double deep-leg deflection tracks and anchor outer track to building structure.
  3. Connect vertical deflection clips to studs and anchor to building structure.
  4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Drawings but not more than 48 inches apart. Fasten at each stud intersection.
1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
  2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.



3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
  1. Install solid blocking at centers indicated.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

### 3.5 INSTALLATION OF CEILING JOIST FRAMING

- A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated.
- B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.
- C. Space joists not more than 2 inches from abutting walls, and as follows:
  1. Joist Spacing: As indicated on Drawings.
- D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.
- E. Install bridging at intervals indicated. Fasten bridging at each joist intersection as follows:
  1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
  2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.
- F. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.
- G. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

### 3.6 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

### 3.7 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

### 3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

### 3.9 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

**SECTION 055000 - METAL FABRICATIONS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Countertop supports.

## 1.3 SUBMITTALS

- A. Shop Drawings: Show fabrication and installation details for metal fabrications.
  - 1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
- B. Welding certificates.

## 1.4 QUALITY ASSURANCE

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

## 1.5 PROJECT CONDITIONS

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

## 1.6 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

## PART 2 - PRODUCTS

## 2.1 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

## 2.2 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

## 2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
- B. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.

## 2.4 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79.

## 2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch, unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
  - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
  - 2. Obtain fusion without undercut or overlap.
  - 3. Remove welding flux immediately.

4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

## 2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

## 2.7 UNISTRUT

- A. Provide unistrut as called for on the drawings for support of miscellaneous ceiling-anchored building elements.

## 2.8 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

## 2.9 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work.

## 2.10 STEEL AND IRON FINISHES

- A. Shop Priming: Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finishes and those to be embedded in concrete or masonry, unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
- B. Surface Preparation for High Performance Coatings: At exposed steel fabrications on the exterior of the building (and at all locations where High Performance Coatings – Exterior, are used), grind all welds smooth and remove manufacturer's marks prior to priming. Provide the following:
  1. Shop Surface Preparation: SSPC-SP10/NACE 2 Near White Blast Cleaning with a minimum angular anchor profile of 1.5 mils

2. Shop Applied Prime Coat: Tnemec, Tneme-Zinc Series 90-97 at 2.5 - 3.5 mils dft or Architect's approved equal that is compatible with the High Performance Coating at that location.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION, GENERAL

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

#### 3.2 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

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

#### 3.3 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 055000

**SECTION 06 10 00- ROUGH CARPENTRY**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Rough Carpentry, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. Work Specified Elsewhere:
  - 1. Section 06 41 23 – Interior Architectural Woodwork.

## 1.2 QUALITY ASSURANCE

- A. Drawings indicate type, arrangement, and location of items of rough carpentry.
  - 1. If variations from arrangement or profile indicated are required, notify Architect.
  - 2. Make such variations at no added expense to Owner.
- B. Contractor is responsible for fitting to recesses, including trim pieces, fillers, and closures.
- C. Lumber Grading Rules and Species:
  - 1. US Department of Commerce (DOC):
    - a. PS 20 American Softwood Lumber Standard.
  - 2. Western Wood Products Association (WWPA).
  - 3. Southern Forest Products Association (SFPA).
- D. Plywood Grading Rules and Recommendations:
  - 1. US Department of Commerce (DOC):
    - a. Softwood plywood: PS1 Structural Plywood.
  - 2. American Plywood Association (APA).
- E. Preservative and Fire Retardant Treatment Standards:
  - 1. American Wood Protection Association (AWPA):
    - a. AWPA U1 Treated Wood.
    - b. AWPA P5 Standard for Waterborne Preservatives.
  - 2. Underwriters Laboratories (UL)
  - 3. ASTM International requirements:
    - a. ASTM E84 Standard Test Method for Surface Burning Characteristics
    - b. ASTM D2898 Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing
- F. Factory Marking:
  - 1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
  - 2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark and fire-retardant treatment for identification.
  - 3. International Building Code (IBC):
    - a. Requirements for identification and labeling.

## 1.3 SUBMITTALS

- A. Project Information:
  - 1. Certification of fire retardant treated material.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

## A. Fire-retardant Treated Dimension Lumber and Plywood:

1. Base:
  - a. Hoover Treated Wood Products, Incorporated
2. Optional:
  - a. Lonza Group Limited
  - b. Arch Wood Protection, Incorporated
  - c. Western Wood Preserving Company

## B. Preservative Treated Lumber:

1. Base:
  - a. Lonza Group Limited
2. Optional:
  - a. Arch Wood Protection Incorporated
  - b. Stella-Jones Incorporated
  - c. Western Wood Preserving Company

## 2.2 MATERIALS

## A. Dimensional Lumber and Plywood:

1. Thoroughly seasoned, non-treated, well-fabricated materials.
2. Longest practical lengths and sizes.
3. Application, except where treated types are indicated:
  - a. Non-structural framing, blocking, backing, nailers, grounds, and similar members.
  - b. Other locations where indicated.

## B. Fire-retardant Treated Lumber and Plywood (FRT):

1. Flame spread index: Less than 25.
2. Smoke developed index: Less than 450.
3. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
4. Kiln dried after treatment, (KDAT).
5. FRT material for interior and above-grade locations:
  - a. Base: Pyro-Guard by Hoover Treated Wood Products, Incorporated
  - b. Optional:
    - 1) Dricon FRT by Arch Wood Protection.
    - 2) FirePro by Western Wood Preserving Company.
  - c. Natural wood products treated to add fire-retardant qualities.
  - d. Moisture content: Not more than 28 percent.
  - e. Interior and above grade applications include but not limited to:
    - 1) Interior, above-grade framing, blocking, and sill plates within non-load bearing interior partitions that are fire rated 2 hours or less.
    - 2) Above-grade framing, blocking, and sill plates within non-load bearing exterior walls that are not fire-rated.
    - 3) Platforms and Stages.
    - 4) Wood in concealed spaces.
    - 5) Framing, blocking, cants and nailers within roof covering and waterproofing systems.
    - 6) Interior sleepers and sill plates in contact with concrete slabs-on-grade.
    - 7) Interior wood items in direct contact with exterior concrete and exterior masonry walls.
    - 8) Window frame blocking within exterior walls.
    - 9) Plywood backing panels for electrical, telecommunication equipment.



- 10) Similar locations where wood products are indicated and building code does not permit non-fire-resistive treated products.
- 11) Above-grade dimensional lumber and plywood, unless indicated otherwise.
  - a) Exception: Upgrade to Exterior grade where scheduled in the following article.
- 6. FRT material for exterior and wet locations or as noted on drawings:
  - a. Base: Exterior Fire-X by Hoover Treated Wood Products, Incorporated
  - b. Optional:
    - 1) Dricon FRX by Arch Wood Protection
  - c. Natural wood products treated to add fire-retardant qualities plus decay and termite resistance.
  - d. Non-leaching treatment under direct exposure to precipitation, sunlight, and effects of weather.
  - e. Exterior applications include but not limited to:
    - 1) Fire-treated wood that is directly exposed to weather.
    - 2) Fire-treated wood in areas of high-humidity, Greater than 80 percent RH.
    - 3) Other areas where indicated.
- C. Preservative Treated Lumber and Plywood:
  - 1. Natural wood products treated to add decay and termite resistance.
  - 2. Base:
    - a. FrameGuard by Lonza Group Limited
  - 3. Optional:
    - a. Lumber Products by Stella-Jones Incorporated
    - b. Advance Guard by Western Wood Preserving Company
  - 4. Preservatives:
    - a. Compatible with direct exposure to precipitation, sunlight and effects of weather.
    - b. Authenticate by factory marking each piece with manufacturer's mark and applicable standards.
    - c. Acceptable treatments:
      - 1) Alkaline Copper Quaternary (ACQ).
      - 2) Copper Boron Azole (CBA).
      - 3) Borate based (BORON).
  - 5. Lumber Species:
    - a. Southern Pine.
    - b. Mixed Southern Pine.
    - c. Hem-Fir.
    - d. Spruce.
    - e. Pine.
    - f. Other species meeting requirements.
  - 6. Plywood:
    - a. Grading:
      - 1) PS1, B-C Grade.
      - 2) PS1, A-C Grade where exposed.
    - b. Veneers:
      - 1) Softwood species.
      - 2) Glue with waterproof adhesives.
  - 7. Moisture content:
    - a. Lumber: 19 percent.
    - b. Plywood 18 percent.
    - c. Kiln dried after treatment, (KDAT).
  - 8. Application:
    - a. Below grade, or in contact with earth.
    - b. Where indicated in Drawings.

- D. Sill Sealing Gaskets:
  - 1. Closed cell neoprene foam.
  - 2. Thickness: 1/4 IN.
  - 3. Match width of sill members indicated.
- E. Adhesives for bonding furring, sleepers, sills and similar items to concrete or masonry:
  - 1. Approved for indicated use by adhesive manufacturer.
  - 2. Comply with ASTM D3498.
- F. Water-Repellent Preservative:
  - 1. Treat of exposed ends of posts and beams.
  - 2. National Wood Window and Door Association (NWWDA) tested and accepted formulation.

### 2.3 FASTENERS

- A. General:
  - 1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
  - 2. Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
    - a. Use fasteners with hot dip zinc coating complying with ASTM A153.
    - b. Use fasteners of Type 304 stainless steel.
- B. Nails, Brads, and Staples: ASTM F1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Lag Bolts: ASME B18.2.1.
- F. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.
- G. Expansion Anchors:
  - 1. Tested in accordance with ASTM E488.
  - 2. Anchor bolt and sleeve assembly:
    - a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
    - b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
  - 3. Interior applications:
    - a. Carbon-steel components.
    - b. Zinc plated to comply with ASTM B633, Class Fe/Zn 5.
  - 4. Exterior and wet applications:
    - a. Stainless Steel components, ASTM F593 and ASTM F594 Alloy Group 1 or 2.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Examine conditions under which work is to be installed.
- B. Verify measurements, dimensions, and details before proceeding.
- C. Coordinate location of furring, nailers, blocking, grounds and similar supports.
- D. Correct unsatisfactory conditions.

### 3.2 INSTALLATION OF ROUGH CARPENTRY

- A. Form to shapes indicated.

- B. Cut and fit accurately.
  - C. Set work to required levels and lines, plumb and true.
  - D. Shim as required.
  - E. Provide wood grounds or nailers as required for attachment of other work and surface applied items.
  - F. Grounds:
    - 1. Dressed, key beveled lumber.
    - 2. Minimum 1-1/2 IN wide x thickness required to bring face of ground even with finish material.
    - 3. Remove temporary grounds when no longer required.
  - G. Wall Blocking:
    - 1. Provide in-wall fire-treated wood blocking reinforcement where following items are required to be wall-mounted to interior walls:
      - a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
      - b. Handrails at stairwells.
      - c. Between studs at height of door stop, behind stop.
    - 2. Metal wall backing:
      - a. See Section 09 22 16.
  - H. Anchor work to support applied loading.
    - 1. Provide washers under bolt heads and nuts.
    - 2. Fasten plywood in accordance with APA recommendations.
    - 3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
    - 4. Pre-drill holes to avoid splitting wood with fasteners.
    - 5. Do not drive threaded friction type fasteners.
- 3.3 INSTALLATION OF BLOCKING AND NAILERS FOR ROOFING AND PARAPETS
- A. Install in accordance with ANSI/SPRI ES-1 Wind Design Standard for Edge Systems Used With Low Slope Roofing Systems.
  - B. Minimum Wood Member Size: 2x6 IN nominal.
  - C. Fasteners:
    - 1. Corrosion resistant.
      - a. Hot dip galvanized: Comply with ASTM A153 or ASTM A653, Class G185.
      - b. Stainless steel: Types 304 or 316.
    - 2. Countersink heads of fasteners.
    - 3. Types required for substrate conditions.
    - 4. Fasteners of diameter and spacing required to resist forces indicated.
    - 5. Spacing:
      - a. Threaded anchor bolts; 3/8 IN or larger:
        - 1) Provide 5/8 IN OD washers or larger.
        - 2) Maximum spacing: 48 IN OC.
        - 3) Stagger 1/3 nailer width.
      - b. Other fastener types:
        - 1) Maximum Spacing:
          - a) Typical: 12 IN OC.
          - b) Up to 16 IN OC where necessary to match spacing of structural members.
        - 2) Stagger 1/3 nailer width.
        - 3) Install 2 fasteners and within 6 IN of nailer ends.

- D. Anchor nailers to resist minimum vertical force of 300 LBS/LF in any direction.
  - 1. Locate fasteners approximately 4 IN from ends but not less than 3 IN.
  - 2. Use minimum of 3 anchors for each nailer.
  - 3. Where members are wider than 6 IN, stagger fasteners from side to side to avoid splitting of the wood member.
  - 4. Corner region enhancements:
    - a. Double the above listed vertical force which must be resisted.
    - b. Length and width of corners as prescribed by ANSI/SPRI RP-4:
      - 1) 40 percent of the building height, but not less than 8-1/2 FT.
- E. Nailers used for perimeter securement of roofing membranes:
  - 1. Install nailers where indicated and where required to secure perimeter of membrane roofing.
  - 2. Match height of nailers to adjacent insulation.
  - 3. Where multiple layers are required to match depth of insulation:
    - a. Attach base layer as indicated in General Requirements above.
    - b. Apply a bead of construction adhesive between laminations.
    - c. Attach subsequent layers using fastener type which is appropriate for wood-to-wood securement.
    - d. Size and locate fasteners as required to resist uplift loading indicated.
- F. Install blocking as indicated for securement of sheet metal edge flashings, parapet copings, and similar items.

#### 3.4 INSTALLATION OF FIRE RETARDANT TREATED WOOD

- A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.
- B. Use only fasteners approved by the manufacturer of fire-retardant-treated or preservative treated wood.
- C. Field Cuts:
  - 1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
    - a. Cross cuts, joining cuts, and drilling holes are permitted.
  - 2. Plywood: Fire retardant treated plywood may be cut in any direction.
  - 3. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPA M4.

END OF SECTION

**SECTION 06 16 00 - SHEATHING**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Wall Sheathing.
  - 2. Exterior Gypsum Soffit Board.
  - 3. Fire Retardant Plywood.
  - 4. Exterior Wall Sheathing.
- B. Related Requirements:
  - 1. Section 061053 "Rough Carpentry" for plywood backing panels.
  - 2. Section 072729 "Fluid Applied Air and Vapor Barrier" for exterior weather barrier.

## 1.3 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For assemblies with fire-resistance ratings, provide materials and construction identical to those of assemblies tested for fire resistance per ASTM E 119 by a testing and inspecting agency acceptable to authorities having jurisdiction.

## 2.2 EXTERIOR GYPSUM SOFFIT BOARD:

- A. ASTM C 1396/C 1396M, with manufacturer's standard edges.
- B. Core: 5/8 inch (15.9 mm), Type X for use at all exterior applications.

## 2.3 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes,

and with the flame front not extending more than 10.5 feet (3.2 m) beyond the centerline of the burners at any time during the test.

1. Use treatment that does not promote corrosion of metal fasteners.
  2. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated. Type and Thickness: Type X, 5/8 inch thick.
  3. Size: 48 by 96 inches.
  4. Thickness: ½" or ¾" as indicated on the drawings.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.

## 2.4 EXTERIOR WALL SHEATHING

- A. Glass-Mat Gypsum Wall Sheathing: ASTM C 1177/1177M.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. CertainTeed Corporation; GlasRoc.
    - b. G-P Gypsum Corporation; Dens-Glass Gold.
    - c. National Gypsum Company; Gold Bond e(2)XP.
    - d. United States Gypsum Co.; Securock.
  2. Type and Thickness: Type X, 5/8 inch thick.
  3. Size: 48 by 96 inches.
  4. Provide fluid applied air and vapor barrier, over sheathing at areas scheduled to receive brick.

## 2.5 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
- B. Nails, Brads, and Staples: ASTM F 1667.
- C. Power-Driven Fasteners: NES NER-272.
- D. Wood Screws: ASME B18.6.1.
- E. Screws for Fastening Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B 117.
1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C 1002.
  2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C 954.

## PART 3 - EXECUTION

### 3.1 INSTALLATION, GENERAL

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
  - 1. NES NER-272 for power-driven fasteners.
  - 2. Table 2304.9.1, "Fastening Schedule," in ICC's "International Building Code."
  - 3. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's "International Residential Code for One- and Two-Family Dwellings."
- D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

### 3.2 SHEATHING INSTALLATION

- A. Comply with manufacturer's written instructions.
  - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
  - 2. Install boards with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
  - 3. Install boards with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Abut ends of boards over centers of studs, and stagger end joints of adjacent boards not less than one stud spacing. Attach boards at perimeter and within field of board to each steel stud.
  - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- D. Vertical Installation: Install board vertical edges centered over studs. Abut ends and edges of each board with those of adjacent boards. Attach boards at perimeter and within field of board to each stud.
  - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of boards.
- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
  - 1. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel silicone emulsion sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.
- F. Provide Weather Barrier at Aluminum Wall System.

### 3.3 CEMENTITIOUS BACKER UNIT INSTALLATION

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated.

END OF SECTION



**SECTION 06 41 23- INTERIOR ARCHITECTURAL WOODWORK**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Work Included: Provide and install Casework, complete, as shown on Drawings and as specified. All casework to be:

**AWI Premium Grade Fabrication required, however AWI certification NOT required.**

- B. This Section includes the following:

1. Plastic-laminate cabinets.
2. Plastic-laminate countertops.
3. Solid-surfacing-material countertops and integral sinks.
4. Quartz transaction countertops.

- C. Related Sections include the following:

1. Division 6 Section "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing woodwork and concealed within other construction before woodwork installation.
2. Division 8 Section "Flush Wood Doors."

## 1.3 DEFINITIONS

- A. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips for installing woodwork items, unless concealed within other construction before woodwork installation.

## 1.4 SUBMITTALS

- A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material indicated.

1. Plastic laminates.
2. Shop-applied transparent finishes.

- C. Samples for Verification:

1. Plastic laminates, 8 by 10 inches, for each type, color, pattern, and surface finish.
2. Solid-surfacing materials, 6 inches square.
3. Quartz materials, 6 inches square.
  
4. One sample door with required hardware.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who has completed architectural woodwork similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
  
- B. Fabricator Qualifications:
  1. Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.
  2. Shop is a certified participant in AWI's Quality Certification
  
- C. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards" for grades of interior architectural woodwork, construction, finishes, and other requirements.
  1. Provide AWI certification labels or compliance certificate indicating that woodwork complies with requirements of grades specified.
  
- D. Single-sourcing materials: It is the intent of the Contract Documents to single-source plastic laminate and solid surface materials specified in this section when scheduled on the drawings to assure matching of specified finishes.

#### 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver woodwork until painting and similar operations that could damage woodwork have been completed in installation areas. If woodwork must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Project Conditions" Article.

#### 1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install woodwork until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period.
  
- B. Field Measurements: Where woodwork is 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 woodwork without field measurements. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

#### 1.8 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that interior architectural woodwork can be supported and installed as indicated.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. General: Provide materials that comply with requirements of the AWI quality standard for each type of woodwork and quality grade specified, unless otherwise indicated.
- B. Wood Species and Cut for Transparent Finish: (Typical at all wood panels)
  - 1. Species: Cherry
  - 2. Application:
    - a. Face Panel Grade: HPVA Grade A
    - b. Color: Stain to match VT Industries door sample "Ravine, RA07"
- C. Wood Products: Comply with the following:
  - 1. Hardboard: AHA A135.4.
  - 2. Softwood Plywood: DOC PS 1, Medium Density Overlay.
  - 3. Hardwood Plywood and Face Veneers: HPVA HP-1.
- D. Thermoset Decorative Overlay: Particleboard complying with ANSI A208.1, Grade M-2, or medium-density fiberboard complying with ANSI A208.2, Grade MD, with surface of thermally fused, melamine-impregnated decorative paper complying with LMA SAT-
- E. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated, or if not indicated, as required by woodwork quality standard.
  - 1. Manufacturer: Subject to compliance with requirements, provide high-pressure decorative laminates by one of the following:
    - a. Wilsonart
    - b. Pionite
- F. Solid-Surfacing Material: Homogeneous solid sheets of filled plastic resin complying with ISSFA-2.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Corian
    - b. Formica

2. Type: Standard slab type, unless Special Purpose type is indicated.
  3. Colors and Patterns: As per finish schedule.
- G. Adhesive for Bonding Plastic Laminate: Contact cement.
- H. Edge-banding:
1. Edge-banding for cabinet body parts shall be purified **3 mm PVC** applied with hot melt glue by automatic edge-banding equipment.
  2. Edge-banding for door and drawer fronts shall be purified 3 mm PVC applied with hot melt glue by automatic edge-banding equipment. Edges and corners shall be rounded with a 3 mm radius and scraped free from machining or chatter marks.
  3. Color shall match vertical laminate at cabinets or as selected by Architect from manufacturer's full color range for solids and patterns.
- I. Cores:
1. All sides, tops, countertops, bottoms, doors, drawer fronts, and partitions shall have minimum  $\frac{3}{4}$ " thick multi-core premium grade panel product cores manufactured for uses as a core material for laminated casework. Provide 1-inch thickness for bottom panel of wall hung units (same as shelves).
  2. Shelf Cores: Shelves shall have the same core material as specified for the cabinet body except provide  $\frac{3}{4}$ -inch thickness.
  3. Multi-Core Panel Products:  
  
Simpson Plyron, Simpson  
States Industries "Armorcore"  
True North "Multi- Core"

## 2.2 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets.
- B. Hardware Standard: Comply with BHMA A156.9 for items indicated by referencing BHMA numbers or items referenced to this standard.
- C. Frameless Concealed Hinges (European Type):
1. BHMA A156.9, B01602, 170 degrees of opening, self-closing.
  2. Type 304 Stainless Steel hinges at MRI room.
- D. Door and Drawer Pulls:
1. Back mounted, 4 inches long, wire pull, Finish- Satin Nickel, 5/16" in diameter.
  2. Hafele 96mm Aluminum Handle (Item No. 116.05.922) at MRI room.
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Shelf Rests: BHMA A156.9, B04013.
- G. Drawer Slides: Side-mounted, full-extension, zinc-plated steel drawer slides with steel ball bearings, BHMA A156.9, B05091, and rated for the following loads:

1. Box Drawer Slides: 100 lbf.
2. Stainless Steel Drawer Slides at MRI rooms: 150 lb
3. Pencil Drawer Slides: 45 lbf.

H. Door Locks: BHMA A156.11, E07121. **(Typical at base cabinets at sink locations)**

I. Drawer Locks: BHMA A156.11, E07041.

J. Keyboard Trays: VersaTables, 24 inches wide, 14 inches deep, Model KD-2414

K. Grommets for Cable Passage through Countertops: 2-1/2-inch beige, molded-plastic grommets and matching plastic caps with slot for wire passage.

L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.

M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.

### 2.3 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide nonferrous-metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance. Provide toothed-steel or lead expansion sleeves for drilled-in-place anchors.

### 2.4 FABRICATION, GENERAL

A. Interior Woodwork Grade: Provide **Premium Grade** interior woodwork complying with the referenced quality standard.

B. Wood Moisture Content: Comply with requirements of referenced quality standard for wood moisture content in relation to ambient relative humidity during fabrication and in installation areas.

C. Complete fabrication, including assembly, finishing, and hardware application, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

### 2.5 INTERIOR STANDING AND RUNNING TRIM FOR TRANSPARENT FINISH

A. Quality Standard: Comply with AWI Section 300.

B. Grade: **Premium.**

### 2.6 PLASTIC-LAMINATE CABINETS

A. Quality Standard: Comply with AWI Section 400 requirements for laminate cabinets.

B. Grade: **Premium.**

- C. AWI Type of Cabinet Construction: Flush overlay.
- D. Laminate Cladding for Exposed Surfaces: High-pressure decorative laminate complying with the following requirements:
  - 1. Horizontal Surfaces Other Than Tops: HGS.
  - 2. Vertical Surfaces: HGS.
  - 3. Edges: PVC T-mold matching laminate in color, pattern, and finish.
- E. Materials for Semi-exposed Surfaces: Provide surface materials indicated below:
  - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, Grade VGS.
  - 2. Drawer Sides and Backs: Melamine.
  - 3. Drawer Bottoms: Melamine
- F. Materials for Exposed Surfaces: Plastic Laminate
- G. Retain one each from three groups below or revise to suit Project.
- H. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Provide Architect's selections from laminate manufacturer's full range of colors and finishes in the following categories:
    - a. Solid colors.
    - b. Patterns.

## 2.7 PLASTIC-LAMINATE COUNTERTOPS

- A. Quality Standard: Comply with AWI Section 400 requirements for high-pressure decorative laminate countertops.
- B. Grade: **Premium.**
- C. High-Pressure Decorative Laminate Grade: HGS.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
  - 1. Provide Architect's selections from manufacturer's full range of colors and finishes in the following categories:
    - a. Solid colors.
    - b. Patterns.
- E. Edge Treatment: Countertop front edge shall be full bullnose type with same laminate cladding on horizontal surfaces. Side edge, that is visible, shall be finished with same laminate cladding on horizontal surfaces.
- F. Core Material: Shall be 1 ¼" thick solid plywood or high density particle board.

- G. Side Splash: Provide ¾" side splash at all locations where counter abuts perpendicular wall. Side splash shall be attached to wall but not to countertop to allow for expansion or contraction of countertop after installation.

## 2.8 SOLID-SURFACING-MATERIAL COUNTERTOPS

- A. Grade: Premium.
- B. Solid-Surfacing-Material Thickness: ¾ inch.
- C. Solid-Surfacing-Quartz -Material Thickness: 2 cm.
- D. Colors, Patterns, and Finishes: Provide materials and products that result in colors of solid-surfacing material complying with the following requirements:
  - 1. Match project finish schedule. Provide Architect with sample for verification.
- E. Fabricate tops in one piece, unless otherwise indicated. Comply with solid-surfacing-material manufacturer's written recommendations for adhesives, sealers, fabrication, and finishing.
  - 1. Fabricate tops with shop-applied edges of materials and configuration indicated.
  - 2. Provide Integral back splash.
  - 3. Provide Integral side splash where countertop abuts perpendicular wall.
- F. Integral Sinks: Provide factory fabricated integral sinks where shown and scheduled on Drawings.
  - 1. Provide Samsung Staron A1121, Color: Bright White BW010

## 2.9 Wood Veneer Casework:

- 1. Applicable Standard: AWI Section 400A - Wood Cabinets.
- 2. Grade: Premium.
- 3. Construction Style: Flush overlay.
- 4. Scribing: Flush with door faces and per Premium Grade regardless of specified casework grade.
- 5. Materials:
  - a. Exposed Surfaces: Hardwood plywood.
  - b. Semi-Exposed Surfaces: Hardwood Plywood.
  - c. Edges: Wood veneer tape banding to match exposed surfaces, not less than 1/16-inch-thick.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Condition woodwork to average prevailing humidity conditions in installation areas before installation.
- B. Before installing architectural woodwork, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

## 3.2 INSTALLATION

- A. Quality Standard: Install woodwork to comply with AWI Section 1700 for the same grade specified in Part 2 of this Section for type of woodwork involved.
- B. Install woodwork level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb (including tops) to a tolerance of **1/8 inch in 96 inches**.
- C. Scribe and cut woodwork to fit adjoining work, and refinish cut surfaces and repair damaged finish at cuts.
- D. Anchor woodwork to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing as required for complete installation.
- E. Standing and Running Trim: Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Do not use pieces less than **36 inches** long, except where shorter single-length pieces are necessary.
- F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
  - 1. Install cabinets with no more than **1/8 inch in 96-inch** sag, bow, or other variation from a straight line.
  - 2. Fasten wall cabinets through back, near top and bottom, at ends and not more than **16 inches** o.c. with No. 10 wafer-head screws sized for **1-inch** penetration into wood framing, blocking, or hanging strips.
- G. Countertops: Anchor securely by screwing through corner blocks of base cabinets or other supports into underside of countertop.
  - 1. Install countertops with no more than **1/8 inch in 96-inch** sag, bow, or other variation from a straight line.
  - 2. Secure backsplashes to tops and to walls.
  - 3. Calk space between backsplash and wall with sealant specified in Division 7 Section "Joint Sealants."
  - 4. Cut circular openings in countertop for electrical cord access below countertop. Provide a grommet around opening for finish appearance. Color of grommet to match countertop. The number of openings required will be determined by the Owner but will not exceed 250.



5. Cut openings in countertops for the installation of grilles as indicated on the drawings and as approved by Architect.
6. Provide full bullnose edge, Typical

### 3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective woodwork, where possible, to eliminate functional and visual defects; where not possible to repair, replace woodwork. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean woodwork on exposed and semi-exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION

**SECTION 07 21 00- BUILDING INSULATION**

## PART 1 -

## 1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Building Insulation in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

## 1.2 QUALITY ASSURANCE

- A. ASTM International (ASTM):
  - 1. ASTM C518 Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - 2. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing .
  - 3. ASTM C578 Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
  - 4. ASTM C739 Standard Specification for Cellulosic Fiber Loose-Fill Thermal Insulation.
  - 5. ASTM C1289
  - 6. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 7. ASTM E90 Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - 8. ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials.
  - 9. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.
- B. Insulation value exterior walls: R-19.

## 1.3 SUBMITTALS

- A. Product Data:
  - 1. Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product is in compliance with specifications.

## PART 2 - PRODUCTS

## 2.1 ACCEPTABLE MANUFACTURERS

- A. Rigid Board Insulation Extruded Polystyrene (XPS):
  - 1. Base:
    - a. Dow Chemical.
  - 2. Optional:
    - a. Pactiv Building Products.
    - b. Owens-Corning.
- B. Insulated Drainage Board:
  - 1. Base:
    - a. Dow Chemical.
  - 2. Optional:

- a. Owens-Corning.
- C. Polyisocynurate Board Insulation
  - 1. Base:
    - a. Hunter Panels
  - 2. Optional:
    - a. Apache Products Company
    - b. Johns Manville.
    - c. Celotex Cooperation
    - d. Atlas Energy Shield PRO
- D. Mineral Fiber Spandrel Insulation:
  - 1. Base:
    - a. Thermafiber.
  - 2. Optional:
    - a. Owens-Corning.
    - b. Industrial Insulations Group.
- E. Fiberglass Batt Insulation:
  - 1. Base:
    - a. Owens-Corning.
  - 2. Optional:
    - a. CertainTeed
    - b. Johns Manville.
    - c. Knauf Insulation.
- F. Vapor Retarder (VR):
  - 1. Base:
    - a. Griffolyn, Reef Industries.
  - 2. Optional:
    - a. Lamtec.
- G. Other Materials:
  - 1. Base:
    - a. As indicated.
- H. Other manufacturers desiring approval comply with Section 00 26 00.

## 2.2 MATERIALS

- A. Rigid Board Insulation - Extruded Polystyrene Foam (XPS): (Perimeter Insulation below grade)
  - 1. Minimum Compressive Strength:
    - a. 25 PSI. (type IV)
  - 2. Minimum Surface Burning Characteristics per IBC, ASTM E84 and NFPA 268:
    - a. Flame Spread: 25 or less.
    - b. Smoke Developed: less than 450.
    - c. No ignition from radiant heat source.
  - 3. Water vapor permeance per ASTM E96:
    - a. 1.50 perm, maximum.
  - 4. Water absorption per ASTM D2842:
    - a. 0.3 percent, maximum.
  - 5. Thermal resistance per ASTM C518:
    - a. R-value of 5.0 per inch at 75 DegF mean temperature.
  - 6. Base Product:

- a. Styrofoam by Dow.
- 7. Optional:
  - a. GreenGuard by Pactiv Corporation.
  - b. Foamular by Owens Corning.
- 8. Minimum thickness: 2 IN or as otherwise shown or required.
- 9. Adhesives for adhering polystyrene insulation: As recommended by insulation manufacturer.
- B. Foil Faced, Polyisocyanurate Board Insulation : (exterior insulation above grade)
  - 1. Polyisocyanurate wall insulation..
  - 2. UL listed for assembly indicated.
  - 3. Rigid, closed cell foam core bonded to impermeable foil facing material.
  - 4. ASTM C1289 Type I, Class 1.
  - 5. R-value: 6.5 per inch in accordance with ASTM C1303, CAN/ULC S770.
  - 6. Compressive Strength: 20 PSI minimum per ASTM D1621, Grade 2.
  - 7. Dimensional Stability: 2 percent maximum linear change in seven days per ASTM D2126.
  - 8. Base Product: Hunter Panels Xci Foil (Class A).
  - 9. Thickness: 2.5 Inch (Total Design R-Value 19.40)

B.


- C. Mineral Fiber Spandrel Insulation:
  - 1. Foil-faced, non-combustible, water repellent, semi-rigid mineral wool insulation board.
    - a. Tape seams with vapor retarder tape.
  - 2. Nominal Density: 8 PCF.
  - 3. Minimum Thermal Value: R4 per IN.
  - 4. Thickness:
    - a. 3 IN.
  - 5. Use a lesser thickness, where required, to maintain 1 IN clearance between back of glass unit and face of spandrel insulation.
  - 6. Flame spread not to exceed 25 when tested in accordance with ASTM E84.
  - 7. Smoke developed not to exceed 50 when tested in accordance with ASTM E84.
  - 8. Base Product:
    - a. Firespan 90 Curtainwall insulation, Thermafiber.

9. Mechanical fasteners; impaling clips/pins:
  - a. Pronged hangers and slotted washers or arrow pointed hangers.
  - b. Size pins to fit insulation thickness.
  - c. Base Product: GEMCO as manufactured by Goodloe E. Moore.
    - 1) Gemco pronged hanger with WP washer.
  - d. Optional: Stic-Klip Manufacturing.
- D. Unfaced Fiberglass Batt Insulation:
  1. Inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.
  2. Un-faced, Type I in accordance with ASTM C665.
  3. Minimum Surface Burning Characteristics per ASTM E84: Flame Spread: <25; Smoke Developed: <50.
  4. Combustion characteristics: Noncombustible; unfaced per ASTM E136.

5. Manufactured without urea-formaldehyde binders.
6. Nominal Thickness / Thermal Resistance Value, measured at 75 DegF:
  - a. Nominal Thickness: 6-1/2 IN / R-19.
- E. Sheet metal vapor retarder:
  1. Minimum 24 GA galvanized steel sheet metal.
    - a. Continuous taping flange.
    - b. Size: As required.
    - c. Profile: As required.
  2. Provide at interface of vapor retarder and steel structure adjacent to the exterior wall.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Verify suitability of substrate to accept installation.
- B. Installation indicates acceptance of responsibility for performance.

#### 3.2 INSTALLATION

- A. General:
  1. Insulate full thickness over surfaces to be insulated.
  2. Fit tightly around obstructions, fill voids.
  3. Cover penetrations with insulation.
  4. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.
  5. If manufacturer's instructions are not available, or not applicable, consult manufacturer's technical representative for specific recommendations prior to installation.
  6. Apply rigid insulation over 2 IN thickness in double layer with staggered joints to achieve total thickness.
  7. Do not use broken or torn pieces of insulation.
  8. Provide minimum cover of 5/8 IN type X gypsum wallboard over exposed foam surfaces.
- B. Rigid Board Insulation (XPS) at foundations:
  1. Extend down for distance indicated in one layer.
    - a. If not indicated, extend down to design frost line.
  2. Install in mastic with tight joints on walls.
  3. Protect from damage and/or displacement during backfilling.
  4. Do not apply to exterior, exposed portions of foundation.
- C. Polyisocyanurate Foam Insulation at exterior Cavity Walls
  1. Verify vapor retarder and moisture barrier installation is complete.
  2. Comply with manufacturer's directions for particular conditions of installation.
  3. Extend insulation full thickness in one layer over entire area to be insulated.
  4. Install insulation over 2.5 IN thick in multiple layers. Stagger joints.
  5. Adhere insulation to sheathing per insulation manufacturer's recommendations.

Tape Joints

  6. Cut and fill tightly around penetrating elements and abutting construction.
  7. Seal unavoidable joints at penetrations and voids with polyurethane spray foam insulation to maintain R-value.

8. Tape joints.

D Un-Faced Batt Insulation at exterior Stud Wall systems:

1. General:
  - a. This Article describes a system of un-faced fiberglass batts which are friction-fit between the stud framing members, and a subsequent installation of sheet vapor retarder over the face of framing.
    - 1) Batts which are pre-faced with Vapor Retarder are not acceptable.
  - b. Position vapor retarder over inside face of framing.
2. Installing Batts:
  - a. Friction fit un-faced batts between studs.
  - b. Tightly butt ends.
  - c. Where specified thickness of batts is less than the depth of framing, install retaining devices to prevent sagging.

END OF SECTION





**SECTION 07 42 13 - METAL COMPOSITE MATERIAL WALL PANELS (ACM)**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Metal composite material wall panels. Project scope includes **removal and re-installation of existing ACM panels** at the building exterior to create construction access. Refer to this specifications section for all installation requirements. Replace panels to match with original if damaged during construction.

## 1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project Site
  1. Meet with Owner, Architect, Owner's insurer if applicable, metal composite material panel Installer, metal composite material panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal composite material panels, including installers of doors, windows, and louvers.
  2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
  3. Review methods and procedures related to metal composite material panel installation, including manufacturer's written instructions.
  4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
  5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal composite material panels.
  6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
  7. Review temporary protection requirements for metal composite material panel assembly during and after installation.
  8. Review procedures for repair of panels damaged after installation.
  9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
  - B. Shop Drawings:
    1. Include fabrication and installation layouts of metal composite material panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details.
    2. Accessories: Include details of the flashing, trim and anchorage, at a scale of not less than 1-1/2 inches per 12 inches (1:10).
  - C. Samples for Initial Selection: For each type of metal composite material panel indicated with factory-applied color finishes.
    1. Include similar Samples of trim and accessories involving color selection.
  - D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
    1. Metal Composite Material Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal composite material panel accessories.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Sample Warranties: For special warranties.
- 1.6 CLOSEOUT SUBMITTALS
- A. Maintenance Data: For metal composite material panels to include in maintenance manuals.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- 1.8 DELIVERY, STORAGE, AND HANDLING
- A. Deliver components, metal composite material panels, and other manufactured items so as not to be damaged or deformed. Package metal composite material panels for protection during transportation and handling.
  - B. Unload, store, and erect metal composite material panels in a manner to prevent bending, warping, twisting, and surface damage.
  - C. Stack metal composite material panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal composite material panels to ensure dryness, with positive slope for drainage of water. Do not store metal

composite material panels in contact with other materials that might cause staining, denting, or other surface damage.

- D. Retain strippable protective covering on metal composite material panels during installation.
- E. Copper Panels: Wear gloves when handling to prevent fingerprints and soiling of surface.

#### 1.9 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal composite material panels to be performed according to manufacturers' written instructions and warranty requirements.

#### 1.10 COORDINATION

- A. Coordinate metal composite material panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

#### 1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal composite material panel systems that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including rupturing, cracking, or puncturing.
    - b. Deterioration of metals and other materials beyond normal weathering.
  - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal composite material panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
  - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
    - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
    - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
    - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
  - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide metal composite material panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
1. Wind Loads: As indicated on Drawings.
  2. Other Design Loads: As indicated on Drawings.
  3. Deflection Limits: For wind loads, no greater than 1/180 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E283 at the following test-pressure difference:
1. Test-Pressure Difference: 1.57 lbf/sq. ft.
- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
1. Test-Pressure Difference: 2.86 lbf/sq. ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- F. Fire Propagation Characteristics: Metal composite material wall panel system passes NFPA 285 testing.

## 2.2 METAL COMPOSITE MATERIAL WALL PANELS

- A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.
1. Provide products from one of the following manufacturers:
    - a. Alpolic
    - b. Alucobond
    - c. Reynobond

- B. Aluminum-Faced Composite Wall Panels Formed with 0.020-inch-thick, coil-coated aluminum sheet facings.
  - 1. Panel Thickness: 0.157 inch (4 mm), typical, except as follows. Provide 0.236 inch (6 mm) at panel locations that are within 6' of walking surface or grade. See exterior elevations for locations.
  - 2. Core: Standard.
  - 3. Exterior Finish: Three-coat fluoropolymer
    - a. Color: **Custom** solid color, to match architect's sample.
- C. Attachment Assembly Components: Formed from extruded aluminum.
- D. Attachment Assembly: Manufacturer's standard

## 2.3 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal composite material panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal composite material panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal composite material panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal composite material panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal composite material panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.
- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal composite material panels and remain weathertight; and as recommended in writing by metal composite material panel manufacturer.

## 2.4 FABRICATION

- A. General: Fabricate and finish metal composite material panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

- B. Fabricate metal composite material panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
- C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
  - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
  - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
  - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
  - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
  - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
  - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

## 2.5 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:
  - 1. Three-Coat Fluoropolymer: AAMA 620. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal composite material panel supports, and other conditions affecting performance of the Work.
  - 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal composite material wall panel manufacturer.
  - 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal composite material wall panel manufacturer.
    - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and assemblies penetrating metal composite material panels to verify actual locations of penetrations relative to seam locations of metal composite material panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

## 3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal composite material panel manufacturer's written recommendations.

## 3.3 METAL COMPOSITE MATERIAL PANEL INSTALLATION

- A. General: Install metal composite material panels according to manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor metal composite material panels and other components of the Work securely in place, with provisions for thermal and structural movement.
  - 1. Shim or otherwise plumb substrates receiving metal composite material panels.
  - 2. Flash and seal metal composite material panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal composite material panels are installed.
  - 3. Install screw fasteners in predrilled holes.
  - 4. Locate and space fastenings in uniform vertical and horizontal alignment.
  - 5. Install flashing and trim as metal composite material panel work proceeds.
  - 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal composite material panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
  8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal composite material panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal composite material wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal composite material wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
1. Dry Seal Systems: Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gasket system.
- F. Clip Installation: Attach panel clips to supports at locations, spacings, and with fasteners recommended by manufacturer. Attach routed-and-turned flanges of wall panels to panel clips with manufacturer's standard fasteners.
1. Seal horizontal and vertical joints between adjacent metal composite material wall panels with manufacturer's standard gaskets.
- G. Subgirt-and-Spline Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard subgirts and splines that provide support and complete secondary drainage assembly, draining to the exterior at horizontal joints. Attach metal composite material wall panels by interlocking perimeter extrusions attached to panels with subgirts and splines. Fully engage integral subgirt-and-spline gaskets and leave horizontal and vertical joints with open reveal. Terminate edge of panels flush with perimeter extrusions.
1. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
  2. Do not apply sealants to joints unless otherwise indicated.
- H. Track-Support Installation: Install support assembly at locations, spacings, and with fasteners recommended by manufacturer. Use manufacturer's standard horizontal tracks and vertical [tracks] [drain channels] that provide support and secondary drainage assembly, draining to the exterior at horizontal joints through drain tube. Attach metal composite material wall panels to tracks by interlocking panel edges with manufacturer's standard "T" clips.



1. Attach routed-and-turned flanges of wall panels to perimeter extrusions with manufacturer's standard fasteners.
  2. Attach flush wall panels to perimeter extrusions by engaging panel edges and by attaching with manufacturer's standard structural silicone adhesive.
  3. Install wall panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.
  4. Do not apply sealants to joints unless otherwise indicated.
- I. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal composite material panel assembly including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal composite material panel manufacturer; or, if not indicated, provide types recommended in writing by metal composite material panel manufacturer.
- J. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
  2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

### 3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal composite material wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

### 3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.

- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal composite material wall panel installation, including accessories.
- D. Metal composite material wall panels will be considered defective if they do not pass test and inspections.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

### 3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal composite material panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal composite material panel installation, clean finished surfaces as recommended by metal composite material panel manufacturer. Maintain in a clean condition during construction.
- B. After metal composite material panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal composite material panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13

**SECTION 07 62 00 – SHEET METAL FLASHING AND TRIM**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide materials, fabrications and installation of flashing and sheet metal work coordinated with the Work of other Sections as shown on Drawing, and as specified.

## 1.2 PERFORMANCE REQUIREMENTS

- A. General: Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, and fastener disengagement.
- B. Fabricate and install roof edge flashing and copings capable of resisting the following forces according to recommendations in FMG Loss Prevention Data Sheet 1-49:
  - 1. Wind Zone 2: For velocity pressures of 31 to 45 lbf/sq. ft: 90-lbf/sq. ft. perimeter uplift force, 120-lbf/sq. ft. corner uplift force, and 45-lbf/sq. ft. outward force.
- C. Thermal Movements: Provide sheet metal flashing and trim that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, hole elongation, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects.
  - 1. Provide clips that resist rotation and avoid shear stress as a result of sheet metal and trim thermal movements.
  - 2. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
    - a. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.
- D. Water Infiltration: Provide sheet metal flashing and trim that do not allow water infiltration to building interior.

## 1.3 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures.
- B. Factory Fabricated Sheet Metal Accessories: Submit manufacturer's product data, installation instructions and general recommendations for each factory fabricated product.
- C. Submit samples as follows:

1. 10-inch long samples of factory-fabricated products exposed as finish work.
- D. Submit shop drawings as follows:
1. Layout, profiles, methods of joining, and anchorage details.

### 1.3 QUALITY ASSURANCE

- A. Comply with the latest edition of the following standards:
1. American Welding Society's "Structural Welding Code"(AWS).
  2. National Roofing Contractors Association (NRCA).
  3. Sheet Metal and Air Conditioning Contractors National Assoc. Inc. (SMACNA).
- B. Comply with the details and recommendations of the Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), and with the current edition of the National Roofing Contractors Association (NRCA) Roofing and Waterproofing Manual.
- C. Wherever incorporated into or affecting the roof application, comply with the roofing manufacturer's published installation instructions.

### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.
- C. Unload materials carefully and store on clean concrete surface or raised platform in safe, dry area. Do not dump onto ground.

### 1.5 PROJECT CONDITIONS

- A. Temporary Protection:
1. Typical Exposed Finishes: Protect as required against damage; remove protection prior to final acceptance of the work.
  2. Exercise care when working on or about roof surfaces to avoid damaging or puncturing new membrane or flexible flashings. Utilize plywood, insulation board or other suitable membrane protection when working on areas of newly installed roofing.
- B. Scheduling, Sequencing: Ensure timely delivery of items to be incorporated into work of other sections and furnish setting drawings or templates and setting instructions for exact installation.
- C. Stack preformed material to prevent twisting, bending, or abrasion and to provide ventilation.

- D. Prevent contact with metals during storage which may cause discoloration or staining.
- E. Apply fluid-applied air barrier within the range of ambient and substrate temperatures recommended by air barrier manufacturer. Protect substrates from environmental conditions that affect performance of air barrier. Do not apply air barrier to a wet substrate or during snow, rain, fog, or mist.

#### 1.6 SPECIAL PROJECT GUARANTEES

- A. Comply with requirements of Section 017600– Guarantees and Warranties.
- B. Special Project Guaranty:
  - 1. Extend period for correction of work for 4 additional years (total of 5 years).
  - 2. Include removal and replacement of superimposed work of other trades.
  - 3. Submit written statement agreeing to above terms and conditions on form in Section 017900, signed jointly Contractor and Installer.
- C. Provide above written guarantee against failure to maintain a waterproof condition of the completed installation.

### PART 2 - PRODUCTS

#### 2.1 SHEET METAL MATERIALS

- A. Galvanized Sheet Steel: ASTM A 526; with minimum 1.25 oz per sq ft galvanized coating, G-90; minimum 24 gauge or as otherwise noted.
- B. Stainless-Steel Sheet: ASTM A 240/A, Type 316.
- C. Zinc-Tin Alloy-Coated Stainless-Steel Sheet: ASTM A 240/A, Type 316, dead-soft, fully annealed stainless-steel sheet, coated on both sides with a zinc-tin alloy (50 percent zinc, 50 percent tin).
- D. Prepainted Steel Sheet for assemblies including factory-applied High-Performance Organic Finish; Steel sheet metallic coated by the hot-dip process and prepainted by the coil-coating process, including:
  - 1. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
  - 2. Exposed-to-View Locations: High-Performance Organic Finish in conformance with Division 8.
    - a. Color(s): Match Architect's sample(s). Refer to the "Finishes" article of this Section for information regarding finishes to "match".

- E. Aluminum Sheet: ASTM B 209, Alloy 3003, 3004, 3105, or 5005, Temper suitable for forming and structural performance required, but not less than H14, finished as follows:
1. Exposed-to-View Locations: High-Performance Organic Finish in conformance with Division 8.
    - a. Color(s): Match Architect's sample(s). Refer to the "Finishes" article of this Section for information regarding finishes to "match".
  2. Concealed-from-View Locations: Class I, Clear Anodic Finish in conformance with Division 8.

## 2.2 SELF-ADHESIVE FLEXIBLE FLASHING

- A. General: Provide single-sourcing of self-adhesive flexible flashing and fluid-applied vapor permeable air barrier products as specified in this Section to assure compatibility for all locations on the building envelope.
- B. Self-Adhesive Flexible Flashing: Provide Flexible Flashings for the Work of this Section recommended by the manufacturer for use with the specified fluid-applied vapor permeable air barrier and coordinated with the Work of other referenced Sections at transitions to Other finish materials, including:
1. Grace Construction Products "Perm-A-Barrier" Wall Flashing, or approved equal; 40-mil self-adhesive, self-sealing rubberized asphalt waterproof membrane.
    - a. Widths: Provide each specified product in their available widths (6, 9, 12, 18, 24 and 36 inches) as required to best flash actual project conditions encountered with as few intermediate lap joints as practical.
    - b. Membrane shall be interleaved with disposable silicone-coated release paper until installed
  2. Physical and Performance Properties: Provide products with the following minimum properties:
    - a. Water Vapor Transmission: ASTM E96, Method B: 0.05 perms max.
    - b. Water Absorption: ASTM D570: max. 0.1% by weight.
    - c. Puncture Resistance: ASTM E154: 80 lbs. min.
    - d. Tear Initiation Resistance: ASTM D1004: min. 13.0 lbs. M.D.
    - e. Tear Propagation Resistance: ASTM D1938: min. 9.0 lbs. M.D.
    - f. Lap Adhesion at 25°F: ASTM D1876: 5.0 lbs./in. of width.
    - g. Low Temperature Flexibility ASTM D1970: Unaffected to -45°F.
    - h. Tensile Strength: ASTM D412, Die C Modified: min. 800 psi.

- i. Elongation, Ultimate Failure of Rubberized Asphalt: ASTM D412, Die C: min. 200-percent.
- C. Sub-strata Primer: Provide Grace Construction Products Perm-A-Barrier WB; or equal; or as recommended by the Flexible Flashing manufacturer in writing for actual project sub-strata conditions.
- D. Slip-sheet: Provide Rosin coated slip-sheet where required by actual project conditions to prevent binding between assembly components.

### 2.3 UNDERLAYMENT MATERIALS

- A. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D 4397.
- B. Felts: 60-minute Building Paper per ASTM D-779 FS-UU-B-790a, Type I, Style 2, Grade D, vapor-permeable weather-resistive barrier.
  - 1. Fortifiber Corporation, "60-minute Super Jumbo Tex", or equal.
- C. Slip Sheet: Rosin-sized paper, minimum 3 lb/100 sq. ft.

### 2.4 RELATED MATERIALS

- A. Sealants: Single Component Silicone Sealant (and High Temperature sealant where required) as specified in Section 079200 – Joint Sealants.
- B. Solder and Flux: Solder ASTM B 32 Type recommended for materials being used; flux FS O-F-506C, Type I, Form A or B, 50/50 or better.
- C. Pipe Clamps: Stainless steel draw band with adjustable screw.
- D. Reglets:
  - 1. Standard recessed, or embedded types with strippable tape covers as manufactured by MM Systems, Fry Reglet, or approved equivalent.
- E. Fasteners (assure compatibility with metals contacted):
  - 1. Metal to wood (unexposed): 11 gauge galvanized ring shank, length sufficient to penetrate 1 inch into wood.
  - 2. Metal to wood (exposed): Hex head with neoprene washers, No. 10, 1-1/4 inches, HDG, painted heads.
  - 3. Rivets: ASTM B 315, alloy 110, 5052, 5056, or 6061; appropriate temper, unless temper is specified. Galvanized steel where soldering.
  - 4. Screws, bolts, nuts, and wire: ASTM B 211, alloy 1100, 5052 to 6061; appropriate temper.
  - 5. Metal to Metal: Stainless steel hex head screw, sufficient to penetrate base metal 1/2 inch, with neoprene washers.

6. Expansion shields, packing and wedges: Lead or other nonferrous alloys.
  7. Other fasteners as required.
- F. Screen for Strainers and Gutter Screens: Galvanized steel wire hardware cloth woven of minimum 20-gauge steel wire with 1/2-inch square mesh.
- G. Items for Permanent Protection of Dissimilar Metals and Materials:
1. Asphalt-Saturated Felt: ASTM D 226.
  2. Bituminous Paint: FS TT-C-494A.
  3. Compressible Tape: ASTM C 509. Closed cell black neoprene tape, size as noted, with adhesive system as recommended by manufacturer.

## 2.5 FACTORY FABRICATED COPING SYSTEMS

- A. General: Manufactured coping system consisting of formed-metal coping cap in section lengths not exceeding 12 feet, concealed anchorage, concealed splice plates with same finish as coping caps, pre-fabricated and mitered corner units, intersection units, and end cap units.
1. Manufacturer: Provide factory-fabricated snap-lock type coping assemblies and accessories by MM Systems; Construction Specialties (C/S); MetFab; W. P. Hickman Company; or equal.
    - a. Provide profiles and layouts as shown on Drawings.
  2. Materials: Material:
    - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
    - b. Finish: Exposed-to-View Locations: High-Performance Organic Finish in conformance with Division 8.
    - c. Color(s): Match Architect's sample(s). Refer to the "Finishes" article of this Section for information regarding finishes to "match".
- B. Basis-of-Design Products:
1. Copings at head-of-wall conditions and parapets with roof on one side: MM Systems, Snap-Lok SLC, Series I.
    - a. Gauge: equivalent to 16-gauge or greater.
  2. Wall Copings with roof on both sides: MM Systems, Snap-Lok Peaked Copings, Series I
    - a. Gauge: equivalent to 16-gauge or greater.



- C. Provide special fabrications as required for the layouts shown on Drawings, including:
1. Prefabricated Inside/Outside Corners, including watertight welded joints.
  2. Prefabricated end units where coping butts a wall surface, including watertight, soldered flashing designed to be concealed behind the wall finish.
  3. Prefabricated units where work by Others penetrates one or more of the coping finish surfaces.
  4. Prefabricated end units where intersect in "Tee" intersections, including watertight, soldered flashing designed to be concealed behind the wall finish.

## 2.6 FACTORY FABRICATED REGLET AND COUNTERFLASHING SYSTEMS

- A. General: Provide factory-fabricated snap-lock type coping assemblies and accessories by Fry Reglet Corporation; MM Systems;; Construction Specialties (C/S); or equal.
- B. Masonry Reglet and Counterflashing Assemblies:
1. Masonry Type: Provide with flat fastening flange with upturn key to match thickness of applied finish materials, including coordinated removable counterflashing and recommended by the manufacturer for installation into brick veneer assemblies as shown on Drawings.
  2. Manufacturer: Fry Reglet, or equal.
  3. Reglet Type: Fry Reglet's "MA", or equal, including top flange length recommended by the manufacturer for the masonry type.
    - a. Reglet Material: Stainless Steel, Type 304, 0.020-inches thick.
    - b. Finish: Standard uncoated finish.
  4. Counterflashing Type: "Springlok" Type flexible flashing.
    - a. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality.
    - b. Finish: High Performance Organic Coating as specified in this Section.
      - 1) Colors: Match Architect's sample(s).
  5. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.
  6. Provide special fabrications as required for the layouts shown on Drawings, including prefabricated Inside/Outside Corners, including watertight soldered joints.

## 2.7 SHOP FABRICATED UNITS – GENERAL

- A. General Metal Fabrication: Shop-fabricate Work to greatest extent possible. Comply with details shown and with applicable requirements of Reference Standards and other recognized industry practices. Fabricate for waterproof and weather-resistant performance, with expansion provisions for running Work, sufficient to permanently prevent leakage, damage, or deterioration of the Work. Form Work to fit substrates. Comply with material manufacturer instructions and recommendations for forming material. Form exposed sheet metal Work without excessive oil-canning, buckling, and tool marks, true to line and levels indicated, with exposed edges folded back to form hems.
1. Comply with SMACNA recommendations and standards.
  2. Verify finish dimensions prior to fabrication.
- B. Seams: Fabricate non-moving seams in sheet metal with flat-lock seams. For metal other than aluminum, tin edges to be seamed, form seams, and solder. Form aluminum seams with epoxy seam sealer; rivet joints for additional strength where required.
- C. Expansion Provisions: Where lapped or bayonet-type expansion provisions in Work cannot be used or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).
- D. Sealant Joints: Where movable, non-expansion type joints are indicated or required for proper performance of Work, form metal to provide proper installation of elastomeric sealant, in compliance with Reference Standards.
- E. Separations: Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with bituminous coating or other permanent separation as recommended by manufacturer/fabricator.
- F. Fabricate lead pipe flashings with minimum 6 inches high risers and minimum 4 inches wide flanges in all directions.

## 2.8 SHOP FABRICATED GUTTERS AND RAINLEADERS

- A. Downspouts: Fabricate to cross section shown on Drawings and otherwise in conformance with SMACNA recommendations, complete with mitered elbows. Furnish with metal hangers, from same material as downspouts, and anchors.
1. Material: Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, minimum 0.0217-inch thick.
  2. Exposed-to-View Locations: High-Performance Organic Finish in conformance with Division 8.
    - a. Color(s): Match Architect's sample(s).
- B. Hanging Gutters: Fabricate to cross section shown on Drawings or otherwise in conformance with SMACNA recommendations, complete with end pieces, outlet tubes, and other accessories as required.

1. Fabricate in minimum 96-inch-long sections.
  2. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice the gutter thickness.
  3. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
  4. Material: Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, G90 coating designation; structural quality, minimum 0.0217-inch thick.
  5. Exposed-to-View Locations: High-Performance Organic Finish in conformance with Division 8.
    - a. Color(s): Match Architect's sample(s).
  6. Expansion Joints: Built in.
  7. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.
- D. Built-in Gutters: Fabricate to cross section shown on Drawings or otherwise in conformance with SMACNA recommendations, with riveted and soldered joints, complete with end pieces, outlet tubes, and other special accessories as required. Fabricate in minimum 96-inch-long sections. Fabricate expansion joints and accessories from same metal as gutters, unless otherwise indicated.
1. Material: Stainless Steel as specified, minimum 0.0156-inch-thick.
  2. Expansion Joints: Built in, including gutter-end expansion joints at walls.
  3. Accessories: Continuous removable leaf screen with sheet metal frame and hardware cloth screen.

## 2.9 METAL FINISHES

- A. General: Provide finishes as specified for exposed-to-view portions of Work specified in this Section.
- B. Single Sourcing of Aluminum Finish: When scheduled on Drawings with the same color designation, metal finishes specified in the following Sections shall be single-sourced to assure correct and accurate new and aged color matching:
  1. Section 076200 –Sheet Metal Flashing and Trim.
  2. Section 084113 – Aluminum Entrances and Storefronts
  3. Section 084213 – Aluminum Framed Entrance
- C. Finish Type:

1. High Performance Organic Coating: Comply with requirements of Division 8.
2. Color: Match Architect's sample.
3. Application: Apply coatings either before or after forming and fabricating panels, as required by coating process and as required for maximum coating performance capability. Protect coating either by application of strippable film or by packing plastic film or other suitable material between panels in a manner to properly protect the finish. Furnish air-drying spray finish in matching color for touch-up.

## 2.10 SCHEDULE OF FLASHING MATERIALS AND FABRICATED UNITS

- A. General: Provide sheet metal flashings and trim fabrications coordinated with Work specified in other Sections, unless otherwise noted.
  - a. Minimum 0.0187-inch-thick Stainless Steel for metal flashings shown on Drawings.
  - b. Flexible Flashings as shown on Drawings and specified in this Section.
1. EIFS: Refer to Section 072400 – Exterior Finish and Insulation System (EIFS).
2. Section 07419 – Polyvinyl-Chloride (PVC) Roofing:
  - a. Minimum 0.0276-inch-thick Galvanized Steel Flashings and accessories as required for the Built-Up Roofing layouts shown on Drawings.
  - b. Reglets and Counterflashings as specified in this Section for the adjacent wall assembly type.
  - c. Prefabricated round-pipe penetration flashing assemblies.
  - d. Stainless Steel pan assemblies at Roof Drains.
  - e. Pre-fabricated Curbs and (loose laid) Splash Blocks provided in Section 077200 – Roof Accessories.
3. Section 084113 – Aluminum Entrances and Storefronts & Section 084213 – Aluminum Framed Entrance
  - a. Note: Concealed and semi-concealed work only when noted "by others" on Division 08 Shop Drawings; all exposed-to-view trims, flashings, gutters and downspouts, and other items to be factory finished to match Window and Window Wall finish and shall be provided in Division 08 by the Window and Window Wall fabricator.
  - b. Minimum 0.0276-inch-thick Galvanized Steel Flashings and accessories as required for the layouts shown on Drawings.

- c. Flexible Flashings and Sheet Vapor Retarder.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive items and verify following:
  - 1. That dimensions are correct to receive items.
  - 2. That adjacent or adjoining surfaces are clean, dry, reasonably smooth, and free from defects.
  - 3. That wood surfaces to be in contact with sheet metal are free from projecting nails or anchors.
  - 4. Absence of other conditions that will adversely affect a water tight installation.
- B. Do not start work until defects have been corrected.

### 3.2 PREPARATION – GENERAL

- A. Coordinate as required with installation of related work.
- B. Provide items as indicated for installation by the roofing applicator, in a timely fashion and in sequence.
- C. Prepare metals for sealant applications in accordance with sealant manufacturer's instructions.

### 3.3 PREPARATION – FLEXIBLE FLASHING

- A. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods that are acceptable to manufacturer of the fluid-applied air barrier system.
- B. Exterior sheathing panels: Ensure that the boards are sufficiently stabilized with corners and edges fastened with appropriate screws.
  - 1. Pre-treat all board joints with 2 to 3-inch.wide, manufacturer's recommended self-adhesive tape.
  - 2. Gaps greater than 1/4-inch should be filled with mastic or caulk, allowing sufficient time to fully cure before application of the tape and fluid applied air barrier system.
- C. Masonry Substrates: Apply air and vapor barrier over concrete block and brick with smooth trowel-cut mortar joints, struck full and flush. Fill all voids and holes, particularly in the mortar joints, with a lean mortar mix, non-shrinking grout or parge coat.

- D. Related Materials: Treat construction joints and install flashing as recommended by manufacturer.
- E. Clean, prepare, treat, and seal substrate according to manufacturer's written instructions. Provide clean, dust-free, and dry substrate for air barrier application.
- F. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.
- G. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.
- H. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate patching membrane.
- I. Remove excess mortar from masonry ties, shelf angles, and other obstructions.
- J. At changes in substrate plane, apply sealant or Bituthene Liquid Membrane at sharp corners and edges to form a smooth transition from one plane to another.
- K. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless-steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

#### 3.4 INSTALLATION – GENERAL

- D. General:
  - 1. Secure flashings in place using specified type fasteners. Use exposed fasteners in locations only as indicated.
  - 2. Insert metal flashings beneath existing flashings to form tight fit. Fasten as specified or as shown on the detail drawings, whichever is greater.
  - 3. Lock seams and end joints. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
  - 4. Install bolts, rivets, and screws where indicated or as necessary to assure a watertight installation.
- E. Soldering:
  - 1. Rivet together all sheet metal before soldering.
  - 2. Pre-tin and treat with acid soldering flux edges of stainless steel and galvanized steel.
  - 3. Solder with a properly heated soldering iron to thoroughly heat the seam and completely sweat the solder through the full width of seam.
  - 4. Solder immediately after application of the flux. Upon completion of soldering, shall be thoroughly clean, neutralize and rinse the flux residue with clean water.
- F. Joints:

1. Coping: Provide with 1 inch standing seams; fold ends.
  2. Counterflashing: Lap seams 3 inches minimum. Bayonet interlock at the hemmed edge, pop rivet, and seal.
  3. Solder mitered joints.
  4. Where positive joining is required, braze or arc-weld in accordance with AWS D1.1-81.
- G. Counterflashing:
1. Install where indicated on the Drawings.
  2. Fasten 12 inches o.c. or as indicated on the Drawings.
  3. Install supplemental counterflashing wherever necessary to achieve minimum 3 inches overlap of flanges onto roof base flashings (i.e. at curb mounted fan units, HVAC units, skylights, etc.). Fasten to underside of counterflashing at maximum 12 inches o.c.
- E. Drains: Provide sheet lead flashing fabrications to roofing applicator as required by roof drain layouts and sizes as shown on Drawings.
- F. Pipe support (pipes less than 2 inches in diameter): Utilizing compatible metals, clamp pipes to treated wood block supports. Adhere blocks with mastic to a protective membrane pad. Set pad unadhered onto the finished but unsurfaced roof membrane.
- G. Drains: Provide flashing fabrications to roofing applicator as required by roof drain layouts and sizes as shown on Drawings.
- H. Pipe support (pipes less than 2 inches in diameter): Utilizing compatible metals, clamp pipes to treated wood block supports. Adhere blocks with mastic to a protective membrane pad. Set pad unadhered onto the finished but unsurfaced roof membrane.

### 3.3 INSTALLATION – FLEXIBLE FLASHING

- A. Mat-Faced Gypsum Sheathing: Fill joints greater than 1/4 inch with sealant according to ASTM C1193 and with air barrier manufacturer's written instructions. Apply tape to joint prior to installing fluid air barrier membrane.
- B. Flexible Self-Adhesive Flashing Installation:
1. Install flexible flashings, transition strips, and auxiliary materials according to air barrier manufacturer's written instructions to form a seal with adjacent construction and maintain a continuous air barrier.
  2. Install all flexible flashings after application of the specified air barrier.

3. Surfaces must be dry and cleaned of any dirt or other substances. Test self-adhesive flashing materials on all sub-strata and sheathing types for adequate adhesion prior to beginning work.
  - a. If adhesion is inadequate, prime sub-strata material with a primer recommended by the moisture barrier manufacturer for the specified sheathing material.
4. Layout: Layout membrane flashing and sheet membrane in conformance with manufacturer's written instructions and as required to provide a continuous secondary moisture barrier for 100-percent coverage.
  - a. Lap horizontal seams of all materials "shingle style," with the lap of the upper sheet over the lower sheet. Provide 3-inch minimum lap joint.
  - b. Lap vertical seams 6 inches minimum.
  - c. Provide continuous self-adhesive flexible wall flashing per manufacturer's recommendations at all surface transitions, including:
    - 1) Top of Wall assembly.
    - 2) Base of Wall assembly.
    - 3) Outside corners (horizontal and vertical).
    - 4) Inside corners (horizontal and vertical).
    - 5) Head, jamb and sills of all openings.
    - 6) Penetrations by dis-similar materials.
  - d. Provide continuous self-adhesive roof moisture barrier underlayment per manufacturer's recommendations for 100-percent coverage.
  - e. Complex Intersections: Provide multiple layers, folded, cut and seamed as required to provide a continuous secondary moisture barrier at complex intersections and transitions.
    - 1) Provide shop pre-fabricated and seamed components where the use of complex multiple folding will not conform to the clearances available.
  - f. Movable Joints: Provide continuous primary moisture barrier protection at movable joints.

### 3.5 FIELD QUALITY CONTROL – FLEXIBLE FLASHING

- A. Testing Agency: Owner may engage a qualified testing agency to perform tests and inspections and prepare test reports.



- B. Inspections: Air barrier materials and installation are subject to inspection for compliance with requirements. Inspections may include the following:
1. Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
  2. Continuous structural support of air barrier system has been provided.
  3. Masonry and concrete surfaces are smooth, clean and free of cavities, protrusions, and mortar droppings.
  4. Site conditions for application temperature and dryness of substrates have been maintained.
  5. Maximum exposure time of materials to UV deterioration has not been exceeded.
  6. Surfaces have been primed, if applicable.
  7. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
  8. Termination mastic has been applied on cut edges.
  9. Strips and transition strips have been firmly adhered to substrate.
  10. Compatible materials have been used.
  11. Transitions at changes in direction and structural support at gaps have been provided.
  12. Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
  13. All penetrations have been sealed.
- C. Tests: Testing to be performed will be determined by Owner's testing agency from among the following tests:
1. Qualitative Testing: Air barrier assemblies will be tested for evidence of air leakage according to ASTM E1186, smoke pencil with pressurization or depressurization.
- D. Remove and replace deficient air barrier components and retest as specified above.

### 3.6 CLEANING

- A. Comply with requirements of Section 017900 – Cleaning.
- B. Following installation, clean exposed surfaces of flashing and sheet metal of excess solder and dirt.

1. Remove grease and oil with appropriate solvent.
  2. Wipe surfaces with clean rags, and leave in condition suitable for application of paint.
- C. Protect flashing assemblies from damage during application and remainder of construction period, according to manufacturer's written instructions.
- D. Protect air barrier from exposure to UV light and harmful weather exposure as required by manufacturer. Remove and replace air barrier exposed for more than 150 days.
- C. Clean spills, stains, and soiling from construction that would be exposed in the completed work using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION

**SECTION 07 81 00 – SPRAY-APPLIED FIREPROOFING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and install spray-applied fire resistive materials for installation of on restrained structural steel and steel decking and associated accessory items, including:
  - 1. Standard Density Sprayed-On Fireproofing.
  - 2. Medium Density Sprayed-On Fireproofing.
  - 3. Primers, Sealers and other accessories as required.
- B. Work Specified Elsewhere:
  - 1. Section 051200 – Structural Steel.
  - 2. Section 053000 – Metal Decking.
  - 3. Section 078400 – Firestopping and Smoke Seals.
  - 4. Section 079200 – Exterior Joint Sealants.
  - 5. Section 079300 – Interior Joint Sealants.

## 1.2 SUBMITTALS

- A. Comply with provisions of Section 01330 – Submittal Procedures.
- B. Product Data: Submit manufacturer's product specifications and installation instructions for each type of material and application method required.
- C. Test Reports: Submit laboratory test reports on each required test of in-place fireproofing, including location and date of samples as tested, and laboratory's interpretations of test data.
- D. Certification: Provide ICBO certification. Submit written certification from fireproofing manufacturer supported by test data that the product furnished complies with each performance criterion specified.
- E. Samples: As required by Owner's Testing Agency during normal application of material.
- F. Thickness Schedule: Indicate material to be used, building elements to be protected with fireproofing, hourly ratings, material thicknesses to be provided, and appropriate references to U.L. designs, or a letter from U.L. stating that the referenced test has been successfully performed.
- G. Fire Testing: Submit evidence that the cementitious fireproofing produced by the manufacturer has been subjected to full-scale ASTM E119 fire testing at Underwriters Laboratories, Inc.

### 1.3 QUALITY ASSURANCE

- A. **Installer Qualifications:** A firm or individual certified, licensed, or otherwise qualified by spray-applied fire resistive materials manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements. A manufacturer's willingness to sell its SFRM to Contractor or to an installer engaged by Contractor does not in itself confer qualification on the buyer.
- B. **Source Limitations:** Obtain spray-applied fire resistive materials through one source from a single manufacturer.
- C. **Spray-applied Fire Resistive Materials Testing:** By a qualified testing and inspecting agency engaged by Contractor or manufacturer to test for compliance with specified requirements for performance and test methods.
  - 1. Spray-applied fire resistive materials are randomly selected for testing from bags bearing the applicable classification marking of UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
  - 2. Testing is performed on specimens of spray-applied fire resistive materials that comply with laboratory testing requirements specified in Part 2 and are otherwise identical to installed fire-resistive materials, including application of accelerant, sealers, topcoats, tamping, troweling, rolling, and water overspray, if any of these are used in final application.
  - 3. Testing is performed on specimens whose application the independent testing and inspecting agency witnessed during preparation and conditioning. Include in test reports a full description of preparation and conditioning of laboratory test specimens.
- D. **Compatibility and Adhesion Testing:** Engage a qualified testing and inspecting agency to test for compliance with requirements for specified performance and test methods.
  - 1. Test for bond per ASTM E 736 and requirements in UL's "Fire Resistance Directory" for coating materials. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2 of this Section.
  - 2. Verify that manufacturer, through its own laboratory testing or field experience, has not found primers or coatings to be incompatible with spray-applied fire resistive materials.
- E. **Fire-Test-Response Characteristics:** Provide spray-applied fire resistive materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to OSHPD. Identify bags containing spray-applied fire resistive materials with appropriate markings of applicable testing and inspecting agency.
  - 1. **Fire-Resistance Ratings:** Indicated by design designations from UL's "Fire Resistance Directory" or other acceptable to authorities having

jurisdiction, for spray-applied fire resistive materials serving as direct-applied protection tested per ASTM E 119.

2. Surface-Burning Characteristics: ASTM E 84.
- F. Provide products containing no detectable asbestos as determined according to the method specified in 40 CFR 763, Subpart E, Appendix E, Section 1, "Polarized Light Microscopy."
- G. Mockups: Apply mockups and set quality standards for materials and execution.
1. Extent of Mockups: Approximately 100 sq. ft. of surface for each product indicated.
  2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 01315 – Project Meetings. Meet with Owner, Architect, Inspector of Record (IOR), Owner's insurer if applicable, Installer, and review methods and procedures related to spray-applied fire resistive materials including, but not limited to, the following:
1. Review and finalize construction schedule and verify sequencing and coordination requirements.
  2. Review products, exposure conditions, design ratings, restrained and unrestrained conditions, calculations, densities, thicknesses, bond strengths, and other performance requirements.
  3. Review weather predictions, ambient conditions, and proposed temporary protections for SFRM during and after installation.
  4. Review surface conditions and preparations.
  5. Review field quality-control testing procedures.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 01600 – Product Requirements.
- B. Deliver and store packaged materials in original containers bearing manufacturer's name and product information. Leave seals unbroken and labels intact until time of use.
- C. Keep materials dry until ready for use by storing off ground, under watertight covers, and away from sweating walls and damp surfaces.
- D. Remove from job site any bags of sprayed fireproofing materials that have been exposed to water before use.
- E. Rotate stock of material so that it is used prior to expiration date.

## 1.5 JOB SITE CONDITIONS

- A. Temperature and Ventilation:
1. Provide and maintain, in place, suitable wind and weatherproof enclosures to prevent rapid drying and to retain heat when required.
  2. Air temperature and steel temperature shall be maintained at 40 degrees F minimum for 24 hours before application and continuing for 24 hours minimum after completion of application.
  3. Provide ventilation of spaces to properly dry materials as recommended by manufacturer. In poorly ventilated areas, provide ventilation to achieve a minimum total air exchange rate of four (4) times per hour.
- B. Protection: Protect adjacent surfaces and equipment from overspray, fallout, and dusting off of fireproofing. Protect applied material from direct or concentrated heat and from drafts.

## 1.6 SEQUENCING AND COORDINATION

- A. General: Integrate the scheduling/coordination of fireproofing Work with other units of Work to achieve the following:
1. Work will not be exposed to weather and other damaging ambient conditions.
  2. Work will not be unnecessarily exposed to abrasion and other damage likely to occur during subsequent Work.
  3. Work will be installed prior to installation of enclosing or concealing elements.
  4. Work will provide time allowance for inspection/testing and subsequent correction of defective fireproofing.
  5. Work will minimize time other Work is exposed to possible fire hazards.
- B. Prior to installation of sprayed fireproofing other trades must have completed installation of items such as hangers, clamps, and other attachments for work suspended from, attached to, or passing through construction required to receive sprayed fireproofing.
- C. Apply sprayed fireproofing prior to installation of ducts, piping conduit, and other work which would prevent correct application.
- D. Do not commence application of fireproofing materials until the completion of the concrete work immediately above that deck.
- E. Do not commence application of fireproofing on underside of roof deck until the following conditions exist:
1. Installation of roof membrane is complete.

2. Roof top equipment has been installed.

#### 1.7 SPECIAL PROJECT GUARANTEES

- A. Comply with requirements Section 01790 – Guarantees and Warranties.
- B. Special Project Guarantee:
  1. Extend period for correction of work for 1 additional year (total of 2 years).
  2. Include removal and replacement of superimposed work of other trades.
  3. Submit written statement agreeing to above terms and conditions on form in Section 01790, signed jointly and severally by Contractor and installer.
- C. Provide above written guarantee against failure of fireproofing which has cracked, flaked, dusted excessively, peeled or fallen from substrate, or otherwise deteriorated to a condition where it would not perform as intended for fireproofing purposes.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturer: Subject to compliance with requirements, provide one of the following:
  1. Monokote MK-6 by W. R. Grace & Co.
  2. Cafco 300 by Isolatek International.
  3. Pyrolite 1 by Carbolite Corp.

#### 2.2 FIREPROOFING MATERIALS

- A. General: Provide fireproofing products 100 percent free of asbestos fibers and mineral wool.
- B. Manufacturer's standard fireproofing product with asbestos- and mineral wool-free fiber reinforcement, fillers and additives.
  1. Produced for spray-on application.
  2. Provide a rigid, porous, noncombustible covering of uniform density and thickness as indicated, applied in one or more courses.
  3. Provide fire-endurance ratings required by UL designs indicated.
- C. Standard Density Sprayed-on Fireproofing: Factory-mixed, dry formulation

mixed with water at Project Site complying with the following requirements:

1. Material Composition: Cementitious formulation composed of inorganic binders, fillers and additives.
  - a. Bond Strength: 200 pounds per square foot as determined per ASTM E 736.
  - b. Dry Density: Values for average and individual densities as required for fire-resistance ratings indicated, as determined per ASTM E 605 or Appendix A "Alternate Method for Density Determination" of AWCI Technical Manual 12-A, but with an average density of not less than 15 pounds per cubic foot.
  - c. Compressive Strength: 1000 pounds per square foot in accordance with ASTM E 761.
  - d. Air Erosion: Maximum weight loss of 0.005 gram per square foot as determined per ASTM E 859.
  - e. Surface-Burning Characteristics: Maximum flame-spread value of 0 and smoke-developed value of 0 when tested per ASTM E 84.
  - f. Mold Resistance: Material shall resist mold growth for a period of 60 days when tested in accordance with ASTM G 21.
  - g. Combustibility: Material shall have a maximum total heat release of 20 MJ/m<sup>2</sup> ten minutes after insertion into a radiant heat flux of 75 KW/m<sup>2</sup> per ASTM E1354.
- D. Medium-density cementitious fireproofing for interior exposed conditions subject to high humidity and moderate physical abuse which conforms to the following physical performance test criteria:
  1. Dry Density: The field density shall be measured, in accordance with ASTM Standard E605. Minimum average density shall be 22 pcf as listed in the U.L. Fire Resistance Directory, ICBO Evaluation Report or as required by the authority having jurisdiction.
  3. Deflection: Material shall not crack or delaminate from the surface to which it is applied when tested in accordance with ASTM E759.
  4. Bond Impact: Material subject to impact tests in accordance with ASTM E760 shall not crack or delaminate from the surface to which it is applied.
  5. Bond Strength: Fireproofing, when tested in accordance with ASTM E736, shall have a minimum average bond strength of 1,000 psf and a minimum individual bond strength of 800 psf.
  6. Air Erosion: Maximum allowable weight loss of the fireproofing material shall be 0.005 gm./s.f. when tested in accordance with ASTM E859.
  7. Compressive Strength: The fireproofing shall not deform more than 10



- percent when subjected to compressive forces of 10,000 psf when tested in accordance with ASTM E761.
8. Corrosion Resistance: Steel with applied fireproofing shall be tested in accordance with ASTM E937 and shall not promote corrosion of steel.
  9. Durometer Hardness: The fireproofing material shall have a minimum Durometer Hardness value of 10 when tested in accordance with ASTM D2240.
  10. Surface Burning Characteristics: Material shall exhibit the following surface burning characteristics when tested in accordance with ASTM E84.
    - a. Flame Spread: 0
    - b. Smoke Development: 0
  11. Mold Resistance: Fireproofing material shall be tested in accordance with ASTM G21 and shall show resistance to mold growth for a period of 60 days.
- E. Protective Sealer: WR Grace Co.'s Daraweld C, or equal. Add light blue dye to sealer.
- F. Primer:
  1. General: Spatterkote Type SK-2; mill-mixed portland cement based fireproofing material. UL listed. Apply a discontinuous textured spray to cellular steel floor units with flat plate on the bottom before application of sprayed-on fireproofing.
  2. Dry Density: Approximately 1.25 per SF per inch of thickness.
- G. Water: Clean and potable, free of silt, mineral, or organic substances, and impurities detrimental to fireproofing material.

## PART 3 - EXECUTION

### 3.1 INSPECTION AND PREPARATION

- A. Installer shall examine substrates and conditions under which fireproofing work is to be performed, and must notify Contractor in writing of unsatisfactory conditions.
- B. Clean substrates of substances which might be incompatible with or interfere with bond of fireproofing, including oil, dirt, scale, grease, paint, and noncompatible shop primer.
- C. Confirm that hangers, inserts, clips, supports, sleeves, clamps or other attachments for work suspended from, attached to or passing through construction required to receive sprayed fireproofing are in place prior to application of sprayed fireproofing.

- D. Remove ill-timed Work which might interfere with installation of fireproofing.
- E. Do not proceed with fireproofing Work until unsatisfactory conditions have been corrected in a manner acceptable to Installer.
- F. Where concrete, masonry or other surfaces are to remain permanently exposed, they shall be protected with masking, drop cloths, or other satisfactory coverings.

### 3.2 INSTALLATION

- A. Comply with manufacturer's printed instructions for particular conditions of installation in each case. Consult with manufacturer's technical representative for conditions not covered by printed instructions.
- B. Coat substrate with bonding adhesive where direct bonding of fireproofing is indicated and where use of adhesive is required or recommended by manufacturer.
- C. Provide thicknesses as indicated or as required for compliance with indicated fire-endurance ratings, whichever is greater in each instance.
  - 1. Extend fireproofing full thickness over entire area of each substrate to be protected.
  - 2. Spray material completely into inverted corners, and to build up work to full thickness at projecting corners.
- D. Provide sprayed-in-place installation of fireproofing materials. Manual application of fireproofing material is not allowed, except to patch damaged areas.
- E. Maintain ambient conditions during installation and for cure period following installation, as recommended by manufacturer.
  - 1. Provide ventilation and avoid excessive rate of drying.
- F. Utilize probes or other approved means to determine thickness during application.

### 3.3 INSTALLATION SCHEDULE

- A. Type and Location:
  - 1. Standard Density spray-applied fire resistive material:
    - a. Provide at all concealed-from-view locations unless otherwise noted in this Section.
  - 2. Medium-density spray-applied fire resistive material:
    - a. Provide at interior and exterior exposed-to-view locations where the primary steel frame of the Building is not covered by other Work, including:

- 1) Mechanical rooms.
  - 2) Electrical rooms and Closets.
  - 3) Telephone and Data Rooms and Closets.
  - 4) Elevator shafts.
  - 5) Mechanical shafts.
  - b. Exterior locations, including:
    - 1) Exterior perimeter of the building.
    - 2) Exterior Soffits.
- B. Provide spray-applied fire resistive material installations in strict conformance with the following designations from UL's "Fire Resistance Directory":
1. Wide-Flange Columns: 3-hour UL Design Number X-772.
  2. Tube and Pipe Columns: 3-hour UL Design Number X-771.
  3. Unprotected Floor Deck Assembly and Beams: 2-hour UL Design Numbers D-925.
  4. Primary Floor Beams: 3-hour UL Design Number N-708.
  5. Secondary Floor Beams: 2-hour UL Design Number N-708.
  6. Roof Deck: Metal deck and sloped insulation: 2-hour UL Design Number P-732.
  7. Roof Deck: Concrete filled metal deck and sloped insulation.
    - a. Primary Roof Beams: 3-hour UL Design Number S-734.
    - b. Secondary Beams: 2-hour UL Design Number S-734.

### 3.4 PROTECTIVE SEALER

- A. General: Apply over exposed sprayed-on fireproofing in locations subject to physical contact and building areas containing sensitive micro-electronic equipment, including:
1. Exposed-to-View locations where medium-density cementitious fireproofing is specified.
- B. Application: Spray method; one coat. Maximum coverage 250 SF of surface per gallon.

### 3.5 FIELD QUALITY CONTROL

- A. Owner's Testing and Inspection Agency will visually inspect and test spray-on fireproofing for thickness, density, and bond strength, in accordance with code requirements and as described below.
  - 1. Areas not in compliance will be reported for proper repair.
  - 2. The Contractor shall patch areas from which testing samples have been removed.
- B. Performance criteria for field testing of fireproofing shall be as follows:
  - 1. Dry Density: Dry density of fireproofing shall be determined in accordance with ASTM E 605 volume displacement test method for each performance criterion. Field density measured shall be consistent with that reported in performance tests and as specified herein.
  - 2. Bond Strength: Sprayed-on fireproofing applied over uncoated or galvanized steel shall have a minimum bond strength of 200 pounds per square foot when tested in accordance with ASTM E 736.
- C. Repair or replace fireproofing found (by field tests) to be below compliance requirements. Add extra course of fireproofing material where feasible to achieve compliance; otherwise remove course and replace with newly installed complying work.

### 3.5 CLEANING, PATCHING, PROTECTION

- A. Comply with requirements of Section 01740 – Cleaning.
- B. Cleaning:
  - 1. Immediately upon completion of spraying operations in each containable area of project, remove over-spray and fall-out of materials from surfaces of the work, and clean surfaces to remove evidence of soiling.
  - 2. Repair or replace damaged work to restore surfaces to acceptable condition.
- C. As other trades successively complete installations of their Work, patch fireproofing installations which have been cut away to facilitate such installations.
- D. Do not allow Work requiring patching to be covered over or otherwise concealed before patching is completed.
- E. Protection: Installer of sprayed-on fireproofing shall advise Contractor of protection requirements for fireproofing Work, which will ensure that fireproofing will be substantially without damage or deterioration at time of substantial completion of Project.
  - 1. Provide protection from reasonably predictable harmful exposures.
  - 2. Repair or replace Work which has not been successfully protected.

END OF SECTION

**SECTION 07 84 00 – FIRESTOPPING**

## Part 1 - GENERAL

## 1.1 Summary

- A. Furnish labor, materials, tools, equipment, and services for Firestopping, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

## 1.2 Quality Assurance

- A. Installer Qualifications:
  - 1. Certified, licensed or approved by firestopping manufacturer, trained to install firestop products per specified requirements.
  - 2. Licensed by State or local authority, where applicable.
  - 3. Shown to have successfully completed not less than five (5) comparable scale projects.
- B. Provide firestop systems in compliance with following requirements:
  - 1. Obtain firestop system for each type of penetration and construction condition from a single firestop systems manufacturer.
  - 2. Firestop products and systems shall bear classification marking of qualified testing and inspection agency.
  - 3. Firestopping tests, performed by qualified, testing and inspection agency.
    - a. UL or other agency, performing testing and follow-up inspection services for firestop systems, acceptable to local authorities having jurisdiction.
  - 4. Existing applications for which no tested and listed classified system is available through a manufacturer:
    - a. Provide Engineering Judgment or Equivalent Fire Resistance Rated Assembly (EFRA) for submittal derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
    - b. Engineering judgment drawings must follow requirements set forth by International Firestop Council.
  - 5. Inspect applied firestopping systems in accordance with International Building Code (IBC) Chapter 17.
    - a. Inspections shall be performed by an FMG 4991 Approved Specialty Contractor/UL Qualified Firestop Contractor and/or ASTM E2174 and ASTM E2393.
    - b. See Section 01 45 23.
  - 6. FM Approved in accordance with FM Standard 4991 – Approval of Firestop Contractors.
  - 7. UL Qualified Firestop Contractor.
- C. Underwriters Laboratories, Inc. (UL):
  - 1. UL 263, Fire Tests of Building Construction and Materials
  - 2. UL 723, Surface Burning Characteristics of Building Materials
  - 3. UL 1479, Fire Tests of Through Penetration Firestops
  - 4. UL 2079, Tests for Fire Resistance of Building Joint Systems
- D. ASTM International (ASTM):
  - 1. ASTM E84 Surface Burning Characteristics of Building Materials
  - 2. ASTM E119 Fire Tests of Building Construction and Materials
  - 3. ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F
  - 4. ASTM E814 Fire Tests of Through Penetration Fire Stops

5. ASTM E1399 Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
  6. ASTM E1966 Test Method for Fire Resistive Joint Systems
  7. ASTM E2174 Standard Practice for On-site Inspection of Installed Fire Stops
  8. ASTM E2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
  9. ASTM E2393 Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers
  10. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
- E. Building Code as locally adopted and amended.
- F. Underwriters Laboratories (UL) Fire Resistance Directory:
1. Through Penetration Firestop Systems (XHEZ).
  2. Joint Systems (XHBN).
  3. Fill, Void or Cavity Materials (XHHW).
  4. Firestop Devices (XHJI).
  5. Forming Materials (XHKU).
  6. Wall Opening Protective Materials (CLIV).
- G. National Fire Protection Association (NFPA):
1. NFPA 70: National Electrical Code
  2. NFPA 101: Life Safety Code
  3. NFPA 22: Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls
  4. NFPA 251: Fire Tests of Building Construction and Materials
- H. Firestop Contractors International Association (FCIA): MOP – FCIA Firestop Manual of Practice
- I. International Firestop Council (IFC):
1. Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments, latest revision.
  2. Inspectors Field Pocket Guide, latest edition.
- J. Identification Labels for Firestop Assemblies:
1. Follow guidelines set in Chapter 7 of International Building Code.
  2. Coordinate with Section 04 22 00 and Section 09 29 00.
  3. Label penetration on both sides of wall or slab.
  4. Label each penetration or group of similar penetrations with a permanent label marked with the following information:
    - a. UL system number.
    - b. Rating.
    - c. Products used.
    - d. Installation date.
    - e. Installer name.
    - f. Penetration reference number unique to each location.
- K. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings.
1. Provide products appropriately tested for the thickness and type of insulation utilized.
- L. Cabling where frequent cable moves, add-ons, and changes are likely to occur in future:
1. Where cable trays are used:
    - a. Utilize re-enterable products (e.g. removable intumescent pillows) specifically designed for retrofit.
  2. Where cable trays are not used:

- a. Utilize fire-rated cable pathway devices.
  - b. Where not practical, re-enterable products designed for retrofit may be used.
- M. Protect penetrations passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies with products tested by being fully exposed to fire outside of chase wall.
- 1. Identify systems within UL Fire Resistance Directory with the words: Chase Wall Optional.
- N. Fire Resistive Joint Sealant:
- 1. Provide flexible fire-resistive joint sealants to accommodate normal and thermal building movement without seal damage.
  - 2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement.
    - a. Test in accordance with cyclic movement test criteria as outlined in: ASTM E1399, ASTM E1966 or UL 2079.
  - 3. Provide fire-resistive joint systems subjected to an air leakage test.
    - a. Conduct in accordance with UL 2079, with published L-Ratings for ambient and elevated temperatures, as evidence of ability of fire-resistive joint system to restrict movement of smoke.
  - 4. Coordinate firestopping with acoustical sealant requirements in Section 07 92 16.
- O. Subject smoke wall containment systems to air leakage test.
- 1. Conduct in accordance with UL 1479, with published L-Ratings for ambient and elevated temperatures, as evidence of ability of fire-resistive joint system to restrict movement of smoke.
- P. System Description:
- 1. Through Penetration Firestop Systems for protection of penetrations through following fire-resistance rated assemblies, including both blank openings and openings containing penetrating items:
    - a. Roof assemblies.
    - b. Floor assemblies.
    - c. Wall and partition assemblies.
    - d. Fire-rated smoke barrier assemblies.
    - e. Existing, fire and smoke-rated assemblies.
    - f. Construction enclosing compartmentalized areas.
  - 2. Fire Resistive Joint Assemblies for linear voids where fire-rated floor, roof, or wall assemblies abut one another, including following types of joints:
    - a. Top and bottom of wall interface with overhead roof or floor structure:
      - 1) Coordinate with acoustical sealant specified in Section 09 29 00.
      - 2) Select products to maintain acoustical, smoke and fire ratings indicated.
    - b. Non-Fire Rated Expansion Joints: Specified in Section 07 95 13.
    - c. Fire Rated Expansion Joints: Specified in Section 07 95 13.

### 1.3 SUBMITTALS

- A. Product Data: Manufacturer's standard information indicating certification of products proposed for use on project.
- B. Project Information: UL reports with illustration of systems, system numbers, temperature ratings, and products proposed for use on project.
- C. Contract Closeout Information:
  - 1. Warranty.
  - 2. Electronic file of project firestopping documentation.



## 1.4 Warranty

- A. Written five (5) year warranty guaranteeing quality of installation and meeting requirements of manufacturer's written instructions and tested systems.

## Part 2 - PRODUCTS

## 2.1 Acceptable manufacturers

- A. Firestopping:
  - 1. Base:
    - a. Hilti - Firestopping Products.
- B. Forming Materials:
  - 1. Base:
    - a. Hilti - Firestopping Products.
- C. Other manufacturers desiring approval, comply with Section 00 26 00.
  - 1. See systems Volume 2 of UL Building Materials Directory.

## 2.2 MATERIALS

- A. Through Penetration Firestop Systems:
  - 1. VOC content not to exceed 250 g/L
  - 2. Base Products:
    - a. FS-ONE Intumescent Firestop Sealant.
    - b. CP 604 Self-leveling Firestop Sealant.
    - c. CP 620 Fire Foam.
    - d. CP 606 Flexible Firestop Sealant.
    - e. CP 601S Elastomeric Firestop Sealant.
- B. Fire-resistive Joints:
  - 1. VOC content not to exceed 250 g/L
  - 2. Base Products:
    - a. CFS-SP WB Firestop Joint Spray.
    - b. CP 601S Elastomeric Firestop Sealant.
    - c. CP 606 Flexible Firestop Sealant.
    - d. CP 604 Self-leveling Firestop Sealant.
- C. Firestop Devices:
  - 1. Factory-assembled collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
  - 2. Base Products:
    - a. CP 680-P Cast-in-Place Firestop Device.
    - b. CP 680-M Cast-in-Place Firestop Device.
    - c. CP 681 Tub Box Kit.
    - d. CFS-DID Firestop Device.
- D. Intumescent Pads, Wall Opening Protective Materials:
  - 1. Intumescent, non-curing pads or inserts for protection of electrical panels, switch and receptacle boxes, medical gas outlets and valve boxes and other items recessed in face of fire rated walls.
  - 2. Base Product:
    - a. CFS-P PA Firestop Putty Pad.
    - b. CP 617 Firestop Putty Pad.
    - c. Hilti Biox Insert.
- E. Fire-rated Cable Pathways:
  - 1. Usage:

- a. Cables passing through fire-rated floors or walls shall pass through fire-rated cable pathway devices made from an intumescent material that adjusts automatically to cable additions or subtractions.
  2. Product description and requirements:
    - a. Pathway device modules comprised of steel raceway and intumescent pads with adjustable smoke seal sleeve.
    - b. F-Rating equal to the rating of barrier the device penetrates.
    - c. Pathway devices shall be capable of allowing a 0 to 100 percent fill of cables.
    - d. Size to accommodate quantity and size of electrical wires and data cables indicated plus 100 percent expansion.
    - e. Provide wire devices with steel wall plates allowing for single or multiple devices ganged together without requiring additional wall structure framing.
  3. Base product:
    - a. CP 653 Speed Sleeve.
      - 1) Use in conjunction with CFS-SL GP when more than one device is required.
    - b. CFS-CC Firestop Cable Collar.
- F. Firestop Putty:
1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
  2. Firestop putty shall be provided and installed at, but not limited to, the gap between wire, cabling, or both, exiting an open end of conduit, where conduit penetrates one or both sides of a smoke or fire rated wall assembly.
  3. Base products:
    - a. CP 618 Firestop Putty Stick.
    - b. CFS-PL Firestop Plug.
- G. Wrap Strips:
1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
  2. Base Products:
    - a. CP 643N Firestop Collar.
    - b. CP 644 Firestop Collar.
    - c. CP 648E/648S Wrap Strips.
- H. Firestop Blocks:
1. Re-enterable, non-curing, intumescent flexible block.
  2. Base products:
    - a. CFS-BL Fire Block.
    - b. CFS-PL Firestop Plug.
- I. Mortar:
1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
  2. Base product:
    - a. CP 637 Firestop Mortar.
- J. Silicone Sealants:
1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces pourable or nonsag or vertical surface nonsag.
  2. Base product:
    - a. CP 601S Elastomeric Firestop Sealant.
    - b. CP 604 Self Leveling Silicone Firestop Sealant.
    - c. CFS-SIL SL Self Leveling Silicone Firestop Sealant.
- K. Pre-formed mineral wool:
1. CP 767 Speed Strips
  2. CP 777 Speed Plugs

- L. Fire Sealant:
  - 1. Single component latex or acrylic formulations that upon cure do not re-emulsify during exposure to moisture.
    - a. CP 601S Elastic Firestop Sealant.
    - b. CP 606 Fire Resistant Joint Filler.
    - c. CP 672 Firestop Joint Spray.
    - d. CFS-SP WB Firestop Joint Spray.
  - 2. VOC content of sealants shall be no greater than 250 g/L.
  - 3. VOC content of sealants shall be no greater than 250 g/L.
  - 4. Adhesives and sealants shall contain no carcinogen or reproductive toxicant components present at more than 1 percent of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled, Chemicals Known to the State to Cause Cancer, or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
- M. Composite Sheet:
  - 1. Non-curing, re-penetrable material.
  - 2. Base Products:
    - a. CP 675T Firestop Board.
    - b. CFS-BL FireBlock.
- N. Forming Materials:
  - 1. Materials listed as components in laboratory-approved designs.
  - 2. Mineral Wool:
    - a. Base Product:CP 767 Speed Strip
    - b. Similar product specifically named as components in laboratory-approved designs.
- O. Perimeter Fire Containment: Specified in Section 07 84 53.
- P. Acoustical Sealant: Specified in Section 07 92 16.

## 2.3 THROUGH PENETRATION FIRESTOP SYSTEMS

- A. General:
  - 1. Schedules below identify requirements for acceptable through penetration firestop systems based on barrier type, fire-resistive rating, and penetrant type. Each system must comply with building code and fire code as locally adopted and amended.
  - 2. Requirements for single-membrane penetrations and through penetration firestops are identical. Unless otherwise noted, penetrants which pass through a single membrane, shall be treated the same as if it passed through the entire fire-resistive assembly.
  - 3. Select each firestop system based on actual field conditions, including penetration type, shape, size, quantities and physical position within opening.
  - 4. Refer to Plans for indication of the required ratings of fire-resistive wall, floor, and roof assemblies.
  - 5. Indicated ratings are minimum and may be exceeded.
  - 6. Firestop Assemblies at Fire-Rated Walls:
    - a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
    - b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
    - c. Smoke Barrier: In addition to (F) Rating, (L) Rating of maximum 5 CFM per SF.
    - d. Non-rated walls and Smoke-Partitions with no fire-resistive requirement: Assembly with (L) rating.
  - 7. Firestop assemblies at fire-rated floors and roofs:

- a. Minimum Fire (F) and Temperature (T) Ratings of Firestop assemblies used in floors or roof shall equal hourly rating of floor or roof being penetrated, but not less than 1-HR.
  - 1) Exception 1: The T-rating may equal zero when portion of penetration, above or below floor, is contained within a wall.
  - 2) Exception 2: Firestops are not required for floor penetrations within a 2-hour rated shaft enclosure.
- B. Voids in wall with no penetrations:
  - 1. Fill with approved through penetration firestopping system.
  - 2. Contractor's option: Patch void in wall with like construction.
- C. Penetrating Ducts with Dampers:
  - 1. Utilize only firestop materials which are included in damper's classification.
  - 2. Do not install firestop systems that hamper performance of fire dampers.
- D. Cable Trays and similar devices:
  - 1. Provide re-enterable products specifically designed for removal and re-installation at openings within walls and floors designed to accommodate voice, data and video cabling.
- E. Electrical panels and devices, medical gas outlets and valve boxes, film illuminators, and other items recessed in to face of rated walls:
  - 1. Where electrical devices are placed on opposite sides of wall, and are less than 24 IN apart measured horizontally, install intumescent pads over back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.

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2.4 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

- A. General:
  - 1. Where joint will be exposed to elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.
- B. Head-of-Wall Assemblies:
  - 1. General:
    - a. Use at top of fire-rated and smoke barrier walls and partitions where they abut floor and roof structures above.
    - b. Select systems with D designation, rated for dynamic movement capability.
    - c. Select systems that can accommodate deflection of structure above.
    - d. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 5 CFM or less per linear foot as tested in accordance with UL 2079.
    - e. Seal non-fire-rated sound-control walls and smoke partitions with acoustical sealant as specified in Section 07 92 16.
  - 2. Minimum F and T ratings:
    - a. The minimum fire rating for firestop assemblies in walls shall equal that of wall, but not less than 1-HR.
    - b. The minimum temperature rating of firestop assemblies in walls may equal zero.
  - 3. Acceptable Systems:
    - a. Metal stud and drywall partitions: Select system from UL HW-D-0000 Series.
    - b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

## Part 3 - EXECUTION

## 3.1 PREPARATION

- A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
- B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.
- C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
- D. Do not proceed until unsatisfactory conditions have been corrected.

## 3.2 Installation

- A. General:
  - 1. Install firestop systems in accordance with manufacturer's instructions and conditions of testing and classification as specified in UL or other acceptable third-party testing agency listing.
  - 2. Penetrations through fire-resistive floor assemblies shall be sealed with firestop system providing minimum Class 1 W-rating as tested in accordance with UL 1479 and ensure air and water resistant seal.
  - 3. Protect materials from damage on surfaces subjected to traffic.
- B. Identification Labels:
  - 1. Identify each firestop assembly as defined in Quality Assurance.
  - 2. Do not locate identification labels, tags, or both, on finished surfaces or where exposed to view by public.

## 3.3 FIELD QUALITY CONTROL

- A. Owner shall engage a qualified independent inspection agency to inspect firestop systems in accordance with ASTM E2174, Standard Practice for On-site Inspection of Installed Fire Stops, and ASTM E2393, Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers.
- B. Construct mock-up on-site to include typical through penetration and fire-resistive joint applications for project.
- C. Maintain areas of work accessible until inspection by authorities having jurisdiction.
- D. Where deficiencies are found, repair or replace assemblies to comply with requirements.

## 3.4 ADJUSTING AND CLEANING

- A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- B. Clean surfaces adjacent to sealed openings free of excess materials and soiling as work progresses.
- C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

**SECTION 07 92 00 - JOINT SEALANTS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes sealants for the following applications, including those specified by reference to this Section:
  - 1. Exterior joints in the following vertical surfaces and nontraffic horizontal surfaces:
    - a. Perimeter joints between materials listed above and frames of doors and windows.
  - 2. Exterior joints in the following horizontal traffic surfaces:
    - a. Control, expansion, and isolation joints in cast-in-place concrete slabs.
  - 3. Interior joints in the following vertical surfaces and horizontal nontraffic surfaces:
    - a. Vertical control joints on exposed surfaces of interior unit masonry and concrete walls and partitions.
    - b. Perimeter joints between interior wall surfaces and frames of interior doors, windows, and elevator entrances.
    - c. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    - d. Other joints as indicated.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Provide elastomeric joint sealants that establish and maintain watertight and airtight continuous joint seals without staining or deteriorating joint substrates.

## 1.4 SUBMITTALS

- A. Product Data: For each joint-sealant product indicated.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

- B. Store and handle materials in compliance with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
  - 1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
- B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS AND MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the products indicated for each type in the sealant schedules at the end of Part 3.

#### 2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

#### 2.3 ELASTOMERIC JOINT SEALANTS

- A. Elastomeric Sealant Standard: Comply with ASTM C 920 and other requirements indicated for each liquid-applied chemically curing sealant in the Elastomeric Joint-Sealant Schedule at the end of Part 3, including those referencing ASTM C 920 classifications for type, grade, class, and uses.

#### 2.4 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed and Concealed Joints: For each product of this description indicated in the Acoustical Joint-Sealant Schedule at the end of Part 3, provide manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834 and the following:



1. Product effectively reduces airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.

## 2.5 JOINT-SEALANT BACKING

- A. General: Provide sealant backings of material and type that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

## 2.6 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants with joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions and the following requirements:
  1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
  2. Clean porous joint substrate surfaces by brushing, grinding, blast cleaning, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining from above cleaning operations by vacuuming

or blowing out joints with oil-free compressed air. Porous joint surfaces include the following:

- a. Concrete.
- b. Masonry.
- c. Unglazed surfaces of ceramic tile.

3. Remove laitance and form-release agents from concrete.

- B. Joint Priming: Prime joint substrates where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

### 3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Acoustical Sealant Application Standard: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.
- D. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- E. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and back of joints.
- F. Install sealants by proven techniques to comply with the following and at the same time backings are installed:
  1. Place sealants so they directly contact and fully wet joint substrates.
  2. Completely fill recesses provided for each joint configuration.
  3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- G. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.

### 3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

### 3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

### 3.6 ELASTOMERIC JOINT-SEALANT SCHEDULE

- A. Multicomponent Nonsag Polysulfide Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
  1. Products: Provide one of the following:
    - a. cm-60; W.R Meadows, Inc.
    - b. T-2235-M; Morton International, Inc.
    - c. T-2282; Morton International, Inc.
    - d. Thiokol 2P; Morton International, Inc.
    - e. GC-5 Synthacalk; Pecora Corporation.
    - f. Two-Part Sealant; Sonneborn Building Products Div., ChemRex Inc.
  2. Type and Grade: M (multicomponent) and NS (nonsag).
  3. Class: 25.
  4. Uses Related to Exposure: T (traffic)

### 3.7 LATEX JOINT-SEALANT SCHEDULE

- A. Latex Sealant: Where joint sealants of this type are indicated, provide products complying with the following:
  1. Products: Provide one of the following:
    - a. Chem-Calk 600; Bostik Inc.
    - b. NuFlex 330; NUCO Industries, Inc.
    - c. LC 160 All Purpose Acrylic Caulk; Ohio Sealants, Inc.
    - d. AC-20; Pecora Corporation.
    - e. PSI-701; Polymeric Systems, Inc.
    - f. Sonolac; Sonneborn Building Products Div., ChemRex, Inc.
    - g. Tremflex 834; Tremco.

## 3.8 ACOUSTICAL JOINT-SEALANT SCHEDULE

- A. Acoustical Sealant for Exposed and Concealed Joints: At all sound partitions and where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Provide one of the following:
    - a. AC-20 FTR Acoustical and Insulation Sealant; Pecora Corporation.
    - b. SHEETROCK Acoustical Sealant; USG Corp., United States Gypsum Co.
- B. Acoustical Sealant for Concealed Joints: At all sound partitions and where joint sealants of this type are indicated, provide products complying with the following:
1. Products: Provide one of the following:
    - a. Pro-Series SC-170 Rubber Base Sound Sealant; Ohio Sealants, Inc.
    - b. BA-98; Pecora Corporation.
    - c. Tremco Acoustical Sealant; Tremco.

END OF SECTION

**SECTION 08 31 13 – ACCESS PANELS**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and install access panels, complete, as shown on Drawings as specified, and if not shown on Drawings, as required to access mechanical, electrical, plumbing and other equipment in conformance with governing codes and workplace safety guidelines.
  - 1. Ceiling-mounted gasketed access panels.
- B. Work Specified Elsewhere:
  - 1. Section 092216 – Non-Structural Metal framing
  - 2. Section 092900 - Gypsum Board.
  - 4. Section 099123 – Interior Painting.

## 1.2 SUBMITTALS

- A. Conform to the requirements of Section 013300 – Submittal Requirements.
- B. Product Data: Submit manufacturer's specifications, catalog cuts, and installation instructions. Submit approved test data or State Fire Marshal listing for fire-rated assemblies.
- C. Shop Drawings: Show attachment to partition, soffit, and ceiling framing at each typical condition.

## 1.3 PRODUCT HANDLING

- A. Delivery and Storage: Deliver and store panels in manufacturer's standard protective packaging.
- B. Protection: Do not remove protective packaging until time of installation.

## PART 2 - PRODUCTS

## 2.1 ACCESS PANELS FOR CEILINGS

**1. Glass Fiber Reinforced Gypsum (GFRG) Type:**

- 1. Manufacturer: Bauco Access Panel Solutions Inc.
- A. baucoplus-II series: Non-rated recessed access doors with concealed hardware and gypsum board inlay for flush installation.

B. Material Overview: Extruded aluminum alloy 6063-T6 frames and supports complete with 5/8" (15.9 mm) or 1/2" (12.7 mm) moisture and mold resistant gypsum board inlay and galvanized internal steel corner reinforcing. Zinc-plated hardened steel screws, free pivot hinge, safety cable with carabineer hook, vinyl screw caps, and EPDM rubber gaskets.

C. Door: Fabricate using 2.8 mm thick extruded aluminum alloy 6063-T6 frame, screwed in place gypsum board inlay complete with galvanized internal steel corner reinforcing. Exposed top edge of frames shall have a concave meniscus rise to 0.5mm thick to accept finishing compound allowing a near invisible flush frame finish.

D. Frame: Recessed aluminum frame shall provide an edge similar to drywall bead against which the ceiling or wall surface shall be finished allowing a near invisible flush frame finish. Fabricate using 2.8mm thick extruded aluminum alloy 6063-T6 frame, complete with galvanized internal steel corner reinforcing. Frame opening complete with perimeter EPDM gasket maintaining the STC of gypsum board assembly.

Frame model specification:  
BPII 58 - for 5/8 board

E. Board: Access Panel inlay shall equal the wall & ceiling specifications to ensure acoustic integrity.

Board Inlay specification:  
baucoplus-II moisture and mold resistant gypsum board inlay

F. Hinge Detail: Concealed, galvanized steel free pivot hinge shall allow all doors to open 120 degrees. All access panel doors shall be fully removable and complete with a safety cable to secure doors to panel frames with a safety cable, test rated for 135lb (61kg), nylon coated, with crimp connections and spring snap aluminum carabiner.

G. Hinge Location:

baucoplus-II panels for ceiling installation will be hinged on the longest side unless specified. When baucoplus-II panels are used in a wall installation, the hinges must be located on the floor side. The last 2 digits of the product code will always be the hinge location, and always the horizontal measurement for a wall installation.

H. Latching/Locking devices:

Concealed touch latch – standard

I. Finish: baucoplus-II series access panels require finishing using common trade tools. For best results, setting-type gypsum finishing compound is recommended. Apply compound separately to the door leaf and surrounding wall or ceiling area up to recessed access panel frame. No taping required. Door shall receive the same finish and paint as the surrounding surfaces. When installed and finished the access panel shall be completely flush with the wall or ceiling surface and only a one sixteenth of an inch shadow gap shall be visible.

J. General Access Panel Dimensions For 5/8" Gypsum board:

baucoplus-II series shall come in the following standard sizes:

Size: 24" x 24"

Model Number: 20-58-2424

Description: 24" x 24" (610mm x 610mm) baucoplus II access panel, 5/8" gypsum inlay, non-rated, concealed touch latch, free pivot hinge

N. Access Panel Sizing: baucoplus-II dimensions in model number refer to clear opening in door.

O. Framing: For a proper fit between framing members the rough framed opening will be 2 1/2" greater than product code sizing. This 2 1/2" allowance provides the door frame size 1 1/8" plus 1/8" allowance on all sides of the panel.

#### P. FABRICATION

- A. Manufacture each access panel assembly as an integral unit ready for site installation.
- B. Furnish number of latches required to hold door flush for a smooth uniform panel appearance when closed.
- C. Larger sizes bracing will be added to add rigidity and/or prevent sagging.
- D. Supply rear of panel door with acoustic treatment when specified.
- E. Provide installation instructions with each panel.
- F. Rear of panel door leaf label indicating product model and size

#### EXECUTION

##### Q. EXAMINATION

A. Examine areas to receive access doors. Notify Architect if areas are not acceptable. Do not begin installation until unacceptable conditions have been corrected.

##### R. PREPARATION

A. Advise installers of work relating to access panel installation including rough opening dimensions, locations of supports, and anchoring methods. Coordinate delivery with other work to avoid delay.

##### S. INSTALLATION

- A. Follow manufacturer's instructions for installing access panels. Install access doors plumb, level, and square.
- B. Anchor frames securely in place.
- C. Set frames to proper alignment with the wall or ceiling.
- D. Position access panels for proper access to concealed equipment requiring access.

##### T. ADJUST AND CLEAN

- A. Adjust panel after installation for proper operation. Remove drywall compound from hinge, frame and door leaf edge. Clean the frame and door with a damp cloth.
- B. Remove and replace panels or frames that are warped, bowed, or damaged.

## 2. Metal Types:

1. Manufacturers: Karp Associates, Inc., Larsen's Manufacturing Co., Milcor, Nystrom, Inc., JL Industries, or equal. Karp specified as standard.
2. Non-Rated Gypsum Board Partitions: Karp Type KDW, flush panel type with frame flanges for joint compound concealment, 16-gauge steel frames and 14-gauge steel doors.
3. Fire-Rated Gypsum Board Partitions: Karp Type KRP-250FR, 16-gauge steel doors and frames. Provide UL label.
4. Exterior Cement Plaster Soffits: Karp Type DSC-210 PL; frame of 13-gauge and door of 16-gauge galvanized steel finished with baked

enamel, recessed, and lined with galvanized self-furring steel lath. Provide concealed pivoting rod hinge and key-operated stainless steel lock.

## 2.2 MISCELLANEOUS MATERIALS

- A. General: Provide fastening devices, masonry anchors, casing beads, and other items as required to secure door and frame in place.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: Examine construction to receive access panels and verify correctness of dimensions and other supporting or adjoining conditions. Do not install panels until unsatisfactory conditions have been corrected. Verify that locations serve portion of work to which access is required.

### 3.2 INSTALLATION

- A. General: Install, per manufacturer's recommendations, securely to framing in locations required to give access to plumbing, mechanical, electrical, or similar devices concealed in walls or ceilings.
- B. GFRG Access Panels: Conceal joint between GFRG frame and gypsum board with tape and joint compound as specified under Section 092900.
- C. Coordination: Coordinate with other trades to verify correct sizes and locations of access panels.

### 3.3 ADJUSTMENT

- A. General: Following installation, adjust access panels for smooth operation.

### 3.4 CLEANING

- A. General: Thoroughly clean surface of grease, oil, or other impurities, touch up abraded prime coats and otherwise prepare for finish painting.

END OF SECTION



**SECTION 08 80 00 – GLAZING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Furnish labor, materials, tools, equipment, and services for Interior Glass and Glazing in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.
- C. **Related Sections:**
  - 1. Section 08 41 00 "Aluminum Entrances and Storefronts."
  - 2. Section 08 44 13 "Glazed Aluminum Curtain Walls."

## 1.2 QUALITY ASSURANCE

- A. Glass Standards:
  - 1. ANSI Z97.1.
  - 2. CPSC 16 CFR 1201.
  - 3. GANA Glazing Manual.
- B. Flat Glass ASTM C1036.
  - 1. Float glass: Type I, Quality q3 and Class 1 unless otherwise indicated.
  - 2. Figured glass: Type II, Quality q7, Form 3 and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
  - 3. Mirror glass and one-way vision glass: Type I, Quality q1 or q2, Class 1 and coated for purpose.
- C. Flat Glass, Heat Treated, Coated and Uncoated, ASTM C1048.
  - 1. Heat strengthened glass: Kind HS, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
  - 2. Tempered glass: Kind FT, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
- D. Mirror Glass:
  - 1. ASTM C1503;
  - 2. Quality: Mirror select.
  - 3. F.S.DD-M-00411B (1).
- E. Fire-Rated Assemblies:
  - 1. General:
    - a. Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
    - b. Underwriters Laboratories, Inc. (UL):
      - 1) UL 9 – Fire Tests of Window Assemblies.
      - 2) UL 10B – Fire Tests of Door Assemblies.
      - 3) UL 10C – Positive Pressure Fire Tests of Door Assemblies.
    - c. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.
  - 2. Door Assemblies:
    - a. Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.

- b. Positive Pressure Compliance: UL 10C.
- c. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per UL 10B, labeled and listed by UL.
- 3. Window Assemblies:
  - a. Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
  - b. Positive Pressure Compliance: UL 10C.

F. Laminated Glass:

- 1. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.
- 2. Laminated Glass Design Guide, by the Glass Association of North America (GANA).

G. Glazing Standards:

- 1. Glazing Manual, by the Glass Association of North America (GANA).

### 1.3 SUBMITTALS

A. Samples:

- 1. Provide one (1) 12 IN x 12 IN example of each specified type of glass.

B. Contract Closeout Information:

- 1. Warranties.

C. Smoke baffle system:

- 1. Shop drawing details, plans and elevations showing supports to building structure, interface at ceiling, blocking, baffle shoe, cap rail, grommet, cladding, sealant/adhesive, and glass.
- 2. Product data.
- 3. Standard warranty.
- 4. Installation Instructions

### 1.4 WARRANTY

A. Written warranty signed by manufacturer or fabricator.

B. Laminated Glass:

- 1. Five (5) years against deterioration including edge separation, delamination that materially obstructs vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

C. Fire-rated Ceramics:

- 1. Five (5) year manufacturer's standard warranty.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

A. Glass Products:

- 1. Base:
  - a. AGC Industries.
- 2. Optional:
  - a. Guardian Industries.
  - b. Pilkington.
  - c. PPG Industries.
  - d. Saint-Gobain.

- B. Fire-rated Glass Ceramic:
  - 1. Base:
    - a. Technical Glass Products.
  - 2. Optional:
    - a. Saffi First.
    - b. Pilkington.
    - c. Saint-Gobain.
- C. Radiation-resistant Glass:
  - 1. Base:
    - a. Ray-Bar Engineering Corp.
  - 2. Optional:
    - a. Nelco.
    - b. Corning Inc.
    - c. Schott North America, Inc.
    - d. Radiation Protection Products (RPP).

## 2.2 MATERIALS

- A. Glass Materials:
  - 1. Comply with indicated standards.
  - 2. See Glass Types Schedule for listing of types.
  - 3. Materials specified in Glass Types Schedules are minimum acceptable products.
  - 4. Single manufacturer produce individual glass types used in fabrication of insulating units.
  - 5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.
- B. Glazing Compounds:
  - 1. Nonsag, nonstain type.
  - 2. Pigmented to match frame units not requiring painting.
  - 3. Compatible with adjacent surfaces.
  - 4. For use in setting glass: Neutral-cure Silicone sealant.
  - 5. Sealants:
    - a. Sealants shall have a VOC content no greater than 250 g/L.
    - b. Sealants shall contain no carcinogen or reproductive toxicant components present at more than 1% of total mass of the product as defined in the California Office of Environmental Health Hazard Assessment's (OEHHA) list entitled "Chemicals Known to the State to Cause Cancer" or the Reproductive Toxicity, Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65).
  - 6. Sealant tape:
    - a. Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
  - 7. Gaskets:
    - a. Polyvinyl chloride or neoprene.
    - b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.
- C. Installation Setting Blocks and Spacers:
  - 1. Neoprene, compatible with sealants used.
  - 2. Setting blocks: 80-90 durometer.
  - 3. Spacers: 40-50 durometer.

4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
5. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

### 2.3 GLASS TYPES SCHEDULE

- A. Refer to Interior Glass Types Schedule and Interior Finish Schedule for basic description of Mark Numbers indicated on Drawing.
- B. Refer to Drawings for depiction of unit sizes and locations.
- C. Upgrade basic type conditions in accordance with following rules:
  1. Heat treatment upgrade based on physical size of unit:
    - a. Heat strengthened or fully tempered units between 55 and 70 SF.
    - b. Fully temper units exceeding 70 SF.
    - c. Strengthen annealed glass where units exceed length or width limitations or both as recommended by glass manufacturer.
  2. Heat treatment upgrade based on locations which are potentially hazardous to occupants:
    - a. Upgrade units to fully tempered, Kind FT, glass as required by any one of following:
      - 1) When required by local Codes.
      - 2) When specifically indicated on Drawings.
      - 3) Locations requiring Safety Glass, Kind FT, by 16 CFR 1201 and ANSI Z97.1:
        - a) Units installed in doors, sash, transom or other operable units.
        - b) Units where any part of unit is within 18 IN, measured vertically, above a floor line, sidewalk, paver, or other walking surface located within 3 FT of the glass unit, measured horizontally.
      - 4) Units in sidelights and other units located adjacent to and within 48 IN of either jamb of door or other operable units; this includes adjacent lites that are in perpendicular plane to door.
  3. Other conditions requiring heat treatment upgrades:
    - a. Units which will be exposed to irregular sun or shade combinations or both shall be Kind HS or better.
    - b. Where glass manufacturer recommends heat treatment coatings or tints specified.
    - c. Where required to resist lateral loads.

### 2.4 INTERIOR GLASS TYPES

#### **A. Annealed:**

1. Clear float, 6mm (1/4 IN) thick, UNO.

#### **B. Tempered:**

1. Clear, fully-tempered tongue-less float, 12 mm (1/2 IN) thick at all glass entrance and aluminum storefront systems, 6mm (1/4 IN) thick elsewhere, unless noted otherwise.

#### **C. Laminated Fire and Safety Glass, 8mm:**

1. Laminated, wireless, UL labeled for assembly indicated.
2. Impact-Safety Rated per ANSI Z97.1 and CPSC 16CFR1201.
3. Thickness: 8mm (5/16 IN), laminated.
4. Surface: Polished.
5. Base Product: FireLite Plus by Technical Glass Products.

**D. Mirror Glass:**

1. Color: Clear.
2. Thickness: 6mm (1/4 IN).
3. Unit Length and Width: As indicated on drawings.
4. Tempered.

**E. Radiation-Resistant Glazing:**

1. Composition: Lead-barium, polished float glass containing not less than 60 percent heavy metal oxides, including not less than 48 percent lead oxide by weight.
2. Color: Clear.
3. Provide glass units of sufficient thickness to provide same radiation shielding as adjacent wall areas. Provide single or multiple plies as necessary.

**F. Laminated, Heat-Strengthened Glass:**

1. Laminated safety glass complying with ANSI Z97.1 and CPSC 16 CFR 1201, consisting of 2 sheets of heat strengthened float glass ASTM C1036, and 60 mil interlayer.

## PART 3 - EXECUTION

## 3.1 INSPECTION

- A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

## 3.2 INSTALLATION

- A. Do not install glass with edge damage.
- B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.
- C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.
- D. Comply with GANA Glazing Manual.
- E. Install sealants as recommended by sealant manufacturer.
- F. Install setting blocks in adhesive or sealant.
- G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.
- H. Minimum Bite:
  1. Monolithic, 6mm (1/4 IN) glass: 3/8 IN minimum bite.
  2. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass and Glazing.
- I. Sealant Depth: Equal to sealant width.
- J. Prevent sealant exudation from glazing channels.
  1. Leave void at heel or install filler at jambs and head.
  2. Do not leave void or install filler at sill.
- K. Miter cut and bond gasket ends together at corners.
- L. Immediately after installation, attach crossed streamers to framing held away from glass.
- M. Do not apply anything to surfaces of glass.

- N. Install spandrel units from exterior of building.
- O. Installation of Mirrors:
  - 1. Mastic Attachment: Install mirrors with mirror adhesive applied to back of mirror and pressed against substrate as recommended by mirror supplier.
- P. Remove and replace damaged glass.
- Q. Installation smoke baffle systems:
  - 1. Install in accordance with approved shop drawings.
  - 2. Follow manufacturers installation instructions.

### 3.3 CLEANING AND PROTECTION

- A. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.
- B. Comply with glass manufacturer's recommendations and GANA 01-0300.

END OF SECTION

**SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
  - 2. Suspension systems for interior gypsum ceilings, soffits, and grid systems.
- B. Related Requirements:
  - 1. Section 054000 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.

## 1.3 SUBMITTALS

- A. Product Data: For each type of product.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

## 2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G40 (Z120) hot-dip galvanized unless otherwise indicated.

- B. Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners.
  - 1. Steel Studs and Runners (or Dimpled Steel Studs and Runners):
    - a. Thickness: 30 Mil (structural); minimum, unless noted otherwise. Use 16 GA studs at lead lined walls.
    - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
  - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- (51-mm-) deep flanges in thickness not less than indicated for studs, installed with studs friction fit into top runner and with continuous bridging located within 12 inches (305 mm) of the top of studs to provide lateral bracing.
  - 2. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
  - 1. Minimum Base-Metal Thickness: As indicated on Drawings.
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch (1.34-mm) minimum base-metal thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
  - 1. Depth: 1-1/2 inches (38 mm).
  - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.068-inch- (1.72-mm-) thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
  - 1. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
  - 2. Depth: 7/8 inch (22.2 mm).
- G. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
  - 1. Configuration: hat shaped.
- H. Cold-Rolled Furring Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
  - 1. Depth: 3/4 inch (19 mm).
  - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch (0.8 mm).
  - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.

## 2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch- (1.59-mm-) diameter wire, or double strand of 0.048-inch- (1.21-mm-) diameter wire.
- B. Hanger Attachments to Concrete:
  - 1. Anchors: Fabricated from corrosion-resistant materials with holes or loops for attaching wire hangers and capable of sustaining, without failure, a load equal



to 5 times that imposed by construction as determined by testing according to ASTM E 488 by an independent testing agency.

- a. Type: Post-installed, expansion anchor.
  2. Powder-Actuated Fasteners: Suitable for application indicated, fabricated from corrosion-resistant materials with clips or other devices for attaching hangers of type indicated, and capable of sustaining, without failure, a load equal to 10 times that imposed by construction as determined by testing according to ASTM E 1190 by an independent testing agency.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch (4.12 mm) in diameter.
- D. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch (1.34 mm) and minimum 1/2-inch- (13-mm-) wide flanges.
1. Depth: 1-1/2 inches (38 mm).
- E. Furring Channels (Furring Members):
1. Cold-Rolled Channels: 0.053-inch (1.34-mm) uncoated-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges, 3/4 inch (19 mm) deep.
  2. Steel Studs and Runners: ASTM C 645.
    - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm), unless noted otherwise.
    - b. Depth: 1-5/8 inches (41 mm) unless noted otherwise.
  3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch (22 mm) deep.
    - a. Minimum Base-Metal Thickness: 0.033 inch (0.84 mm).
  4. Resilient Furring Channels: 1/2-inch- (13-mm-) deep members designed to reduce sound transmission.
    - a. Configuration: hat shaped.
- F. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Armstrong World Industries, Inc.; Drywall Grid Systems.
    - b. Chicago Metallic Corporation; Drywall Grid System.
    - c. USG Corporation; Drywall Suspension System.

## 2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
  - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

### 3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
  - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
  - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
  - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
  - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- C. Install bracing at terminations in assemblies.
- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
  - 1. Single-Layer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
  - 2. Multilayer Application: 16 inches (406 mm) o.c. unless otherwise indicated.
  - 3. Tile Backing Panels: 16 inches (406 mm) o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section (for cripple studs) at head and secure to jamb studs.
    - a. Install two studs at each jamb unless otherwise indicated.
    - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
    - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
  3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
  4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
  5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
  6. Curved Partitions:
    - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (150 mm) o.c.
- E. Direct Furring:
1. Screw to wood framing.
  2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.

### 3.5 INSTALLING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches (1219 mm) o.c.
  2. Carrying Channels (Main Runners): 48 inches (1219 mm) o.c.
  3. Furring Channels (Furring Members): 16 inches (406 mm) o.c.
- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.

- a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
  2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of unistrut or equivalent devices.
  3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
  5. Do not attach hangers to steel roof deck.
  6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
  7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
  8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet (3 mm in 3.6 m) measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

**SECTION 09 22 20 – ACOUSTICAL INSULATION**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Provide materials, fabrications and installation of acoustical insulation and associated accessories.

## 1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Manufacturer's product data and literature describing each type of insulation.

## 1.3 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Insulation shall be certified by the manufacturer to comply with California standards for insulating materials.
  - 2. Insulating materials shall be installed in compliance with Flame Spread Rating and Smoke Density requirements of IBC.
- B. Fire Performance Characteristics: Provide insulation materials whose fire performance characteristics have been determined per the ASTM test method indicated below. Identify products with appropriate markings of applicable testing and inspecting organization.
  - 1. Surface Burning Characteristic: ASTM E84
  - 2. Fire Resistance Ratings: ASTM E119
  - 3. Combustion Characteristics: ASTM E136
- C. Single Source Responsibility for Insulation Products: Obtain each type of building insulation from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver and store packaged materials in original containers bearing identification of manufacturer's name, thermal resistance rating, and fiber materials. Maintain seals unbroken and labels intact until time of use.
- C. Keep materials dry by storing off ground under watertight covers.

## 1.6 PROJECT CONDITIONS

- A. Comply with requirements of Section 013100 – Project Management and Coordination.
- B. Do not install insulation until construction has progressed to a point that inclement weather will not damage or wet insulation.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Acoustical Insulation: Unfaced, friction-fit, flexible sound attenuation batt of fiberglass.
  - 1. Provide thermal resistance rating of R-13 at 3-5/8" thick metal stud walls and R-19 at 6" stud walls.
  - 2. Comply with requirements of ASTM C 665-84, Type I.
  - 3. Manufacturers: Owens-Corning Fiberglass Corp. "Unfaced Fiberglass Insulation," Schuller- "Unfaced Fiberglass Insulation" or Certainteed Products Corp. "Rigid Fit Unfaced Fiberglass Insulation."

### 2.2 ACCESSORIES

- A. Electrical Box Acoustical Sealer: Resilient sealer pads; "Electrical Box Pads" manufactured by 3M, or approved equivalent.
- B. Insulation Support: String wire, staples, nails as required.
- C. Stick Fasteners: Rust-resistant metal fasteners and washers adhesively applied to substrate. Stic-Klip Mfg. Co. "Type A or N" with Speed Washers or Miracle Adhesives Corp. "Stuk-Ups, Prong or Spindle and Washer".
- D. Adhesive for Stick Fasteners: Type as recommended by fastener manufacturer.
- E. Sealing Tape: Type as recommended by the thermal insulation manufacturer.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine areas to receive insulation for conditions that will adversely affect installation and performance.
- B. Do not start work until defects have been corrected.
- C. Coordination: Ensure that all work that will be concealed by the work of this Section, such as electrical and plumbing work, that require inspection, have received all required inspections and been accepted by the inspecting authority.

### 3.2 INSTALLATION OF INSULATION

#### A. General Requirements:

1. 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.
2. Install insulation to fit snugly between framing members and around pipes, conduits, and outlet boxes as necessary to maintain integrity of insulation.
3. Provide means to prevent displacement where required.

#### B. Acoustical Insulation:

1. Fill spaces between studs with acoustical insulation.
2. Cover rear surface of all recessed mechanical and electrical outlet boxes with outlet box acoustical isolation pad.

### 3.3 DEFECTIVE WORK

- A. Remove any wet insulation or material deemed defective by the Architect, and replace with new material.
- B. Restore other work to original condition which was damaged by repair or replacement of defective insulation work.
- C. Remove damaged materials from project.

### 3.4 PROTECTION

- A. General: Protect installed insulation and vapor retarders from damage due to harmful weather exposures, physical abuse, and other causes.
- B. 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 09 29 00 – GYPSUM BOARD**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and Install gypsum board panels and cementitious panels, complete as shown, including finishing materials and accessories.
1. Interior gypsum board walls, ceilings and soffits:
    - a. Fire/smoke-rated assemblies.
    - b. Acoustic assemblies.
    - c. Water-resistant assemblies.
    - d. Impact-resistant gypsum board wall assemblies.
    - e. General wall assemblies, including multi-layer assemblies to facilitate reveals and other decorative features.
    - f. Cementitious backer board for interior tile assemblies.
  2. Interior finishing materials and accessories:
    - a. Tapes, joint treatments, and coating materials to prepare wall surfaces for painting by others.
    - b. Corner beads, reveals, and other trims.
    - c. Neoprene tapes for sealing to work by others.
    - d. Fasteners, adhesives and sealants.
    - e. Special trim and accessories.
  3. Projectile Resistant Backing: ballistic-proof fiberglass backing for Pharmacy wall assemblies and where shown on Drawings.
- B. Work Specified Elsewhere:
1. Section 092216 – Non-Structural Metal Framing.
  4. Section 093000 – Tile.
  5. Section 072400 – Exterior Insulation and Finish System (EIFS).
  6. Section 099123 – Interior Painting.

## 1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.



- B. Provide manufacturers' data describing products and installations.

### 1.3 QUALITY ASSURANCE

- A. Comply with the latest edition of the following standards:
  - 1. American Society for Testing and Materials ASTM C 840, Standard Specification for Application and Finishing of Gypsum Board.
  - 2. Gypsum Association (GA) File Numbers in GA-600 Fire Resistance Design Manual.
- B. Fire rated gypsum board systems shall satisfy minimum fire ratings as noted and shall conform to methods approved by applicable Building Code.
- C. Tolerances of Installed Trims and Accessories:
  - 1. Horizontal Variation from Level: 1/8-inch in 12 feet.
  - 2. Vertical Variation from Plumb: 1/8-inch in 8 feet.

### 1.5 DELIVERY, STORAGE AND HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Deliver materials to the project site with manufacturers' labels intact and legible.
- C. Keep materials dry by storing inside building and fully protect from weather.
- D. Stack gypsum board neatly and flat, with care to avoid damage to edges, ends and surfaces.

### 1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Establish and maintain application and finishing environment in accordance with ASTM C 840.
- B. Provide adequate ventilation to eliminate excessive moisture within building during this work.

## PART 2 - PRODUCTS

### 2.1 MATERIALS - INTERIOR APPLICATIONS

- A. Interior Gypsum Board: Use 5/8-inch-thick, Type 'X' gypsum board throughout, unless otherwise noted.
  - 1. Typical Finish Board, use throughout unless otherwise noted. ASTM C 36, Type X; tapered, or beveled taper edge, 48 inches wide by maximum length to minimize number of joints.

2. Water-Resistant Gypsum Backing Board: Provide USG's Fiberock Brand "Aqua-Tough"; Georgia-Pacific (GP) "DensShield Tile Guard"; Glass-Mat, Water-Resistant Backing Board through core gypsum board panels per ASTM C 1178, Type FRX-G; tapered, or beveled taper edge, 48 inches wide by maximum length to minimize number of joints.
  - a. Locations: Use at high humidity/moisture locations, including HSKP rooms, Kitchen and Served areas.
3. High Abuse, Impact Resistant Board: Provide National Gypsum Hi-Abuse Kal-Kore, USG's Fiberock Brand "Aqua-Tough". 5/8-inch-thick, ASTM C1278, Type X; fiber reinforced gypsum panels; tapered, or beveled taper edge, 48 inches wide by maximum length to minimize number of joints.
  - a. Gypsum core wall panel with additives to enhance surface indentation resistance, and impact resistance of the core and surface with abrasion-resistant paper on front and long edges with heavy liner paper bonded to the back side and conforming to ASTM C36.
  - b. Impact Resistance: No failure after 100 impacts when tested in accordance with ASTM E695, modified.
  - c. Indentation Resistance: Not less than the following loads to produce the indicated depth of the surface indentation when tested in accordance with ASTM D1037, modified:
    - 1) 0.100-inch at 260 pounds.
    - 2) 0.200-inch at 524 pounds.
  - d. Locations: Typical all corridors from finished floor to 48 inches above finished floor.
4. 1/4-inch Flexible Type: Provide board manufactured to bend to fit tighter radii than specified regular-type gypsum board.
  - a. Provide only at non-rated curved layouts that exceed maximum allowable bending radii of specified standard thickness gypsum board.
  - b. Thickness: 1/4 inch. Provide minimum 2 layer application with staggered joints.
  - c. Long Edges: Tapered.
5. Early-install/Concealed locations (Contractor Option): Provide Georgia Pacific DensGlass Ultra Shaft and DensAmor Plus in conformance with ASTM D 3273; products inherently mold and mildew resistant for use in shaftwalls, concealed locations above finished ceilings, internal layers of multi-layer assemblies and other locations approved by Architect to allow installation before the building enclosure is 100-percent complete.

- a. Use at Shaft-side of shaft assemblies and any location where early install is required prior to closing in of the building.
- B. Cementitious Backer Board: Per ANSI A108.1; Provide Custom Building Product's "Wonderboard"; USG's "Durock Cement Board". Panels of high-density portland cement surface coating on both faces of lightweight portland cement and expanded ceramic aggregate core, nominal 5/8-inch-thick and 3.2 to 3.8 pounds per square foot.
1. General: Provide as shown on Drawings for tile assemblies specified in Section 093000 – Tile. (Typical at all toilets/restrooms) At fire-rated wall assemblies and inside faces of exterior walls, apply over gypsum board base layer.
- C. Acoustically enhanced Gypsum Wallboard Composite:
- a. Two-ply high density, mold resistant, paper faced gypsum wallboard laminated together with viscoelastic dampening polymer.
  - b. Composite Thickness 5/8 inches
  - c. Fire-resistance, Type X gypsum core
  - d. Base Product: Quite Rock ES by PABCO Gypsum OR Sound Break XP by National Gypsum Company
- D. Interior Joint Finishing Materials:
1. General: Comply with ASTM C 475/C 475M.
  2. Joint Tape:
    - a. Interior Gypsum Wallboard: Paper.
    - b. Tile Backing Panels: As recommended by panel manufacturer.
  3. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
    - a. Prefilling: At open joints, beveled panel edges, and damaged surface areas, use setting-type taping compound.
    - b. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping or drying-type, all-purpose compound as recommended by the manufacturer to obtain best results from actual project conditions.
      - 1) Use setting-type compound for installing paper-faced metal trim accessories.
    - c. Fill Coat: For second coat, use drying-type, all-purpose compound.
    - d. Finish Coat: For third coat, use drying-type, all-purpose compound.

- e. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
4. Joint Compound for Tile Backing Panels:
- a. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.
  - b. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
  - c. Cementitious Backer Units: As recommended by backer unit manufacturer.
- E. Fasteners:
- 1. Screws: ASTM C 954 or ASTM C 1002 self-drilling and self-tapping steel screws with double-lead thread design as approved by system manufacturer for standard and heavier gauge load bearing steel framing.
  - 2. Nails: ASTM C 514, annular ring type as approved by system manufacturer.
  - 3. Staples: Galvanized, as recommended to approved accessory manufacturer.
- F. Metal Backing: Refer to Section 092216 – Non-Structural Metal Framing.
- G. Metal Accessories: ASTM C 1047 Electro-galvanized steel corner beads and trim (casing beads) formed for application of joint cement and manufactured specifically for gypsum board construction, minimum base steel 0.014 inch thick.
- H. Special Trims and Accessories:
- 1. General: Provide extruded aluminum trims and accessories in conforming to profiles and shapes as shown on Drawings and as specified.
    - a. Provide double-layer gypsum board assemblies at locations shown on Drawings to receive recessed reveal trims.
    - b. Material: Extruded aluminum alloy 6063 T5.
    - c. Manufacturer: Provide products manufactured by Gordon, Fry Reglet Company, Flannery Company, or equal.
    - a. Accessories: For each trim profile noted below, provide factory fabricated where required by layouts shown on Drawings, including:
      - 1) Mitered assemblies for "T-intersections" and "X-intersections".

- 2) Finished end caps.
2. Partition "End Cap" Trims: Provide for providing finished ends to gypsum board walls including chemical conversion coating. Typical where gypsum board walls butt mullions of window or window wall assemblies, allowing attachment of partition cap to mullion prior to construction of gypsum board wall.
  - a. Overall Width: Provide width matched to partition assembly, including:
    - 1) 4-inch stud walls with 5/8-inch gypsum board each side.
    - 2) 6-inch stud walls with 5/8-inch gypsum board each side.
  - b. Tape/screw Flanges: Nominal 7/8-inch.
  - c. Manufacturer: Provide "910 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
3. Reveal "Top Track" Trim: Provide for top of wall or partial height partition top cap termination where shown on Drawings.
  - a. Reveal Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
  - b. Reveal Width: As shown on Drawings.
  - c. Overall Width: Provide width matched to partition assembly, including:
    - 1) 4-inch stud walls with 5/8-inch gypsum board each side.
    - 2) 6-inch stud walls with 5/8-inch gypsum board each side.
  - d. Tape/screw Flanges: Nominal 7/8-inch.
  - e. Manufacturer: Provide "922 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
4. Reveal "Field" Trims: Provide for creating square-edged vertical and horizontal reveal lines in gypsum board wall assemblies where shown on Drawings.
  - a. Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
  - b. Reveal Width: As shown on Drawings.
  - c. Tape/crew Flanges: Nominal 7/8-inch.
  - d. Manufacturer: Provide "500 Series" double-sided Final Forms

reveals by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.

5. Reveal "Edge" Trim: Provide for finished vertical and horizontal reveal edges at top and sides of gypsum board panels where shown on Drawings.
  - a. Reveal Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
  - b. Reveal Width: As shown on Drawings.
  - c. Tape/screw Flanges: Nominal 7/8-inch.
    - d. Manufacturer: Provide "200 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
6. Reveal "Base" Trim: Provide for recessed base at bottom of gypsum board panels at floor where shown on Drawings.
  - a. Reveal Depth: Nominal 5/8-inch for use with 5/8-inch gypsum board panels.
  - b. Reveal Width: 4-inches.
  - c. Tape/screw Flanges: Nominal 7/8-inch.
    - d. Manufacturer: Provide "800 Series" Final Forms by Gordon or equivalent products manufactured by Fry Reglet Company, Flannery Company, or equal.
7. Special Fabrications: Provide factory fabricated mitered assemblies for "T-intersections" and "X-intersections" where shown on Drawings.
8. Finish: Special trims to be primed and painted to match adjacent wall surfaces as specified in Section 099123 – Interior Painting.
  - I. Adhesive for Laminating Board: As recommended by approved board manufacturer.
  - J. Acoustical Sealant: As specified in Section 079200 – Joint Sealants.
  - K. Electrical Box Sealer:
    - a. Non-rated Locations: As specified in Section 079200 – Joint Sealants.
    - b. Fire-rated Locations: As specified in Section 078413 – Penetration Firestopping.
  - L. Concealed, Non-Rated Access Panels: As specified in Section 08310 – Access Panels.

### PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Inspect areas and surfaces scheduled to receive gypsum board and verify that:
  - 1. Support systems are in proper alignment, straight and true.
  - 2. Required blocking, bracing and backing members of support systems are installed.
- B. Do not start work until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. Coordinate details with other work supporting, adjoining, or fastening to gypsum board.

### 3.4 INSTALLATION - INTERIOR GYPSUM BOARD

- A. General Requirements:
  - 1. Apply and finish gypsum board in accordance with requirements of ASTM C 840 unless otherwise noted.
  - 2. Cut gypsum board by scoring and breaking or sawing from face side. Smooth all cut edges and ends of gypsum board where necessary, in order to obtain neat jointing.
  - 3. Scribe ceiling board neatly in casing bead where it meets surfaces in other planes.
  - 4. Apply first to the ceiling at right angles to framing members, then to walls. Use boards of maximum practical length so that a minimum number of end joints occur.
  - 5. Apply in either vertical or horizontal direction with ends and edges falling on framing members or other solid backing except where edge joints are at right angles to support. Bring ends and edges into contact with adjoining board, but do not force into place.
  - 6. Lay out joints at openings so that no end joint aligns with edges of opening unless control joints will be installed at these points.
    - a. All joints running parallel to framing shall be centered as near as possible on face of framing member.
    - b. Stagger end joints and arrange joints on opposite sides of partition to occur on different studs.
    - c. At external corners, butt and fit board to provide solid edge.
  - 7. Hold gypsum board nominal 1/4-inch above floor or curb typical.
  - 8. Where gypsum board is carried full height to structure above, provide

for deflection of structure by undercutting board nominal 3/8 inch and seal top edge of board to structure in continuous bead to form elastic closure.

9. Cut board to fit electrical outlets, pipes, or other items as required.
    - a. Cut gypsum board by scoring on face and back in outline before removal or by cutting with a saw or other suitable tool.
    - b. Smooth all cut out where necessary.
  10. After trim is applied and prior to decoration, correct surface damage and defects.
  11. Provide gypsum backer board gusset at double stud walls where studs are less than 3-5/8 inches thick.
  12. Fastening:
    - a. Attach board from center to edges and ends, pressing firmly against supports. Place fasteners approximately not more than 1 inch nor less than 3/8 inch from edges with heads just below gypsum board surfaces; but do not break paper.
    - b. Walls: Space screws maximum 12 inches on center for ceilings and maximum 16 inches on center for walls in field and along abutting edges.
    - c. Suspended Ceilings: Space screws maximum 12 inches on center in field and along abutting edges.
- B. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
  2. 1/4-inch Board Application: For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.
    - a. Continue double layer 1/4-inch board application to closest adjacent inside or outside corners. Do not "shim" double board to align with adjacent 5/8 thick gypsum board.
  3. Fire-rated Assemblies: Provide in strict conformance with referenced UL-listed assembly. Use on standard thickness type "X" board bent per manufacturer's written instructions.
- C. Joint Treatment:
1. Apply tape and cement to joints and corners in strict accordance with directions of gypsum board manufacturer.



2. Pre-fill V-grooves formed by the abutting beveled or rounded wrapped edges with joint compound as per manufacturing recommendations.
  3. Use tape and cement, allow to dry between coats. Use number of coats required by level of finish specified.
  4. Work final coat to smooth level plane surface.
    5. Protect external corners with metal corner beads unless otherwise noted.
    6. Treat fastening head dimples same as joints; tape may be omitted.
    7. Joints and fastening head dimples in backer board need only be treated as required to preserve fire rating.
    8. Seal joints shown on Drawings and where gypsum board meets dissimilar material with specified sealant. Tool to neat surface, ready for paint; remove excess material.
- D. Fire-Rated Conditions:
1. At penetrations of rated assemblies, preserve continuity of fire rating with firestopping systems as specified in Section 07840 – Firestopping and Smoke Seals.
  2. Where adjacent interior spaces have suspended ceilings of different heights, extend separating partition finish on both faces of studs to at least 3 inches above higher ceiling finish.
  3. Conform to applicable codes and authorities for requirements of taping and cementing joints and fastener heads.
- E. Sound Retardant Partitions:
1. Construct partitions in accordance with Drawings and as herein specified.
  2. Hold face layers and base layers 1/4 inch clear from abutting surfaces, floors, walls and overhead structure. Seal with specified sealant and tape. Tape not required at floors.
  3. Provide airtight closures at wall penetrations (outlet boxes, pipes, duct work and other items) by neatly cutting gypsum board to clear penetrations. Seal void with specified sealant and apply joint tape to both gypsum board and penetrating object.
  4. Seal airtight the backs and sides of electrical junction boxes with resilient sealer pads.
- F. Furring over Recessed Light Fixtures: At non-rated lighting fixtures, construct furring from gypsum board as indicated on Drawings.

- G. Water-Resistant Board: During board application, coat all cut edges with approved water resistant adhesive as recommended by manufacturer for the application.
- H. Enclosure System: Install in strict accordance with requirements of approved manufacturer's system using metal components, gypsum components, and other accessories as required.
- I. Cementitious Backer Board:
  - 1. General: Install cementitious backer board in strict conformance with the requirements of the tile assemblies specified in Section 093000 – Tile.
  - 2. Provide support systems so that all edges of cementitious backer boards are supported.
  - 3. Use only corrosion-resistant fasteners.

### 3.5 FINISHING INTERIOR GYPSUM BOARD ASSEMBLIES

- A. Levels of Gypsum Board Finish: Provide the following levels of gypsum board finish per USG "Gypsum Construction Handbook, Centennial Edition".
  - 1. Level 1: for ceiling plenum areas, concealed areas, and where indicated, unless a higher level of finish is required for fire-resistive-rated assemblies and sound-rated assemblies.
  - 2. Level 2: where water-resistant gypsum backing board panels form substrates for tile, and where indicated.
  - 3. Level 3: Not used.
  - 4. **Level 4: Typical, for all gypsum board surfaces unless otherwise indicated.**
  - 5. Level 5: Not used.
- B. Level 4 gypsum board finish: Embed tape in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads, and accessories. Touch up and sand between coats and after last coat as needed to produce a surface free of visual defects and ready for decoration. Use the following joint compound combination:
  - 1. Embedding and First Coat: Ready-mixed, drying-type, all-purpose or taping compound.
  - 2. Fill (Second) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
  - 3. Finish (Third) Coat: Ready-mixed, drying-type, all-purpose or topping compound.
- C. Where Level 5 gypsum board finish is indicated: apply joint compound combination specified for Level 4 plus a thin, uniform skim coat of joint compound over entire surface.

1. Use joint compound specified for the finish (third coat) or a product specially formulated for this purpose and acceptable to gypsum board manufacturer.
  2. Produce surfaces free of tool marks and ridges ready for decoration of type indicated.
- D. Where Level 2 gypsum board finish is indicated, apply joint specified for first coat in addition to embedding coat.
- E. Where Level 1 gypsum board finish is indicated, apply joint compound specified for embedding coat.
- F. Finish water-resistant gypsum backing board forming base for mortar-set ceramic tile to comply with ASTM C 840 and board manufacturer's directions for treatment of joints behind tile.
- G. Impact-Resistant Gypsum Board:
1. Construct partitions in accordance with Drawings and as herein specified.
  2. General: Install to a height of no less than 4 feet above finish floor at locations shown on Drawings.

### 3.6 PARTITION IDENTIFICATION

- A. Identify partitions indicated on drawings as having a required fire or smoke rating.
1. Follow guidelines set in Chapter 7 of International Building Code or as locally amended.
  2. Permanently identify with stenciling
    - a. Minimum 6 inches high letters with minimum ½ inch stroke.
    - b. Bottom of lettering to start at 6 inches above ceiling.
    - c. Stenciling to be 10 feet on center max.
    - d. Color : Red for 1-hr rated walls, Blue for 2-hr rated walls, Green for smoke partition walls.
    - e. Provide in a manner acceptable to authority having jurisdiction.

### 3.7 CLEANING AND PROTECTION

- A. Remedy any fastener popping or ridging.
- B. Promptly remove any residual joint compound from adjacent surfaces.
- C. Provide final protection and maintain conditions, in a manner suitable to Installer, that ensures gypsum board assemblies remain without damage or deterioration at time of Substantial Completion.

END OF SECTION

**SECTION 09 51 13 – ACOUSTICAL PANEL CEILINGS**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and install acoustical ceilings panels and accessories, complete, as shown and specified, including:
  - 1. Mineral core acoustical ceiling panels.
- B. Work Specified Elsewhere:
  - 1. Section 092216 – Non-Structural Metal Framing.
  - 2. Section 122200 – Curtains and Drapes.
  - 3. Division 23 – Mechanical (Air Supply, Ducts, and Connections).
  - 4. Division 26 – Electrical (Lighting Fixture Attachments).

## 1.2 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM):
  - 1. C635; Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
  - 2. C636; Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.
- B. Ceiling and Interior System Contractors Association (CISCA):
  - 1. Ceiling Systems Handbook.

## 1.3 SYSTEM DESCRIPTION

- A. Performance Criteria:
  - 1. Fire-Hazard Classification: Provide acoustical ceilings that are identical to those tested for following fire hazard characteristics, per ASTM test method indicated below, by UL or other testing and inspecting organizations acceptable to authorities have jurisdiction. Identify acoustical ceiling components with appropriate markings of applicable testing and inspecting organization.
    - a. Test Method: ASTM E84.
    - b. Flame Spread: 25 or less.
    - c. Smoke Developed: 50 or less.

## 1.4 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Product Data: Manufacturer's specifications, data, and installation instructions.
- C. Shop Drawings:
  - 1. Coordination Drawings: Reflected ceiling plans drawn accurately to scale and coordinating penetrations and ceiling-mounted items. Show following:
    - a. Ceiling suspension members.
    - b. Method of attaching hangers to building structure.
    - c. Ceiling-mounted items including light fixtures; air outlets and inlets; speakers; sprinkler heads; and special moldings at walls, column penetrations, and other junctures with adjoining construction.
- D. Samples:
  - 1. For Initial Selection: Manufacturer's standard sample sets consisting of actual acoustical units or sections of units showing full range of colors, textures, and patterns available for each type of unit indicated.
  - 2. For Verification: 12-inch-square sample of each type of exposed finish specified or selected and of same thickness and material indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
- E. Qualification Data: For firms and persons specified in Quality Assurance article to demonstrate their capabilities and experience. Include list of completed projects with project names, addresses, names of Architects and Owners, and other information specified.
- F. Research Reports: Or evaluation reports of model code organization acceptable to authorities having jurisdiction that show compliance of acoustical ceiling system and components with building code in effect for Project.
- G. Product Test Reports: From qualified independent testing agencies that are based on its testing or current products for compliance of acoustical ceiling systems and components with requirements.

#### 1.5 QUALITY ASSURANCE

- A. Qualifications of Installer: Engage experienced Installer who has successfully completed acoustical ceilings similar in material, design, and extent to those indicated for Project.
- B. Single-Source Responsibility: Obtain each type of acoustical ceiling unit from single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of Work.

- C. Coordination of Work: Coordinate layout and installation of acoustical ceiling units and suspension system components with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system components (if any), and partition system (if any).

#### 1.7 PRODUCT HANDLING

- A. Delivery and Storage: Deliver acoustical ceiling units to Project site in original, unopened packages and store them in fully enclosed space protected against damage from moisture, direct sunlight, surface contamination, and other causes.
- B. Handling: Handle acoustical ceiling units carefully to avoid chipping edges or damaging units in any way.

#### 1.8 PROJECT CONDITIONS

- A. Storage: Before installing acoustical ceiling units, permit them to reach room temperature and stabilized moisture content.
- B. Space Enclosure: Do not install acoustical ceilings until space is enclosed and weatherproof, wet-work in space is completed and nominally dry, work above ceilings is complete, and ambient conditions of temperature and humidity will be continuously maintained at values near those expected for final occupancy.

### PART 2 - PRODUCTS

#### 2.1 MINERAL CORE ACOUSTICAL PANELS

- A. Manufacturer: Provide products manufactured by CertainTeed; USG; or Armstrong.
  - 1. Basis-of-Design: **"USG MARS CLIMAPLUS HEALTHCARE (Item # 86684)"**. (Field verify to match with adjacent existing ceiling tiles).
- B. Mineral Core Acoustical Panel Types:
  - 1. Type 1:
    - a. General: USG MARS CLIMAPLUS HEALTHCARE (Item # 86684)
    - b. Size: 24 inches by 24 inches by 3/4-inch-thick.
    - c. Edge Detail: Shadowline Tapered (SLT)
    - d. Noise Reduction Coefficient: UL Classified NRC of 0.70 in compliance with ASTM C423.
    - e. Sound Transmission Class: UL Classified CAC minimum of 35 in compliance with ASTM E1414 or ASTM E413.
    - f. Light reflectance: 0.89
    - g. Provide manufacturer's coordinated field and border units, as required by layouts shown on Drawings.

- h. Specified grid system: DONN DX/DXL heavy duty 15/16 Tee System

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Examine substrates and structural framing to which ceiling system attached or abuts, with Installer present, for compliance with requirements specified in this and other sections that affect installation and anchorage of ceiling system. Do not proceed with installation until unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. General: Install acoustical ceiling systems per Reference Standards and manufacturer's instructions.
- B. Acoustical Ceiling Tiles:
  - 1. General: Make joints straight and true to line with exposed surfaces flush and level. Tightly butt tiles with corners and arises full and without broken edges.
  - 2. Suspended System:
    - a. Concealed Grid: Install tile with concealed metal splines in kerfed edges between tiles to form concealed mechanical joints.
    - b. Edge Units: Install spring steel spacers where supported on edge trim.
    - c. Access Tile: Install units by concealed saddle and notched hook spline method.
    - d. Identification Markers: Install one per access tile; locate on tile as directed.

#### 3.3 CLEANING

- A. Cleaning: Clean exposed surfaces of acoustical ceiling panels. Comply with manufacturer's instructions for cleaning and touch-up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION

**SECTION 09 65 19 – RESILIENT FLOORING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and install resilient flooring, resilient base and accessories, complete as shown on Drawings and as specified, including:
1. Homogeneous sheet vinyl, heat welded including integral coved base.
  2. Resilient Base.
  3. Edge Strips, Reducer Strips and other floor-edge transitions.
  5. Cap trim, cove-shaped furring, and accessories for cove base installations.
  6. Hot Weld Strips and cold seam materials.
  7. Adhesives and other accessory materials as required to provide complete floor assemblies as specified.
- B. Work Specified Elsewhere:
1. Section 035300 – Concrete Toppings.
  2. Section 087100 – Door Hardware.
  3. Section 093000 – Tile.

## 1.2 REFERENCE STANDARDS

- A. Resilient Floor Covering Institute (RFCI).
- B. American Society for Testing and Materials (ASTM):
1. ASTM E-1907-98: "Standard Practices for Determining Moisture-Related Acceptability of Concrete Floors to Receive Moisture-Sensitive Finishes".
  2. ASTM F-1869-89: "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride".



### 1.3 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. General: Schedule submittals as required to provide a minimum of 60-days from flooring materials order day to start of installation.
- C. Shop Drawings: Provide seaming diagrams for public spaces including corridors.
- D. Samples:
  - 1. Edge, Reducer and Transition Strips: Each specified type and color, 12 inches long.
  - 2. Resilient Tile Flooring: 2 samples, each type and color specified, 12 inches square.
  - 3. Resilient Sheet Flooring: 2 samples, each type and color specified, 12 inches square.
  - 4. Resilient Base: 2 samples each type and color, 12 inches long. None required for black color.
- E. Product Data: Manufacturer's specifications, data, and installation instructions.
- F. Qualifications: Submit Contractor's and Installer's project lists and specified manufacturer certifications, including project names and addresses and contact names and telephone numbers.
- G. Maintenance Manuals: Manufacturer's written maintenance instructions.

### 1.4 QUALITY ASSURANCE

- A. Qualifications of Installer: Minimum of three project installations of extent comparable to proposed Project.
- B. Regulatory Requirement: Materials shall have the following flammability ratings, according to NFPA 253:
  - 1. Smoke Density: 45 or less.
  - 2. Critical Radiant Flux: Class I - Minimum 0.45 watts per square centimeter. (Class II - Minimum 0.22 watts per square centimeter.)

- C. Slip Resistance: Static coefficient of friction for installed flooring shall be equal to or greater than .06 when measured with a James Machine per ASTM D2047.

#### 1.5 PRODUCT HANDLING

- A. Comply with requirements of Section 016000 – Product Requirements.
- B. Delivery: Deliver materials to Project site in manufacturer's unopened containers clearly marked with manufacturer's name, brand, size, thickness, grade, color, graining, and design.
- C. Storage: Store materials per manufacturer's recommendations and at not less than 70 degrees F for at least 24 hours before installation.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Requirements: Maintain temperature in spaces to receive resilient flooring at 70 degrees F minimum at least 48 hours before, during, after installation; thereafter, maintain a 55 degrees F minimum.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. Basis-of-Design: Tile Products as scheduled on the Drawings provide a "Basis-of-Design" for each scheduled Resilient Flooring Product and have been selected and approved for use by the Owner based manufacturer's samples provided to the Architect, and have been fully coordinated with finish materials specified elsewhere.
- B. Resilient Flooring substitution requests will only be considered for acceptance by the Architect when the following conditions are met:
  - 1. Proposed substitution Resilient Flooring meets or exceeds the specified material, construction and performance criteria.
  - 2. Proposed Resilient Flooring substitution visually matches scheduled types for thickness, textures, patterns, color, and reflectance and other surface characteristics as determined by the Architect.
  - 3. Acceptance of a proposed substitution Resilient Flooring by the Architect shall incur no additional cost to the Owner, including costs incurred to re-select adjacent finishes specified elsewhere as required to coordinate and match substituted Resilient Flooring for color, texture or pattern.

## 2.2 RESILIENT BASE AND ACCESSORIES

- A. Manufacturer: Provide products manufactured by Roppe.
- B. Adhesive for Resilient Bases: Waterproof type recommended in writing or supplied directly by base manufacturer.
- C. Resilient Base Materials: Thermoplastic Rubber, Type TP- Premium Edge wall base. Finish: Smooth Matte Finish. Corners- Factory pre-formed. Thickness- 1/8"; 4-foot minimum length.
  - 1. Provide colors as scheduled on Drawings and specified and as required to match Architect's samples.
  - 2. Provide manufacturer's standard black at casework bases.
- D. Resilient Base Types:
  - 1. Rubber Wall Base by Roppe
    - a. Color: As scheduled on Drawings.
    - b. Height: 4-inches.
    - c. Seal rubber base to resilient flooring with continuous clear silicon sealant.
- E. Locations: Provide resilient base at locations shown or scheduled on Drawings, including:
  - 1. Exposed, Sealed and Painted Concrete floors.
  - 2. Floors finished with materials specified in this Section.
  - 3. Plywood.

## 2.4 HOMOGENEOUS SHEET VINYL FLOORING

- A. General: Provide PVC-Free Resilient Sheet Flooring in conformance with ASTM F-1303, Type I, Grade 1, Class B Backing, for types, compositions, and other characteristics indicated.
  - 1. Manufacturer: Match existing.
  - 2. Homogeneous Vinyl Flooring Types:
    - a. As scheduled on Drawings.

## B. Performance Requirements:

1. Fire Resistance: 450 or less when tested per ASTM E-662/NFPA 258 (Smoke Density), 0.45-watts/cm<sup>2</sup> or better (Class 1 or better) when tested per ASTM E-648/NFPA 253 (Critical Radiant Flux).
2. Static Load Limit: 750-pounds per square inch or better when tested per ASTM F-970.
3. Slip Resistance: equal or exceed specified requirements.

## C. Homogeneous Sheet Vinyl Flooring Accessories:

1. Adhesive: Provide Solvent-free Adhesives recommended by each Homogeneous Sheet Vinyl Flooring Manufacture in writing for use with each type of specified Homogeneous Sheet Vinyl Flooring and for the actual conditions at the project area.
  - a. Adhesive Trowel: Use appropriate trowel tooth patterns as recommended by the Adhesive Manufacturer in writing for use with the specified Homogeneous Sheet Vinyl Flooring types.
2. Sub-Floor Primer and Sealer: Provide sub-floor Sealers or Primers where recommended by the Resilient Sheet Flooring Manufacturer(s) in writing where required by the Sub-Floor conditions at the project area at the project area noted during verification of conditions.
3. Welding Rods: For Homogeneous Sheet Vinyl Flooring shown on Drawings or scheduled to receive heat-welded seams, provide 4-mm welding rod as recommended in writing by the manufacturer of each specified type of Flooring. Provide single-sourcing of welding rods and sheet vinyl flooring for each specified type of Resilient Sheet Flooring.
  - a. Colors: Provide welding rods to match Architect's samples or as selected by Architect from manufacturer's full range of colors.
4. Homogeneous Sheet Vinyl Flooring Initial Cleaning: Typical at all locations, follow Resilient Sheet Flooring manufacturer's written instructions recommending process and product for each specified type.
  - a. Finish Sheen: to be Matte.

## 2.6 MATERIALS FOR COVERED BASE AT RESILIENT FLOORS

- A. General: Provide materials as required to install cove base at locations shown or scheduled on Drawings. Not all specified resilient sheet flooring types may require cove base; some resilient flooring types may be scheduled to receive several base treatments, including cove base. Cove base shall be fully adhered to the wall not sticky taped.
- B. Materials:
1. Fillet Cove Strips: Provide redwood cove strips as recommended by each specified resilient sheet flooring manufacturer in writing to coordinate with each specified resilient sheet flooring type.
  2. Outside Corner for Resilient Sheet Cove Base: Provide the each specified manufacturer's outside pre-molded corner to match each specified resilient sheet flooring type. Provide types and color(s) as scheduled on Drawings and as specified.
  3. Cap Strip: Extruded aluminum, clear anodized. Single-source one cap strip type and finish for use through-out entire scope of project. Provide cap strips in the longest length practical to minimize butt joints.

## 2.7 REDUCER STRIPS, EDGE STRIPS AND TRANSITIONS

- A. Manufacturer: Where Manufacturer's standard products are scheduled on Drawings and specified, provide the specific products indicated or materials complying with the requirements set forth in this Section.
- B. Adhesive for reducer, edge and transition strips: Waterproof type recommended in writing or supplied directly by base manufacturer.
- C. Locations: Provide reducer, edge and transition strips at locations where different floor finishes meet, as required to protect the transition joint and/or provide a gentle transition between floor finishes of differing thicknesses, including:
1. Exposed, Sealed and Painted Concrete floors: to any other floor finish.
  2. Section 093000 – Tile: to any floor finish specified in this Section and Section 096813 – Tile Carpeting.
  3. Floor finishes specified in this Section:
    - a. All locations between two different floor finish materials specified in this Section.

- b. Between two different floor finish colors of the same material specified in this Section when shown or scheduled on Drawings.
  - c. Between floor finishes specified in this Section and at transitions to carpet specified in Section 096813 – Tile Carpeting.
- D. Manufacturer: Provide reducer, edge and transition strips by Johnsonite, Mercer, or equal.
- 1. Provide reducer, edge and transition strips at all level differences in flooring. Center on door frame where possible.
    - a. Colors: As selected by the Architect from the manufacturer's full range of standard colors.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Examine substrates and adjoining construction and conditions under which Work will be installed. Give written notification of deficiencies detrimental to proper or timely installation; do not proceed until corrected.
- B. Slab Moisture Test:
- 1. General: Test substrates to determine acceptable dryness prior to application of resilient flooring. Use ASTM F-1869-89, "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride", as applicable for the specified flooring as recommended by resilient flooring manufacturer.
  - 2. Slab-Moisture Content Testing: Perform tests at locations not more than 50 feet apart in every direction, but no less than one test per 1000-square feet. Verify the following performance criteria are equaled or exceeded before beginning floor installation:
    - a. Vapor and moisture barrier shall reduce vapor transmissions from concrete slabs-on-grade and above-grade concrete and metal deck assemblies to 3 pounds or less per 1000-square feet in a 24-hour period when tested per ASTM F-1869-89.
    - b. Alkalinity: Maximum pH of 10.

3. Contingency for High Moisture Readings: Report all unacceptable test results to Architect.
- C. Air-Moisture Content Testing:
1. General: Determine relative humidity of air in rooms to receive resilient flooring, using wet-bulb and dry-bulb sling psychrometer. Do not install resilient flooring when relative humidity exceeds 45 percent.
- D. Adhesion Test:
1. Secure one, three-foot-square piece of each specified type of resilient sheet or 3-foot by 3-foot area of each specified type of tile in each typical area that has passed the specified moisture test, using adhesive(s) as specified and recommended by manufacturer(s).
  2. The test pieces shall remain in place for 72 hours.
  3. Determine if the adhesive is bonding the material satisfactorily to the surface. Resilient flooring should not be able to be removed without severe deformation, tearing, or destruction of the sample(s).
  4. Where there is evidence of unsatisfactory bonding, manufacturer's representative is to be notified in order that they may verify and evaluate the conditions.
  5. Notify Architect immediately if, in the opinion of manufacturer's representative, the adhesion test results are unsatisfactory.
  6. Remove successful test pieces and adhesive prior to commencing final installation.

### 3.2 PREPARATION

- A. Surface Preparation: Clean substrate of deleterious materials which impair bonding of resilient flooring. Do Work on smooth, even troweled finish. Remove rough areas and protrusions from concrete by grinding. Fill cracks, rough areas, and other surface defects with an acceptable plastic filler.
- B. Primer/Sealer Coat: Apply primer to concrete surfaces; work well into surfaces; use minimum quantity that will assure complete surface coverage with a non-absorptive base. Allow primer to thoroughly dry before applying adhesive.

1. Prime coat may be omitted if recommended by resilient flooring manufacturer in writing based on review of the project area. Review the requirements for each specified type of resilient flooring for each project area.
2. Do not combine different specified flooring types under one manufacturer's recommendation.

### 3.3 INSTALLATION

#### A. Edge Strips:

1. General: Install in continuous lengths at door openings and other exposed edges of resilient flooring, unless otherwise shown. Install edge strips before applying primer.
2. Metal: Anchor strips solidly to substrate with countersunk non-magnetic stainless steel screws; use lead shields for anchoring into concrete; space screws 1-inch from each end and not more than 9-inch centers at intermediate points.
3. Vinyl: Set in and securely bond to substrates with adhesive per manufacturer's recommendations.

#### B. Prime Coat: Apply primer to concrete surfaces; work well into surfaces; use minimum quantity that will assure complete surface coverage with a non-absorptive base.

- a. Allow primer to thoroughly dry before applying adhesive.
- b. Prime coat may be omitted if recommended by resilient flooring manufacturer.

#### C. Adhesive: Apply to substrate with properly notched steel trowels; allow adhesive to become tacky before applying resilient flooring.

#### D. Resilient Flooring: Extend flooring, and fit neatly and tightly, into breaks and recesses, against bases, around pipes and penetrations, around permanent casework, equipment, and under-casework recesses.

#### E. Sheet Material:

1. General: Lay sheet material with minimum number of joints with bottom surface securely bonded to substrate and top surface left smooth, clean, and free from imperfections.
  - a. Make joints straight, tight, and inconspicuous.



- b. Roll each sheet from center to edges to assure complete bond and tight joints.
  2. Joints: Provide Chemically Weld; Adhesive Weld; Heat Weld as scheduled on Drawings and in conformance with sheet flooring manufacturer's written instructions.
  3. Coved Bases:
    - a. Install a continuous redwood cove strip at intersection of floor and vertical surfaces prior to laying sheet material.
    - b. Use cove strip with a 3/4-inch radius; make bases 4 inches high, unless otherwise shown; butt ends; miter corner; secure with acceptable type fasteners.
    - c. Apply cove strips and sheet material to solid backing.
    - d. Roll sheet material into adhesive; hold in place until complete adhesion is assured.
    - e. Make top of base level and straight; terminate top edge into a metal trim cap.
    - f. Securely screw trim cap to backing before applying sheet material; use single lengths where possible; make neat mitered corners and butted ends.
    - g. Use standard aluminum alloy or stainless steel trim cap of standard design as selected, unless otherwise shown.
  4. Perimeter Bond System: At Contractor's option, a perimeter bond system may be used for installation of sheet vinyl flooring.
    - a. Do work with manufacturer's approved and trained applicators per manufacturer's recommendations and supervision.
    - b. Install sheet vinyl flooring with adhesive spread only at seam lines, projections, and wall lines.
    - c. Cut seams with an electrically operated cutting machine made for purpose.
- F. Resilient Bases:
  1. General: Where base is scheduled, install around perimeter of room or space, at base of partitions, walls, columns, pilasters, casework, and other permanent fixtures.

- a. Install top-set coved type bases throughout, except install straight type bases at carpet.
  - b. Secure bases to surfaces with waterproof adhesive; make joints tight; keep top and bottom edges in firm contact with adjacent surfaces.
    - 1) Provide a continuous seal of the resilient base to both the wall surface at the upper edge and the floor surface at the bottom edge.
  - c. Use longest lengths possible; straight pieces less than 24 inches long not permitted.
  - d. Miter or cope inside corners.
2. Coved Type: Provide with premolded end stops and premolded one-piece external corners.
  3. Straight Type: Provide with preformed one-piece external corners.
  4. Edges and Seams: Match edges at seams. Double cut adjoining lengths. Make tight butt joints.

### 3.4 CLEANING

- A. General: Not more than four days before Substantial Completion, thoroughly clean work per resilient flooring manufacturer's recommendations. Use of solvents, wet mopping, or washing is prohibited.
- B. Defective and Damaged Work: Replace with acceptable Work at no additional cost to Owner.

### 3.5 PROTECTION

- A. General: Protect Work from traffic during construction period so Work will be without indication of use or damage at time of Substantial Completion.

END OF SECTION

**SECTION 09 91 23- INTERIOR PAINTING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Interior and Exterior Painting, complete as shown on Drawings and as specified.
1. Work includes, but is not limited to, painting of following items, materials, and spaces:
    - a. Paint every interior and exterior exposed-to-view unfinished surface, except as otherwise shown on Drawings or as specified.
    - b. Paint the following exposed mechanical and electrical items to match adjacent surfaces even if the items are factory-finished:
      - 1) Wall and ceiling diffusers/registers installed in gypsum board assemblies at any location.
      - 2) Access doors at any location except when concealed above suspended ceilings.
      - 3) Flush-mounted electrical panelboards and cabinets in gypsum board assemblies at any location.
      - 4) All exposed piping, conduit, duct work and similar surfaces in Stair Enclosures and Fire Control Room (except items with factory "red" finish).
    - c. Paint semi-visible areas behind registers, grilles, diffusers, screen vents as required to "black out".
    - d. Paint auxiliary rails of smoke containment screens with high-temperature coating.
    - e. Stairs: Paint all exposed ferrous metal assemblies, concrete landings and treads, including hazard striping as required by code.
    - f. Stenciling at Smoke Partition and Fire Rated Walls: See section 092900 Gypsum Board.
  2. Do not paint the following items:
    - a. Factory-finished items specified in various Sections.
    - b. Pre-finished wall, ceiling, and floor coverings.
    - c. Concrete traffic or walking decks, walks, steps, and ramps.

- d. Code-Required Labels: Keep equipment identification and fire rating labels free of paint.
  - e. Surfaces concealed in walls and above ceilings except as specifically indicated otherwise.
  - f. Ducts, piping, conduit, and equipment concealed in walls and ceilings, unless specifically indicated otherwise.
  - g. Do not paint "Shell Areas" as shown on drawings except paint all sides of doors and frames at walls into finished areas.
  - h. Mechanical or elevator shafts not requiring periodic cleaning.
  - i. Mechanically-finished nonferrous metal, such as stainless steel, aluminum, and bronze, except exposed mechanical and electrical items.
  - j. Interior spaces specifically noted as unpainted.
3. Note: This Section includes a comprehensive listing of paint finish types. Not all paint systems included herein may be required by the Scope of Work of this Project, or the scope of some finishes may be very limited. The responsibility of the Contractor to schedule the Work so that all specified and required Painting Scope is included in the Scope of Work for the Project.
- B. Work Specified Elsewhere:
- 1. Section 050500 – Metal Fasteners.
  - 2. Section 079200 – Joint Sealants.
  - 3. Section 099113 – Exterior Painting.

## 1.2 SUBMITTALS

- A. Comply with requirements of Section 013300 – Submittal Procedures.
- B. Product Data: Submit complete list of materials proposed for use, together with manufacturer's data and specifications.
- C. Samples:
  - 1. Opaque Colors and Finishes: Submit samples, on hardboard, using materials accepted for Project, of each color and paint finish selected with texture to simulate actual conditions. Prepare three samples, 8-1/2 inches by 11 inches, with required number of paint coats clearly visible.
  - 2. Transparent and Stained Finishes: Prepare samples on species and quality of wood to be used in the Work. Re-submit as requested until

acceptable sheen, color, and texture are achieved. Label and identify each sample as to location and application.

### 1.3 QUALITY ASSURANCE

- A. Labeling: Include following on label of each container:
  - 1. Manufacturer's name and product name.
  - 2. Generic type of paint.
  - 3. Manufacturer's stock number.
  - 4. Color.
  - 5. Instructions for reducing, where applicable.
- B. Special Requirements of Regulatory Agencies: Use materials for Work of this Section which comply with volatile organic compound limitations and other regulations of local Air Quality Management District and other local, state, and federal agencies having jurisdiction.
- C. Project Mock-Up: As directed by the Architect, apply on actual wall surfaces where designated, samples of each and any color selected for final review.
  - 1. On at least 100 square feet of surface as directed, provide full-coat finish samples until required sheen, color and texture are obtained.
  - 2. Duplicate painted finishes of prepared samples.
  - 3. Simulate finished lighting conditions for review of in-place work.

### 1.4 PRODUCT HANDLING

- A. Comply with requirements of Section 01 6000 – Product Requirements.
- B. Delivery: Deliver material in sealed containers with labels legible and intact.
- C. Storage of Materials:
  - 1. Store only acceptable Project materials on Project site.
  - 2. Store in suitable location.
  - 3. Restrict storage to paint materials and related equipment.
  - 4. Comply with health and fire regulations.

### 1.5 PROJECT CONDITIONS

- A. Environmental Requirements:

1. Comply with manufacturer's recommendations as to environmental conditions under which coatings and coating systems can be stored and applied.
  2. Do not apply finish in areas where dust is being generated.
- B. Protection: Cover or otherwise protect finished work of other trades and surfaces not being painted concurrently or not to be painted.

#### 1.6 SCHEDULING

- A. Gypsum Board: Verify that a fully-cured skim coat has been applied to Gypsum Board specified for Level 5 finish and scheduled to receive semi-gloss or gloss paint finishes. Do not proceed until completed.

#### 1.7 MAINTENANCE

- A. Extra Materials: At completion of Work, deliver to Owner extra stock of paint of one gallon of each color used of each coating material used. Tightly seal and clearly label containers.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Primers and Single-color Paints: Provide paint systems as manufactured by the following manufacturers. Unless otherwise specified, single source all components of a paint system from a single manufacturer, including primer/sealer/undercoat and body and finish coats to assure compatibility.
1. Benjamin Moore and Co. (BM).
  2. ICI Dulux Paints (ICI).
  4. Sherwin-Williams Co. (S/W).

#### 2.2 MATERIALS

- A. General: Provide materials selected for coating system for each type of surface which are the product of single manufacturer.
- B. Thinner: As recommended by each manufacturer for his respective product.
- C. Unsuitability of Specified Products: Claims concerning unsuitability of any materials specified will not be entertained, unless such claim is made in writing to the Architect before Work is started.

#### 2.3 COLORS

- A. Color and Sheen: Colors are scheduled on Drawings (or as selected by Architect if not scheduled on Drawings) based on standard color chips provided by one or more of the listed manufacturers.
- B. Mixing: Deliver paints and stains ready mixed to Project site.

#### 2.4 MILDEW RESISTANCE

- A. General: Add fungicidal agent to paint per manufacturer's recommendations. Add agent to paint at factory. Clearly indicate on labels that paint is mildew resistant.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Verification of Conditions: Examine surfaces scheduled to receive paint and finishes for conditions that might adversely affect execution, permanence, or quality of work and which cannot be put into acceptable condition through preparatory work. Proceed with preparation or coating application only when conditions are satisfactory.
- B. Review all questions regarding the scope of painting with Owner prior to proceeding with Work.

#### 3.2 SURFACE PREPARATION

- A. General: Remove scale, dirt, dust, grit, rust, wax, grease, efflorescence, loose material, and other foreign matter detrimental to proper adhesion of paint.
- B. Gypsum Board:
  - 1. Narrow, Shallow Cracks and Small Holes: Fill with spackling compound.
  - 2. Deep, Wide Cracks and Deep Holes: Rake out, dampen with clear water, and fill with thin layers of gypsum board joint compound.
  - 3. Curing: Allow to dry.
  - 4. Sanding: Sand smooth after drying; do not raise nap of paper on gypsum board.
- C. Metals:
  - 1. Chipped or Abraded Areas in Shop Coatings: Touch-up using appropriate primer.
  - 2. Galvanized Surfaces: Apply a wash coat made by dissolving 8 ounces copper acetate or copper sulfate in one gallon of water; apply with brush.
  - 3. Stainless Steel: Scarify surfaces before applying prime coat.

- D. Wood:
1. General: If required, sandpaper surfaces smooth before applying primer. Thoroughly clean knots; apply thin coat of knot sealer over surfaces shown to receive opaque finish.
  2. Back Priming: Back prime surfaces installed against cementitious surfaces; give particular attention to sealing cross-grained surfaces.
  3. Puttying:
    - a. General: Fill nail holes, cracks, and other depressions flush with putty after prime coat application. Allow putty to dry; sandpaper smooth before applying body coat.
    - b. For Opaque Finish: Linseed oil type putty.
- E. Protection:
1. General: Properly protect floors and other adjacent work by drop cloths or other suitable coverings. In areas scheduled for painting, maintain wrappings and factory-applied protection provided by other trades.
  2. Hardware and Other Obstructions: Remove or protect factory finished items such as hardware, plates, lighting fixtures, grilles, and similar items placed prior to painting. Reposition or remove protection upon completion of each space. Equipment adjacent to surfaces requiring paint disconnected, moved, reset, and reconnected by respective trades.
  3. Fire Precautions: At end of each work day, place in metal containers or remove from premises, solvent soaked cloths, waste, and other materials which constitute a fire hazard.
- F. Moisture Content: Do not apply initial coating until moisture content of surface is within limitations recommended by paint manufacturer.

### 3.3 APPLICATION

- A. General: Apply paint per manufacturer's instructions and as specified. Thoroughly stir paint and keep at uniform consistency during application. Apply paint evenly, free from drops, ridges, waves, laps, and brush marks; finished surface uniform in sheen, color, and texture. Apply succeeding coats to unscarred and completely integral base coats; slightly vary color of undercoats to distinguish them from preceding coat. Allow sufficient time between coats to assure proper drying. Sandpaper smooth interior finishes between coats.
- B. Prime Coat: Do not thin primers in excess of manufacturer's printed directions. Apply by brush, unless otherwise specified, within 8 hours after cleaning.



- C. Body and Finish Coats: Do not thin; apply by brush, roller or spray.
- D. Drying Time: Comply with recommendations of product manufacturer for drying time between succeeding coats.
- E. Moldings and Ornaments: Leave clean and true to details with no undue amount of paint in corners and depressions.
- F. Edges of Paint: Where adjoining other materials or colors, make clean and sharp with no overlapping.
- G. Refinishing: Refinish entire wall where portion of finish is deemed not acceptable.
- H. Precaution: Do not paint over fusible links, UL labels, or sprinkler heads.
- I. Exposed Plumbing and Mechanical Items: Finish items without factory finish such as conduits, pipes, access panels, and items of similar nature to match adjacent wall and ceiling surfaces, unless otherwise directed.

### 3.4 CLEANING

- A. General: Touch up and restore finish where damaged. Remove spilled, splashed, or spattered paint from surfaces. Do not mar surface finish of item being cleaned.
- B. Storage Space: Leave clean and in condition required for equivalent spaces in Project.

### 3.5 PAINT SYSTEMS

- A. Schedule: Only major areas are scheduled. Treat miscellaneous and similar items and areas within room or space with similar system.
- B. Number of Coats: Where number of coats are specified, it is only as a minimum requirement. Apply additional coats, at no additional cost to Owner, if necessary to completely hide base material, produce uniform color, and provide satisfactory finish result.
- C. Thickness of Coats: For each paint system product, provide the manufacturer's recommended mil-thickness for each applied coat.
- D. Systems Specifications: These specifications are a guide and are meant to establish procedure and quality. Confer with Architect to determine exact finish desired.
- E. Acceptance of Final Colors: Do not apply final coats of paint for either exterior and interior systems until colors have been reviewed and accepted by the Architect.

3.6 INTERIOR PAINT SYSTEMS (Systems are based on products by S-W; other manufacturers listed in Part Two may be used)

A. Interior Gypsum Board – Flat:

1. General: Provide as follows unless otherwise scheduled on Drawings or noted as follows in this Section.
2. Flat Finish — Low Odor Zero VOC System
3. Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600, 0 g/L VOC
4. 1st coat: ProMar 200 Zero VOC Flat, B30-2600 series, 0 g/L VOC
5. 2nd coat: ProMar 200 Zero VOC Flat, B30-2600 series, 0 g/L VOC

B. Interior Gypsum Board – Eggshell/Satin:

1. General: Provide as follows unless otherwise scheduled on Drawings or noted as follows in this Section.
2. Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600 0 g/L VOC
3. 1st coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC
4. 2nd coat: ProMar 200 Zero VOC Eg-Shel B26-2600 series, 0 g/L VOC

C. Interior Gypsum Board – Semi-gloss:

1. General: Provide at stairs, service areas and where scheduled.
2. Primer: ProMar 200 Zero VOC Interior Latex Primer, B28W2600, 0 g/L VOC
3. 1st coat: ProMar 200 Zero VOC Semi-Gloss B31-2600 series, 0 g/L VOC
4. 2nd coat: ProMar 200 Zero VOC Semi-Gloss B31-2600 series, 0 g/L VOC

D. Interior Gypsum Board – Epoxy Coatings:

1. General: Provide at Restroom and other gypsum surfaces as scheduled on Drawings and required by the the governing Health Codes:
2. Eg-Shel Finish
  - a. Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC
  - b. 1st coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Eg-Shel, K45 series, <150 g/L VOC
  - c. 2nd coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Eg-Shel, K45 series, <150 g/L VOC
3. Semi-Gloss Finish (typical, unless noted otherwise)
  - a. Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC
  - b. 1st coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Semi-Gloss, K46 series, <150 g/L VOC
  - c. 2nd coat: Pro Industrial Pre-Catalyzed Water-Based Epoxy Semi-Gloss, K46 series, <150 g/L VOC
4. Gloss Finish
  - a. Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC
  - b. 1st coat: Pro Industrial Zero VOC Water-Based Epoxy Gloss, B73-300 series, 0 g/L VOC

- c. 2nd coat: Pro Industrial Zero VOC Water-Based Epoxy Gloss, B73-300 series, 0 g/L VOC

E. Interior Ferrous Metal:

1. General: Shop and field-applied paint finishes for the Work of Section 050500 – Metal Fabrications, is included in the Scope of Work for those Sections.
2. For other exposed-to-view ferrous metal items, including items specified in DIVISION 23 – Mechanical; and DIVISION 26 – Electrical, provide the finishes as follow:
3. Bare Metal Items; High Performance Coating System: Mechanical and Electrical Piping, Conduits, Ductwork, Supports, Hangers, Machinery and Similar Items:
  - a. Eg-Shel or Gloss Finish (Verify with Architect for each room / area prior to painting)
  - b. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC
  - c. 1st coat: Pro Industrial Zero VOC Water-Based Epoxy Eg-Shel, B73-360 series or Gloss, B73-300 series, 0 g/L VOC
  - d. 2nd coat: Pro Industrial Zero VOC Water-Based Epoxy Eg-Shel, B73-360 series or Gloss, B73-300 series, 0 g/L VOC
4. Shop Primed or painted (by others) Items; Semi-Gloss finish:
  - a. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC
  - b. 1st coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
  - c. 2nd coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
5. Shop Galvanized Items:
  - a. Galvanizing repair provided in Section 050500 – Metal Fabrications.
  - b. Galvanized Metal Decking & Ferrous Decking — Including Bar Joists
    - i. Flat, Eg-Shel, or Semi-Gloss Finish
    - ii. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC
    - iii. 1st coat: Low VOC Waterborne Acrylic Dryfall, Flat B42W81, Eg-Shel B42W82, Semi-Gloss, B42W83, All sheens <50 g/L VOC
    - iv. 2nd coat: Low VOC Waterborne Acrylic Dryfall, Flat B42W81, Eg-Shel B42W82, Semi-Gloss, B42W83, All sheens <50 g/L VOC
  - c. Galvanized Metal Decking & Ferrous Decking — Including Bar Joists – High Performance System

- i. Primer: Pro Industrial Pro-Cryl Universal Primer, B66-310 series, <100 g/L VOC
  - ii. 1st coat: Pro Industrial Multi-Surface Acrylic Eg-Shel, B66-560 series, <150 g/L VOC
  - iii. 2nd coat: Pro Industrial Multi-Surface Acrylic Eg-Shel, B66-560 series, <150 g/L VOC
- F. Interior Aluminum and Copper:
  1. Refer to Section 076200 – Flashing and Sheet Metal for shop and field-applied paint finishes specified in those Sections.
  2. Mechanical and Electrical Items:
    - a. Pretreatment: Metal Pretreatment.
    - b. 1st Coat: Aluminum Primer. Provide additional general purpose sealer coat when recommended by paint manufacturer.
    - c. 2nd Coat: Acrylic Paint, Semi-Gloss.
    - d. 3rd Coat: Acrylic Paint, Semi-Gloss.
- G. Interior Wood:
  1. General: Transparent Finishes are specified and provided in Section 064123 Interior Architectural Woodwork
  2. Semi-Gloss Finish — Low Odor Zero VOC System
  3. Primer: ProMar 200 Zero VOC Primer, B28W2600, 0 g/L VOC
  4. 1st coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
  5. 2nd coat: Pro Industrial Zero VOC Acrylic Semi-Gloss, B66-650 series, 0 g/L VOC
- H. Interior Concrete Slabs:

1<sup>st</sup> and 2<sup>nd</sup> Coat: Benjamin Moore Floor Enamel C112 or Sherwin Williams – Porch and Floor Enamel.
- I. Interior Mechanical Insulation; Finish Varies:
  1. Provide finish materials recommended in writing by the mechanical insulation manufacturer for their products in exterior locations. Adapt the following as required.
    - a. 1st Coat: General Purpose PVA Sealer, or as recommended by the insulation manufacturer.
    - b. 2nd Coat: Match adjacent finish system.
- J. Miscellaneous Interior Painting Systems:
  1. Ductwork at Grilles and Diffusers:

- a. Apply interior surfaces of ductwork partially visible through grilles and diffusers.
  - b. 1st Coat: Galvanized Metal Primer.
  - c. 2nd Coat: Acrylic Paint, Matte Black.
  - d. 3rd Coat: Acrylic Paint, Matte Black.
2. Exposed Insulated Pipes and Ductwork:
    - a. 1st Coat: 1 coat General Purpose PVA sealer. Omit sealer where glass fabric jackets are used.
    - b. 2nd Coat: Acrylic Paint, match adjacent finish.
    - c. 3rd Coat: Acrylic Paint, match adjacent finish.
  3. Exposed Non-Insulated Pipes and Ductwork: Including conduit.
    - a. Cast-Iron Pipe:
      - 1) Pre-treatment: Conform with the requirements of Section 050500 – Metal Fabrications.
      - 2) 1st Coat: Ferrous Metal Primer.
      - 3) 2nd Coat: Acrylic Paint, match adjacent finish.
      - 4) 3rd Coat: Acrylic Paint, match adjacent finish.
    - b. Other Pipes, Conduit, and Ductwork:
      - 1) Pre-treatment: Conform with the requirements of Section 050500 – Metal Fabrications.
      - 2) 1st Coat: As specified for ferrous and non-ferrous metals as applicable.
      - 3) 2nd Coat: Acrylic Paint, match adjacent finish.
      - 4) 3rd Coat: Acrylic Paint, match adjacent finish.
- K. Miscellaneous Interior Painting Systems:
1. Factory Finished Equipment: Satisfactorily refinish surfaces damaged before, during, or after installation as directed; use 128 semi-gloss enamel.
  2. Plywood Equipment Backing:
    - a. General: Telephone, Data and Electric Closets.

- b. 1st Coat: Latex Enamel Undercoater.
  - c. 2nd Coat: Acrylic Paint; match adjacent finish.
  - d. 3rd Coat: Acrylic Paint; match adjacent finish.
- L. Pipe Identification:
- 1. General: Per ANSI A13.1; buried pipe, electrical conduit, and pipe in concealed spaces such as furred spaces and shafts not included.
  - 2. Color Scheme: ANSI Z53.1 in combination with legend and flow markers; continuous total length coverage. Safety colors as specified under applicable Mechanical Section.
  - 3. Legend: Stencil letters of colors, type, and sizes per ANSI A13.1. Tags for identification of pipes less than 3/4-inch overall outside diameter, including valves and fittings; provided under applicable mechanical Section.
  - 4. Flow Markers: Provide each type with appropriate size arrows to indicate flow direction in pipe; same color as legend.
  - 5. Visibility: Locate legend and flowmarkers for easy visibility from operating floor; space not over 20 feet with at least one per room.
- M. STENCILING OF FIRE RATED AND SMOKE PARTITION WALLS:
- A. Identify partitions indicated on drawings as having a required fire or smoke rating.
    - 1. Follow guidelines set in Chapter 7 of International Building Code or as locally amended.
    - 2. Permanently identify with stenciling
      - a. Minimum 6 inches high letters with minimum 1/2 inch stroke.
      - b. Bottom of lettering to start at 6 inches above ceiling.
      - c. Stenciling to be 10 feet on center max.
        - b. Color : Red for 1-hr rated walls, Blue for 2-hr rated walls, Green for smoke partition walls.
        - c. Provide in a manner acceptable to authority having jurisdiction.
- 3.8 CLEANING:
- A. Comply with provisions of Section 017900 – Cleaning.
  - B. Remove paint spots, oil, and stains from adjacent surfaces upon completion of Work; leave Work clean.

END OF SECTION

**SECTION 10 26 00 – WALL AND DOOR PROTECTION**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Work Included: Provide and install wall protection, wall corner guards and other finish protection products, complete, as shown on Drawings and as specified, including:

1. Surface-Mounted Corner Guards and Partition End Guards.
2. Protective Wall Covering Wainscot
3. Crash Rails

- B. Work Specified Elsewhere:

1. Section 081113 – Hollow Metal Doors and Frames.
2. Section 084113 – Aluminum Entrances and Storefronts.
3. Section 081416 – Flush Wood Doors.
4. Section 079200 – Joint Sealants.
5. Section 087100 – Door Hardware
6. Section 092216 – Non-Structural Metal Framing.

## 1.2 SUBMITTALS

- A. Comply with provisions of Section 013300 – Submittal Procedures.
- B. Product Data: Manufacturer's catalog cuts, standard color charts, and data sheets; including installation details and instructions, for each item specified.
- C. Samples:
1. Crash Rails: 12-inch-long piece of each type specified, including color.
  2. Corridor Handrail: 12-inch-long piece of each specified type, including mounting bracket and specified finish.
  3. Partition End and Corner Guards: 12-inch-long piece of each type specified, including color.
  4. Wall protection and Door Protection: 12-inch-square piece of each specified type, including corner and specified color.

## 1.3 PRODUCT HANDLING



- A. Delivery and Storage: Deliver and store items and related fasteners in manufacturer's original packaging, identified with manufacturer's name and type of product, and size. Store materials indoors, protected from moisture and other sources of damage.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURER

- A. General: Provide vinyl/acrovyn wall and corner protection single-sourced from one manufacturer to assure color matching.
- B. Manufacturer: Inpro Corporation, Acrovyn Construction Specialties, Inc., Pawling Corporation OR Korogard
  - a. Basis-of-Design: Acrovyn wall protection systems
- C. Fire Hazard Classification: Flame spread of 25 or less when tested per ASTM E84.

### 2.3 CORNER GUARDS

- A. Type: Acrovyn Surface mounted Corner Guard with continuous aluminum retainer.
  - 1. Size: 2" X 2" X 4'-0".
  - 2. Mounting Style: Surface-mounted.
  - 3. Color: As scheduled on Drawings.
  - 4. Mounting Height: 4" from top of finished floor. (match existing)
  - 6. Locations: Typical at all corners and as shown on Drawings.

### 2.4 PROTECTIVE WALL COVERING WAINSCOT

- A. Type: Sheet plastic wall protection by Acrovyn. Typical where shown on Drawings.
  - 1. Size: 0.060" thick Rigid Sheet by sizes shown on Drawings.
  - 2. Mounting Style: Surface-mounted.
  - 3. Extrusion: Extrusion: High-impact vinyl acrylic extrusion, nominal 078" (1.98mm) thick. Class A fire rating, when tested in accordance with ASTM E 84.
  - 3. Color: As scheduled on Drawings.

4. Mounting Height: From finished floor to 4 feet above finish floor. Align top of wall protection with top of corner guards where occurs (Match adjacent existing).
5. Locations: As shown on Drawings.

## 2.5 CRASH RAILS/ WALL GUARD

- A. Manufacturer: Acrovyn (match adjacent existing)
- B. Type: Acrovyn crash rail, surface-mounted crash rail with continuous aluminum retainer. Typical at corridors and as shown on Drawings (match adjacent existing).
  1. Size: 8 inch tall by lengths shown on Drawings (match adjacent existing)
  2. Mounting Style: Surface Mounted
  3. Color: As scheduled on Drawings.
  4. Mounting Height: As shown on Drawings.
  5. Locations: Typical at all corridor locations.

## 2.5 MISCELLANEOUS MATERIALS

- A. Fasteners: Manufacturer's standard, removable, corrosion-resistant fasteners of size and length suitable for the conditions of installation.
- B. Adhesive: As recommended by manufacturer for setting material.
- C. Backing Plates: As specified in Section 092216 – Non-Structural Metal Framing and as shown on Drawings.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions: After application of wall base and finish painting of walls is complete, examine areas and conditions under which items are to be installed. If unsatisfactory conditions exist, do not proceed with the Work until such conditions have been corrected.

### 3.2 PREPARATION

- A. Cleaning: Prior to application, clean side of units that will be in contact with wall surface.

### 3.3 INSTALLATION

- A. General: Install units per manufacturer's instructions and as specified. Install wall and corner guards, crash rails and handrails plumb and true and securely fastened to backing plates or substrates.

### 3.4 ADJUSTING AND CLEANING

- A. Cleaning: Prior to time of final acceptance, strip units of protective coverings, and clean in accordance with manufacturer's instructions.
- B. Defective Materials: Remove and replace any defective, misaligned, or damaged units, at no additional cost to Owner.

END OF SECTION

**SECTION 105200 - FIRE-PROTECTION SPECIALTIES**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Fire-protection cabinets for the following:
    - a. Portable fire extinguishers.
    - b. Semi-recessed Fire Extinguisher Cabinets (Match hospital standard)

## 1.3 SUBMITTALS

- A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire-protection specialties.
  - 1. Fire Extinguishers: Include rating and classification.
  - 2. Cabinets: Include roughing-in dimensions, details showing mounting methods, relationships of box and trim to surrounding construction, door hardware, cabinet type, trim style, and panel style.
- B. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of cabinet finish indicated.

## 1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain fire extinguishers and cabinets through one source from a single manufacturer.
- B. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Standard for Portable Fire Extinguishers."
- C. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

## 1.5 COORDINATION

- A. Coordinate size of cabinets to ensure that type and capacity of fire extinguishers indicated and provided by Owner under separate Contract are accommodated.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Fire-Protection Cabinets:
    - a. General Accessory Manufacturing Co.
    - b. J.L. Industries, Inc.
    - c. Larsen's Manufacturing Company.
    - d. Modern Metal Products; Div. of Technico.
    - e. Watrous; Div. of American Specialties, Inc.

## 2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: Carbon steel, complying with ASTM A 366/A 366M, commercial quality, stretcher leveled, temper rolled.
- B. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:
1. Sheet: **ASTM B 209**.
  2. Extruded Shapes: **ASTM B 221**.

## 2.3 PORTABLE FIRE EXTINGUISHERS

- A. Multipurpose Dry-Chemical Type: UL-rated 4-A:60-B:C, **10-lb** nominal capacity.

## 2.4 FIRE-PROTECTION CABINETS

- A. Cabinet Construction: Provide manufacturer's standard box (tub), with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated. Weld joints and grind smooth. Miter and weld perimeter door frames.
1. Cabinet Metal: Enameled-steel sheet.
  2. Cabinet Metal: Aluminum sheet.
- B. Cabinet Type: Suitable for the following:
1. Fire extinguisher.
- C. Cabinet Mounting: Suitable for the following mounting conditions:
1. Semi recessed: Cabinet box partially recessed in walls of shallow depth to suit style of trim indicated.
- D. Cabinet Trim Style: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.
1. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backband).
- E. Cabinet Trim Material: Manufacturer's standard, as follows:
1. Steel sheet.
- F. Door Material: Manufacturer's standard, as follows:
1. Steel sheet.

- G. Door Glazing: Manufacturer's standard, as follows:
  - 1. Break Glass: Clear float glass, ASTM C 1036, Type I, Class 1, Quality q3, 1.5 mm, single strength.
- H. Door Style: Manufacturer's standard design (Match hospital standard).
- I. Door Construction: Fabricate doors according to manufacturer's standards, of materials indicated, and coordinated with cabinet types and trim styles selected.
  - 1. Provide minimum 1/2-inch- thick door frames, fabricated with tubular stiles and rails, and hollow-metal design.
  - 2. Provide inside latch and lock for break-glass panels.
- J. Door Hardware: Provide manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated. Provide either lever handle with cam-action latch, or exposed or concealed door pull and friction latch. Provide concealed or continuous-type hinge permitting door to open 180 degrees.

## 2.5 ACCESSORIES

- A. Identification: Provide lettering to comply with authorities having jurisdiction for letter style, color, size, spacing, and location.
  - 1. Identify fire extinguisher in cabinet with the words "FIRE EXTINGUISHER" applied to door.
    - a. Application Process: Silk-screened.
    - b. Lettering Color: Red.
    - c. Orientation: Vertical.

## 2.6 COLORS AND TEXTURES

- A. Colors and Textures: As selected by Architect from manufacturer's full range for these characteristics.

## 2.7 FINISHES, GENERAL

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Cabinet and Door Finishes: Provide manufacturer's standard baked-enamel paint for the following:
  - 1. Exterior of cabinets and doors.
  - 2. Interior of cabinets and doors.

## 2.8 STEEL FINISHES

- A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond using manufacturer's standard methods.
- B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat. Comply with

paint manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine roughing-in for cabinets before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where semi-recessed cabinets are to be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing fire-protection specialties.
- B. Install in locations and at mounting heights indicated or, if not indicated, at heights acceptable to authorities having jurisdiction.
  1. Prepare recesses for cabinets as required by type and size of cabinet and trim style.
  2. Fasten cabinets to structure, square and plumb.

#### 3.3 ADJUSTING, CLEANING, AND PROTECTION

- A. Adjust cabinet doors that do not swing or operate freely.
- B. Refinish or replace cabinets and doors damaged during installation.
- C. Provide final protection and maintain conditions that ensure that cabinets and doors are without damage or deterioration at the time of Substantial Completion.

END OF SECTION 105200

**SECTION 211313 - WET-PIPE SPRINKLER SYSTEMS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Pipes, fittings, and specialties.
  - 2. Specialty valves.
  - 3. Sprinklers.

## 1.3 DEFINITIONS

- A. 175 psig Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.
- B. AHJ: Authority Having Jurisdiction.

## 1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
  - 2. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each fire-department connection.
- B. Shop Drawings: For wet-pipe sprinkler systems.
  - 1. Include plans, elevations, sections, and attachment details.
  - 2. Include diagrams for power, signal, and control wiring.
- C. Delegated-Design Submittal: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.



## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler systems, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  - 1. Domestic water piping.
  - 2. Compressed air piping.
  - 3. HVAC Ductwork.
  - 4. Equipment Flues.
  - 5. Drain, Waste, and Vent Piping.
  - 6. Items penetrating finished ceiling including the following:
    - a. Lighting fixtures.
    - b. Air outlets and inlets.
    - c. Acoustical Treatments
- B. Qualification Data: For qualified Installer.
- C. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- D. Welding certificates.
- E. Fire-hydrant flow test report.
- F. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- G. Field quality-control reports.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

## 1.8 QUALITY ASSURANCE

## A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

## B. Welding Qualifications: Qualify procedures and operators according to 2010 ASME Boiler and Pressure Vessel Code.

## 1.9 FIELD CONDITIONS

## A. Interruption of Existing Work Functions: Do not interrupt work functions in the existing building unless notification and acceptance by Owner has been received:

1. Notify Construction Manager no fewer than seven days in advance of proposed interruption of work functions.
2. Do not proceed with interruption without Construction Manager's written permission.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

## A. Project scope:

1. Existing construction: modify existing wet pipe fire suppression system with new quick response heads on flexible drops.
2. Provide concealed sprinklers in public and group areas. Architect may request additional locations be provided with concealed sprinklers.
3. Sprinkler heads should be centered on one half of all 2x4 acoustical tiles and centered on all 2x2 acoustical tiles in all areas.
4. Coordination with other trades is important. Sprinkler locations, types, and colors not complying with above and not approved by the architect in writing and installed shall be removed and surfaces repaired at no cost by the fire sprinkler contractor.

## B. Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, 2010 Edition unless otherwise directed by AHJ.
2. Local codes or ordinances.

## C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

- D. Delegated Design: Engage a qualified professional engineer or NICET Level III technician to design wet-pipe sprinkler systems.
1. Perform a water flow test near the site and publish results to architect and EOR for review. Information that should be included in the published results includes, but is not limited to, the following:
    - a. Date.
    - b. Time.
    - c. Performed by, name and firm.
    - d. Water utility and name of contact/witness.
    - e. Location of Residual Fire Hydrant R.
    - f. Location of Flow Fire Hydrant F.
    - g. Static Pressure at Residual Fire Hydrant R psig.
    - h. Measured Flow at Flow Fire Hydrant F gpm.
    - i. Residual Pressure at Residual Fire Hydrant R psig.
  2. Sprinkler system design shall be approved by authorities having jurisdiction.
    - a. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
    - b. Sprinkler Occupancy Hazard Classifications:
      - 1) Building Service Areas: Ordinary Hazard, Group 1.
      - 2) Electrical Equipment Rooms: Ordinary Hazard, Group 1.
      - 3) General Storage Areas: Ordinary Hazard, Group 1.
      - 4) Laundries: Ordinary Hazard, Group 1.
      - 5) Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
      - 6) Office and Public Areas: Light Hazard.
      - 7) Other areas not meeting the space classifications above shall be brought to the attention of the architect for review and classification.
  3. Minimum Density for Automatic-Sprinkler Piping Design:
    - a. 0.05 gpm over 400-sq. ft. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    - b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.
    - c. Ordinary-Hazard, Group 2 Occupancy: 0.20 gpm over 1500-sq. ft. area.
    - d. Extra-Hazard, Group 1 Occupancy: 0.30 gpm over 2500-sq. ft. area.
    - e. Extra-Hazard, Group 2 Occupancy: 0.40 gpm over 2500-sq. ft. area.
    - f. Special Occupancy Hazard: As determined by authorities having jurisdiction.
  4. Maximum Protection Area per Sprinkler: According to UL listing.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

## 2.2 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A 135/A 135M; ASTM A 795/A 795M, Type E; Pipe ends may be factory or field formed to match joining method.

- B. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- C. Galvanized- and Uncoated-Steel Couplings: ASTM A 865/A 865M, threaded.
- D. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL 860.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
  - 1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free or EPDM rubber gasket.
    - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
    - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
  - 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- H. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
  - 1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- I. Grooved-Joint, Steel-Pipe Appurtenances:
  - 1. Pressure Rating: 175-psig minimum.
  - 2. Uncoated Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting, with dimensions matching steel pipe.
  - 3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

### 2.3 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
  - 1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Automatic (Ball Drip) Drain Valves:
  - 1. Standard: UL 1726.

2. Pressure Rating: 175-psig minimum.
3. Type: Automatic draining, ball check.
4. Size: NPS 3/4.
5. End Connections: Threaded.

## 2.4 SPRINKLER PIPING SPECIALTIES

- A. Branch Outlet Fittings:
1. Standard: UL 213.
  2. Pressure Rating: 175-psig minimum
  3. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
  4. Type: Mechanical-tee and -cross fittings.
  5. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
  6. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
  7. Branch Outlets: Grooved, plain-end pipe, or threaded.
- B. Flow Detection and Test Assemblies:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  2. Pressure Rating: 175-psig minimum
  3. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded or grooved.
- C. Sprinkler Inspector's Test Fittings:
1. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
  2. Pressure Rating: 175-psig minimum
  3. Body Material: Cast- or ductile-iron housing with sight glass.
  4. Size: Same as connected piping.
  5. Inlet and Outlet: Threaded.
- D. Flexible Sprinkler Hose Fittings:
1. Standard: UL 1474.
  2. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
  3. Pressure Rating: 175-psig minimum 300 psig.
  4. Size: Same as connected piping, for sprinkler.

## 2.5 SPRINKLERS

- A. Acceptable Manufacturers:
1. Reliable Automatic Sprinkler Co.
  2. Tyco Fire & Building Products LP.
  3. Victaulic Company.
  4. Viking Corporation.
- B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
  - D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
  - E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum
  - F. Automatic Sprinklers with Heat-Responsive Element:
    - 1. Nonresidential Applications: UL 199.
    - 2. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
  - G. Sprinkler Finishes: as directed by architect.
  - H. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
    - 1. Ceiling Mounting: one piece, with minimum 0.51-inch vertical adjustment.
    - 2. Sidewall Mounting: one piece, with minimum 0.5-inch vertical adjustment.
  - I. Sprinkler Guards:
    - 1. Standard: UL 199.
    - 2. Type: Wire cage with fastening device for attaching to sprinkler.
- 2.6 NPS 1/2NPS 1/2PRESSURE GAGES
- A. Standard: UL 393.
  - B. Dial Size: 3-1/2- to 4-1/2-inch diameter.
  - C. Pressure Gage Range: 0- to 250-psig minimum.
  - D. Label: Include "WATER" label on dial face.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

#### 3.2 SERVICE-ENTRANCE PIPING

- A. Connect sprinkler piping to water-service piping for service entrance to building. Comply with requirements for exterior piping in Section 211100 "Facility Fire-Suppression Water-Service Piping" for exterior piping.

- B. Install shutoff valve, backflow preventer, pressure gage, drain, and other accessories indicated at connection to water-service piping.

### 3.3 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
  - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.
  - 2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
- C. Install seismic restraints on piping. Comply with NFPA 13 requirements for seismic-restraint device materials and installation.
- D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
- E. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
- H. Install sprinkler piping with drains for complete system drainage.
- I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
- J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
- K. Install alarm devices in piping systems.
- L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. In seismic-rated areas, refer to Section 210548 "Vibration and Seismic Controls for Fire-Suppression Piping and Equipment."
- M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gage and

valve. Install gages to permit removal, and install where they are not subject to freezing.

- N. Fill sprinkler system piping with water.
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- P. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

### 3.4 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
- B. Install unions adjacent to each valve in pipes NPS 2 and smaller.
- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
  - 1. Apply appropriate tape or thread compound to external pipe threads.
  - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
  - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.



- J. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- K. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- L. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

### 3.5 VALVE AND SPECIALTIES INSTALLATION

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Specialty Valves:
  - 1. Install valves in vertical position for proper direction of flow, in main supply to system.
  - 2. Install alarm valves with bypass check valve and retarding chamber drain-line connection.
  - 3. Install deluge valves in vertical position, in proper direction of flow, and in main supply to deluge system. Install trim sets for drain, priming level, alarm connections, ball drip valves, pressure gages, priming chamber attachment, and fill-line attachment.

### 3.6 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of narrow dimension of acoustical ceiling panels.
- B. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

### 3.7 FIRE DEPARTMENT CONNECTION EXAMINATION

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of fire-department connections.
- B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.8 FIRE DEPARTMENT CONNECTION INSTALLATION

- A. Install wall-type fire-department connections.
- B. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

### 3.9 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.
- B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

### 3.10 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
  - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
  - 4. Energize circuits to electrical equipment and devices.
  - 5. Coordinate with fire-alarm tests. Operate as required.
  - 6. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

### 3.11 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

### 3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain the system.

END OF SECTION 211313

**SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

## PART 2 - PRODUCTS

## 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

## 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Carbon steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Nonshrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade: Galvanized-steel-pipe sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Galvanized-steel-pipe sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. PVC-pipe sleeves.
  - 5. Interior Partitions:
    - a. Piping Smaller Than NPS 6: PVC-pipe sleeves.
    - b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

**SECTION 224216.13 - COMMERCIAL LAVATORIES & SINKS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Scrub Sink
  - 2. Supply fittings.
  - 3. Waste fittings.
- B. Related Requirements:
  - 1. Section 224100 "Residential Plumbing Fixtures" for residential sinks.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for sinks.
  - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

## 1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sinks to include in maintenance manuals.

## 1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Faucet Washers and O-Rings: Equal to 10 percent of amount of each type and size installed.

2. Faucet Cartridges and O-Rings: Equal to 5 percent of amount of each type and size installed.

## PART 2 - PRODUCTS

### 2.1 SCRUB SINK

- A. Scrub Sinks: Heavy gauge stainless steel, hands-free water control and soap dispensing.
  1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Steris
    2. Fixture:
      - a. (2) Station
      - b. Heavy gauge stainless steel.
      - c. Integral laminar flow faucet heads
  3. Mounting: Wall.

### 2.2 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61 Annex G, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.
- B. Standard: ASME A112.18.1/CSA B125.1.
- C. Supply Piping: Chrome-plated brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated brass or stainless-steel wall flange.
- D. Supply Stops: Chrome-plated brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.
- E. Operation: Loose key.

### 2.3 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.
- B. Drain: Grid type with NPS 1-1/2 offset and straight tailpiece.
- C. Trap:
  1. Size: NPS 1-1/2.
  2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated brass or steel wall flange.



3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch-thick stainless-steel tube to wall; and stainless-steel wall flange.

## 2.4 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.
- B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Install sinks level and plumb according to roughing-in drawings.
- B. Install supports, affixed to building substrate, for wall-hung sinks.
- C. Install accessible wall-mounted sinks at handicapped/elderly mounting height according to ICC/ANSI A117.1.
- D. Set floor-mounted sinks in leveling bed of cement grout.
- E. Install water-supply piping with stop on each supply to each sink faucet.
  1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
  2. Install stops in locations where they can be easily reached for operation.
- F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

- G. Seal joints between sinks and counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."
- H. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

### 3.3 CONNECTIONS

- A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.
- B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

### 3.4 ADJUSTING

- A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.
- B. Adjust water pressure at faucets to produce proper flow.

### 3.5 CLEANING AND PROTECTION

- A. After completing installation of sinks, inspect and repair damaged finishes.
- B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed sinks and fittings.
- D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

**SECTION 226213 - VACUUM AND GAS PIPING FOR LABORATORY AND HEALTHCARE FACILITIES**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. This Section includes tubing, piping, and related accessories for the following medical gas systems.
  - 1. Oxygen systems, designated "oxygen."
  - 2. Medical compressed air systems, designated "air."
  - 3. Medical-surgical vacuum and waste anesthesia gas disposal systems, designated "vacuum" and "WAGD."
  - 4. Nitrogen, and nitrous oxide systems.

## 1.3 SYSTEM PERFORMANCE REQUIREMENTS

- A. Installer Qualifications: Engage an experienced Installer of medical gas systems.
  - 1. The term "experienced Installer" is specified in Division 1 Section "Reference Standards and Definitions."
- B. Provide medical gas piping systems complying with requirements of NFPA 99 "Standard for Health Care Facilities."
- C. Provide compatible accessories, tube, fittings, and valves for each system.

## 1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
- B. Product data for the following:
  - 1. Special purpose valves.
  - 2. Medical gas accessories.
  - 3. Medical gas alarm system components.
- C. Wiring diagrams for medical gas alarm systems. Include ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between portions of wiring that are factory installed and portions that are field installed.
- D. Inspection and test reports specified in "Field Quality Control" in this Section.
- E. Certificates of inspections and tests from independent testing agency specified in "Field Quality Control" in this Section.

F. Maintenance data for inclusion in Operating and Maintenance Manuals.

#### 1.5 COORDINATION DRAWINGS

- A. Coordination drawings for medical gas systems. Do not submit but retain at job site for coordination.

#### 1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate, based on evaluation of agency-submitted criteria conforming to ASTM E 699, that it has the experience and capability to conduct satisfactorily the inspection and testing indicated without delaying the progress of the Work.
- B. Comply with NFPA 50 "Standard for Bulk Oxygen Systems at Consumer Sites."
- C. Comply with NFPA 70 "National Electrical Code."
- D. Comply with NFPA 99 "Standard for Health Care Facilities."
- E. Comply with UL 498 "Standard for Attachment Plugs and Receptacles."

F. Comply with UL 544 "Standard for Medical and Dental Equipment."

- G. NRTL Listing and Labeling: Provide equipment that is listed and labeled.
  - 1. The Terms "Listed" and "Labeled": As defined in the "National Electrical Code," Article 100.

#### 1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store tubing with sealing plugs in ends or with end protection, and small accessories in factory-fabricated fiberboard containers.
  - 1. Store pre-cleaned and sealed medical gas tube, fittings, valves, and accessories with sealing plugs and sealing packaging intact.
  - 2. Label medical gas tube, fittings, valves, and accessories that have not been pre-cleaned, and that have been pre-cleaned but have seal or packaging that is not intact, with temporary labels indicating that cleaning is required before installation.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Medical Gas Systems Accessories:
    - a. Beacon Medeas.
    - b. Amico
    - c. Ohio Medical

## 2.2 MEDICAL GAS TUBING, GENERAL

- A. Copper Tube, Fittings, Valves, and Piping Components: Factory- cleaned, -purged, and -sealed, and marked or labeled "CLEANED FOR MEDICAL GAS SERVICE," "CLEAN FOR OXYGEN SERVICE," "ACR/OXY," "OXY," "NITROGENIZED."
  - 1. Components required, but not available cleaned for medical gas use, may be provided, but must be cleaned before use as specified below under "PREPARATION."
- B. Pipe joining materials, specialties, and basic installation requirements are specified in Division 22 Section "Basic Piping Materials and Methods."

## 2.3 MEDICAL GAS TUBE

- A. Pre-cleaned and Sealed Copper Tube: ASTM B 88, Type K or Type L, water tube, seamless, drawn temper, cleaned for medical gas use, purged, and with ends sealed.

## 2.4 MEDICAL GAS TUBE FITTINGS

- A. Wrought-Copper Fittings: ASME B16.22, solder-joint, pressure type.
- B. Bronze Tube Flanges: ASME B16.24, Class 300.
- C. Flexible Connectors: Bronze or stainless-steel flexible pipe connectors as specified in Division 15 Section "Mechanical Sound, Vibration, and Seismic Control."

## 2.5 MEDICAL GAS TUBING JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8, BCuP (copper-phosphorus) Series alloys. Flux is prohibited, except when used with bronze fittings.
- B. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos-free, and suitable for oxygen use.

## 2.6 VALVES

- A. General duty valves such as gate, globe, check, ball, and butterfly valves for use in associated piping such as water supply are specified in Division 15 Section "Valves."
- B. Ball Valves 3 Inches and Smaller: Bronze-body, full-flow, chrome-plated brass ball valve, with Buna-N or TFE seat seals and stem seals, blow-out-proof stem, threaded or braze-joint ends, locking-type handle, designed for quarter turn between open and closed positions and for 300 psig working pressure.
  - 1. Provide union-type body with bolted swing-away center section.
  - 2. Provide factory-cleaned, factory-sealed (for oxygen use), and factory-installed, Type K or L copper tube extensions with pressure gage installed downstream from valve in pressure systems and upstream from valve in vacuum systems.
- C. Check Valves 3 Inches and Smaller: Bronze body, straight-through pattern, spring-loaded ball check valve, designed for 300 psig minimum working pressure.

## 2.7 MEDICAL GAS SYSTEM ACCESSORIES

- A. General: Provide the following medical gas system accessories from manufacturer of existing accessories, compatible with existing systems.
- B. Service Outlets: Include brass valve and body block with seals in roughing-in and finishing assemblies, steel outlet box and cover plate; 3/8-inch Type K or L copper tube brazed to valve; and pressure outlets with automatic secondary service valve to prevent gas flow when primary valve is removed.
1. Quick-Connect Coupling: Indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment with positive locking ring which retains equipment stem in valve during use.
  2. Wall Outlet Cover Plates: One-piece, stainless-steel plate with NAAMM AMP 503, No. 4 finish; metal with chrome plated finish; or anodized aluminum with permanent, color-coded, medical gas identifying label matching corresponding outlets.
  3. Vacuum Bottle Slide Brackets: Bottle slide and mounting assembly matching pattern of vacuum outlet. Provide 1 slide bracket for each wall-mounted vacuum inlet.
- C. Pressure Control Panels: Steel box and steel support brackets for recessed roughing-in. Provide a stainless-steel or anodized-aluminum cover plate having printed operating instructions. Provide control panels with manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line pressure control regulator, outlet supply pressure gage, a DISS service outlet, and tubing outlet for remote service outlet.
1. Minimum Working Pressure: 180 psig.
  2. Line Pressure Control Regulator: Self-relieving, diaphragm type, and with precision manual adjustment.
  3. Pressure Gages: 0- to 300-psig range.
  4. Provide temporary dust shield and U-tube for testing for use before final assembly.
  5. Nitrogen Control Panels: Label cover plate "Nitrogen Pressure Control." Provide with CGA V-5, DISS No. 1120 nitrogen service outlet.
- D. Ceiling-Mounted Service Units: Provide service outlets (inlets) without cover plates and vacuum slides as specified in "Service Outlets" paragraph; electric outlets as specified in "Power Outlets" paragraph; and service labels color coded as indicated.
1. Ceiling Mounting Plate: Provide manufacturer's standard plate or field-fabricated plate or roughing-in assembly conforming to manufacturer's printed installation instructions.
  2. Exposed Surfaces: 20-gage minimum thickness stainless steel with No. 4 directional polish.
  3. Servicing: Provide access panels or means of removing shroud.
  4. Blank cover plates for cutouts not having services.
  5. 3/8-inch, Type K copper extension tubes for connection to medical gas systems.
  6. Service Outlets: Types and number indicated.
  7. Dust Covers: For service outlets.

8. DISS Service Outlets: CGA V-5, DISS threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive locking which retains equipment stem in valve during use.
  - a. Oxygen Outlets: CGA V-5, DISS No. 1240.
  - b. Air Outlets: CGA V-5, DISS No. 1160.
  - c. Vacuum Outlets (Inlets): CGA V-5, DISS No. 1220.
  - d. Nitrous Oxide Outlets: CGA V-5, DISS No. 1040.
  - e. Nitrogen Outlets: CGA V-5, DISS No. 1120.
  - f. Evacuation Outlets (Inlets): CGA V-5, DISS No. 2220.
  - g. Carbon Dioxide Outlets: CGA V-5, DISS No. 1080.
9. Quick-Connect Service Outlets: Indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive locking ring which retains equipment stem in valve during use.
10. Hose-Reel Ceiling Service Outlet Assemblies: Individual, concealed, hose-reel units, with stainless-steel face plates, steel mounting boxes, factory- or field-fabricated mounting brackets, and color-coded service hoses with adjustable stops. Provide DISS-type medical gas inlets for services indicated, and 12 feet of conductive neoprene 1/4- or 5/16-inch inside diameter medical gas hose, rated for 200-psig minimum working pressure and having end connection fittings indicated.
  - a. Hose Color: Black, when service is clearly indicated.
11. Provide the following type and quantity of hose services:
  - a. Oxygen: Quick-connect outlet. See drawings for quantity.
  - b. Vacuum: Quick-connect inlet. See drawings for quantity.
  - c. Nitrous oxide: Quick-connect outlet. See drawings for quantity.
  - d. Evacuation: Quick-connect inlet. See drawings for quantity.
  - e. Power Receptacle: One L5-20R, single, locking type, 20 ampere.

### PART 3 - EXECUTION

#### 3.1 PREPARATION

- A. General: Where factory-pre-cleaned and -capped tubing and piping are not available, or when pre-cleaned tubing and piping must be pre-cleaned because of exposure, perform the following procedures:
  1. Clean medical gas pipe and pipe fittings, tube and tube fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service, in accordance with CGA G-4.1-85 "Cleaning Equipment for Oxygen Service."
  2. Wash medical gas piping, tubing, and components in a hot alkaline cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of one pound of chemical to three gallons of water.
    - a. Scrub to ensure complete cleaning.
    - b. Rinse with clean hot water after washing to remove cleaning solution.

#### 3.2 TUBING APPLICATIONS

- A. General: Refer to Part 2 of this Section for the following materials.

- B. Interior: Use "Pre-cleaned and Sealed Copper Tube" with wrought copper fittings and brazed joints.

### 3.3 TUBING INSTALLATION, GENERAL

- A. Install supports and anchors in accordance:
  - 1. Spacing Between Hangers: As described in NFPA 99.
- B. Valve Applications: Use ball valves specified in this Section for main shutoff and zone valve duties.

### 3.4 ACCESSORIES INSTALLATION

- A. Install accessories in accordance with NFPA 99 and manufacturer's printed installation instructions.
- B. Install ceiling-mounting service accessories firmly anchored to substrate in accordance with manufacturer's printed installation instructions. Provide structural steel, hanger rods, anchors, and fasteners, in addition to components furnished with the accessories, necessary to fabricate supports.

### 3.5 CONNECTIONS

- A. Install tubing and piping adjacent to equipment to allow servicing and maintenance.
- B. Install medical gas tubing and electrical connections to medical gas alarm system components.
- C. Electrical Connections: Power wiring and disconnect switches are specified in Division 16 Sections "Wires and Cables" and "Circuit and Motor Disconnects."
  - 1. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

### 3.6 LABELING AND IDENTIFICATION

- A. Install labeling on valves, valve box covers, and alarm panels in accordance with requirements of NFPA 99.
- B. Captions and Color Coding: Use the following or similar medical gas captions and color coding for accessories, when specified and where required by NFPA 99.
  - 1. Oxygen: White letters on green background.
  - 2. Air: Black or white letters on yellow background.
  - 3. Vacuum: Black letters on white background.
  - 4. Nitrous Oxide: White letters on blue background.
  - 5. Nitrogen: White letters on black background.
  - 6. WAGD: Black letters on white background or white letters on purple background.
  - 7. Carbon Dioxide: White letters on gray background.
- C. Label medical gas systems operating at other than standard pressure with system operating pressure.



## 3.7 FIELD QUALITY CONTROL

- A. System Clearing: Purge medical gas system tubing using oil-free dry air or nitrogen after installation of tubing but before installation of service outlet valves, alarms, and gages.
- B. Pressure Test: Subject each section of each system, except high-pressure air and nitrogen, to test pressure of from 150 psig to 200 psig and high-pressure air and nitrogen systems to test pressure of 250 psig with oil-free dry air or nitrogen before attachment of system components, after installation of station outlets with test caps (when supplied) in place, and before concealing piping system. Maintain test until joints are examined for leaks by means of soapy water.
- C. Standing-Pressure Test: Install assembled system components after testing individual systems as specified above. Subject systems to 24-hour standing-pressure test at 20 percent above normal line pressure but not less than 66 psig. Subject vacuum and evacuation systems to 12 to 18 inches of mercury minimum vacuum in lieu of pressure test.
- D. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.
- E. Repair medical gas systems and replace components that fail tests specified.
- F. Independent Testing Agency Services: Provide services of an independent testing agency meeting requirements of Division 1 Section "Quality Control Services" to inspect, test, and certify medical gas systems as specified below. Testing agency work does not include installer quality control procedures or tests.
  - 1. Inspect, test, and certify complete medical gas systems in accordance with the requirements of NFPA 99, Standard for Health Care Facilities. Inspect, test, and certify each medical gas system, including each tubing system, outlets and inlets, accessories, alarm panels and devices, safety devices, medical gas sources, and equipment.
  - 2. Provide oil-free dry air or nitrogen, materials, equipment, and labor required for testing.
  - 3. Provide medical gases required for systems testing.
  - 4. Prepare written reports of tests results including corrective action.
  - 5. Certify that medical gas systems comply with requirements specified, that tests were properly performed, and that test results were satisfactory.
  - 6. Inspect outlets and inlets, gages, alarms, and zone valves for proper labeling for gas service and function.
  - 7. Inspect manifold supply systems for installation and operation as required by NFPA 99, Chapter 5.
  - 8. Phase I Tests: Perform the following tests using dry air or nitrogen after installation of gas systems is complete and before connection of new systems to existing gas sources.
    - a. Outlet and Inlet Cross-Connection Test: Pressurize one medical gas system to 50 psig, with other systems at atmospheric pressure, and access each outlet with an appropriate adapter and test gage. Repeat procedure for each system.

- b. Outlet and Inlet Cross-Connection Test: Pressurize each system in 10-psig increments and access each outlet with an appropriate adapter and test gage.
  - c. Alarm System Test: Test for operation of functions specified in article "Medical Gas Alarm System," within limits required.
  - d. Pressure Test: Test systems at operational pressure with system components installed. No leaks allowed. Conduct tests by zone.
  - e. Particulate Sampling: Test positive pressure terminal outlets, using a 0.45-micron filter, for evidence of solid particulate contamination. Allowable limit is 2 mg. per cubic meter.
  - f. Moisture: Test positive pressure terminal outlets for dew point to verify absence of moisture in piping. Dew point of gas dispensed from terminal outlets shall not exceed dew point of source test gas by more than 4 deg F.
  - g. Systems Purity: Test terminal outlets and test gas source for contaminant levels as defined below. Excessive contaminant levels will require additional purging to outlets within a specific zone until levels are within the following limits.
    - 1) Total Hydrocarbons as Methane: 1 part per million.
    - 2) Halogenated Hydrocarbons: 2 parts per million.
    - 3) Carbon Monoxide: 2 parts per million.
  - h. Air Compressor Purity: Collect medical air compressor air samples taken from downstream side of filters and air dryers. Test samples for contaminants and moisture within the following limits.
    - 1) Total Hydrocarbons as Methane: 25 parts per million.
    - 2) Halogenated Hydrocarbons: 5 parts per million.
    - 3) Carbon Monoxide: 10 parts per million.
    - 4) Moisture (Dew Point): Plus 40 deg F at dryer discharge.
9. Phase II Tests: After Phase I testing has been completed, test completed medical gas systems using applicable medical gas for each system. Completed systems have outlets and inlets, alarms, and gages installed; and gas supply systems installed and ready for operation.
- a. Final Purging: Introduce applicable medical gas for each system into respective piping systems. Purge installed outlet valves to remove nitrogen test gas present from Phase I testing. Test vacuum inlets for ability to flow.
  - b. Outflow Analysis: Analyze medical gas at positive pressure outlets to confirm delivery of proper medical gas at proper concentration level. Minimum allowable concentration levels are defined by the U.S. Pharmacopoeia XXII/National Formulary XVII (USP/NF) and the following CGA Commodity Specifications.
    - 1) CGA G-4.3, Commodity Specification for Oxygen.
    - 2) CGA G-6.2, Commodity Specification for Carbon Dioxide.
    - 3) CGA G-7.1, Commodity Specification for Air.
    - 4) CGA G-8.2, Commodity Specification for Nitrous Oxide.
    - 5) CGA G-10.1, Commodity Specification for Nitrogen.
    - 6) The U.S. Pharmacopoeia XXII/National Formulary XVII is available from the U.S. Pharmacopoeia, 12601 Twinbrook Pkwy., Rockville, MD 20852.
  - c. Systems Delivery Pressures: Test pressure piping systems to confirm supply sources are set to deliver gas at following nominal pressure levels.

- 1) All Systems, except Nitrogen and High-Pressure Air: 50-55 psig at maximum flow.
  - 2) Nitrogen and High-Pressure Air: 160 psig minimum at maximum flow.
  - d. Systems Suction Levels: Test vacuum and evacuation piping systems to confirm that vacuum producers are set to maintain suction of not less than 12 inches of mercury at most distant inlets.
10. Testing Agency Certification: Certify that specified inspection, tests, and procedures have been performed and report results. Include the following:
- a. Inspections performed.
  - b. Procedures, materials, and gases used.
  - c. Tests methods used.
  - d. Results of tests.

### 3.8 COMMISSIONING

- A. Provide the services of a factory-authorized service representative to inspect alarm system installation and to provide start-up service.
- B. Operate and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment discovered by the service representative.
- C. Checks Before Start-up: Perform the following final checks before start-up:
  1. Verify that specified tests of piping systems are complete.
  2. Check that safety (pressure-relief) valves have correct setting that is greater than medical air compressor discharge pressure, but not greater than pressure rating of system components.

### 3.9 DEMONSTRATION

- A. Provide the services of a factory-authorized service representative to demonstrate alarm system start-up and shut-down procedures, preventative maintenance and servicing procedures, and troubleshooting procedures. Review operating and maintenance information.
- B. Provide 7-day written notice in advance of demonstration.

### **END OF SECTION 226213**

**SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Sleeves.
  - 2. Sleeve-seal systems.
  - 3. Grout.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

## PART 2 - PRODUCTS

## 2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- E. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

## 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
  - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless steel.
  - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

## 2.3 GROUT

- A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- B. Characteristics: Non-shrink; recommended for interior and exterior applications.
- C. Design Mix: 5000-psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
  - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
    - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
  - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
  - 1. Cut sleeves to length for mounting flush with both surfaces.
  - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
  - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

### 3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

### 3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
  - 1. Exterior Concrete Walls above Grade:
    - a. Piping Smaller Than NPS 6: Cast-iron wall sleeves.
    - b. Piping NPS 6 and Larger: Cast-iron wall sleeves.
  - 2. Exterior Concrete Walls below Grade:
    - a. Piping : Cast-iron wall sleeves with sleeve-seal system].
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 3. Concrete Slabs-on-Grade:
    - a. Piping : Cast-iron wall sleeves with sleeve-seal system.
      - 1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
  - 4. Concrete Slabs above Grade:
    - a. Piping : PVC-pipe sleeves.
  - 5. Interior Partitions:
    - a. Piping : Galvanized-steel-sheet sleeves.

END OF SECTION 230517

**SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
1. Equipment labels.
  2. Warning signs and labels.
  3. Pipe labels.
  4. Duct labels.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

## PART 2 - PRODUCTS

## 2.1 EQUIPMENT LABELS

- A. Metal Labels for Equipment:
1. Material and Thickness: aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
  2. Letter Color: Black.
  3. Background Color: White.
  4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
  5. Minimum Letter Size: 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-quarters the size of principal lettering.
  6. Fasteners: Stainless-steel rivets or self-tapping screws.
  7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- B. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
  2. Letter Color: Black.
  3. Background Color: White.
  4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
  5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

6. Minimum Letter Size: 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-quarters the size of principal lettering.
  7. Fasteners: Stainless-steel rivets or self-tapping screws.
  8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

## 2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 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-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Label Content: Include caution and warning information plus emergency notification instructions.

## 2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.



- B. Pre-tensioned Pipe Labels: Pre-coiled, semi-rigid plastic formed to partially cover circumference of pipe and to attach to pipe without fasteners or adhesive.
- C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings; also include pipe size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
  - 2. Lettering Size: At least 1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

#### 2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/16 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: Black.
- C. Background Color: White.
- D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- F. Minimum Letter Size: 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-quarters the size of principal lettering.
- G. Fasteners: Stainless-steel rivets or self-tapping screws.
- H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- I. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
  - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

## 3.2 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

## 3.3 PIPE LABEL INSTALLATION

- A. Piping Color-Coding: Painting of piping is specified by architect.
- B. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
  - 1. Near each valve and control device.
  - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
  - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
  - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
  - 5. Near major equipment items and other points of origination and termination.
  - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
  - 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- C. Pipe Label Color Schedule:
  - 1. Chilled-Water Piping: White letters on a safety-green background.
  - 2. Condenser-Water Piping: White letters on a safety-green background.
  - 3. Heating Water Piping: White letters on a safety-green background.
  - 4. Refrigerant Piping: Black letters on a safety-orange background.
  - 5. Low-Pressure Steam Piping: White letters on a safety-purple background.
  - 6. High-Pressure Steam Piping: White letters on a safety-purple background.
  - 7. Steam Condensate Piping: White letters on a safety-purple background.

## 3.4 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes:

1. Blue: For cold-air supply ducts.
  2. Yellow: For hot-air supply ducts.
  3. Green: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

END OF SECTION 230553

**SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Balancing Air Systems:
    - a. Variable-air-volume systems.
  - 2. Balancing Hydronic Systems:
    - a. Variable-volume systems.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. NEBB: National Environmental Balancing Bureau.
- C. TAB: Testing, adjusting, and balancing.
- D. TABB: Testing, Adjusting, and Balancing Bureau.
- E. TAB Specialist: An entity engaged to perform TAB Work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Contract Documents Examination Report: Within 15 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
- C. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

- D. Certified TAB reports.
- E. Sample report forms.
- F. Instrument calibration reports, to include the following:
  - 1. Instrument type and make.
  - 2. Serial number.
  - 3. Application.
  - 4. Dates of use.
  - 5. Dates of calibration.

#### 1.5 QUALITY ASSURANCE

- A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
  - 1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
  - 2. TAB Technician: Employee of the TAB contractor and who is certified by AABC or NEBB as a TAB technician.
- B. Certify TAB field data reports and perform the following:
  - 1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
  - 2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.
- C. TAB Report Forms: Use standard TAB contractor's forms approved by Owner.
- D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."
- E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
- F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

#### 1.6 PROJECT CONDITIONS

- A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

#### 1.7 COORDINATION

- A. Notice: Provide seven days' advance notice for each test. Include scheduled test dates and times.
- B. Perform TAB after leakage and pressure tests on air distribution systems have been satisfactorily completed.

## PART 2 - PRODUCTS (Not Applicable)

## PART 3 - EXECUTION

## 3.1 TAB SPECIALISTS

- A. Subject to compliance with requirements, engage one of the following:
1. Certified Test and Balance.
  2. Bonneville Test and Balance.
  3. BTC Test and Balance.
  4. Diamond Test and Balance.
  5. R and S Analysis
  6. Intermountain Test and Balance
  7. Test and Balancing, Inc.
  8. Independent Test and Balance

## 3.2 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.
- B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.
- C. Examine the approved submittals for HVAC systems and equipment.
- D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.
- E. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- F. Examine test reports specified in individual system and equipment Sections.
- G. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.
- H. Examine terminal units; such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- I. Examine strainers. Verify that startup screens are replaced by permanent screens with indicated perforations.
- J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

- K. Examine operating safety interlocks and controls on HVAC equipment.
- L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

### 3.3 PREPARATION

- A. Prepare a TAB plan that includes strategies and step-by-step procedures.
- B. Complete system-readiness checks and prepare reports. Verify the following:
  - 1. Permanent electrical-power wiring is complete.
  - 2. Automatic temperature-control systems are operational.
  - 3. Equipment and duct access doors are securely closed.
  - 4. Balance, smoke, and fire dampers are open.
  - 5. Isolating and balancing valves are open and control valves are operational.
  - 6. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
  - 7. Windows and doors can be closed so indicated conditions for system operations can be met.

### 3.4 GENERAL PROCEDURES FOR TESTING AND BALANCING

- A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", or ASHRAE 111-1988, or NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems".
- B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
  - 1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
  - 2. After testing and balancing, install test ports and duct access doors that comply with requirements in Section 23 33 00 "Air Duct Accessories."
  - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 23 07 13 "Duct Insulation," Section 23 07 16 "HVAC Equipment Insulation," and Section 23 07 19 "HVAC Piping Insulation."
- C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.
- D. All instruments used by the Contractor shall have been calibrated within the previous 12 months. The final balance report shall contain copies of calibration documents showing calibration tolerances, date of calibration and calibrating firm.
- E. Air and water quantities shall be balanced to within 5% of the quantities shown.
- F. Balance air flow at duct branch damper with outlet dampers full open.

- G. Test, adjust and record fan RPM to design requirements, record initial and final readings.
  - H. Test and record motor amps, initial and final readings.
  - I. Make pitot tube traverse readings of main ducts and obtain design CFM for supply, return and outside air systems by adjusting fans and dampers.
  - J. Test and record systems static pressures, suction and discharge; record initial and final readings.
  - K. Test and adjust each terminal unit.
  - L. Check and record inlet static pressures and modulation limit CFM values, initial and final readings after adjustments.
  - M. The Balancing Contractor shall have a Controls Mechanic available at all times to assist the balancing personnel in adjusting control devices.
  - N. Clearly mark the final position of all dampers, diffusers, reheat boxes, etc. with permanent identification material, neatly applied so as to be easily read and understood.
  - O. Confusing or illegible markings shall be removed and reapplied as directed by the Project Manager.
  - P. All mechanical HVAC systems, air and water, shown on the plans shall be tested and adjusted To design flow. If heating air flow values are different than cooling, provide certification that Heating CFM values are within design.
  - Q. Replace sheaves and drives where required to meet design conditions.
  - R. Copies of a formal balance report shall be prepared and submitted for inclusion in the Operation And Maintenance Manuals. The report shall contain a complete, legible schedule of:
    - 1. All equipment outlets/inlets and their respective flows
    - 2. Pitot tube traverse readings and associated calculations
    - 3. Reheat box settings, GPM and CFM
    - 4. Box static pressures at inlets
    - 5. Box CFM limits (maximum and minimum)
    - 6. Status of each pump and fan, including RPM, AMPS, suction and discharge static pressures, and flow rates.
    - 7. A set of master plans shall be bound with the schedules (11" x 17" maximum) identifying the location of each inlet/outlet and device tested.
    - 8. Calibration documents
- 3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS
- A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.



- B. Prepare schematic diagrams of systems' "as-built" duct layouts.
- C. For variable-air-volume systems, develop a plan to simulate diversity.
- D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.
- E. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.
- F. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.
- G. Verify that motor starters are equipped with properly sized thermal protection.
- H. Check dampers for proper position to achieve desired airflow path.
- I. Check for airflow blockages.
- J. Check condensate drains for proper connections and functioning.
- K. Check for proper sealing of air-handling-unit components.
- L. Verify that air duct system is sealed as specified in Section 23 31 13 "Metal Ducts."

### 3.6 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Compensating for Diversity: When the total airflow of all terminal units is more than the indicated airflow of the fan, place a selected number of terminal units at a minimum set-point airflow with the remainder at maximum-airflow condition until the total airflow of the terminal units equals the indicated airflow of the fan. Select the reduced-airflow terminal units so they are distributed evenly among the branch ducts.
- B. Pressure-Independent, Variable-Air-Volume Systems: After the fan systems have been adjusted, adjust the variable-air-volume systems as follows:
  - 1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
  - 2. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
  - 3. Measure total system airflow. Adjust to within indicated airflow.
  - 4. Set terminal units at maximum airflow and adjust controller or regulator to deliver the designed maximum airflow. Use terminal-unit manufacturer's written instructions to make this adjustment. When total airflow is correct, balance the air outlets downstream from terminal units the same as described for constant-volume air systems.
  - 5. Set terminal units at minimum airflow and adjust controller or regulator to deliver the designed minimum airflow. Check air outlets for a proportional reduction in airflow the same as described for constant-volume air systems.

- a. If air outlets are out of balance at minimum airflow, report the condition but leave outlets balanced for maximum airflow.
6. Re-measure the return airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
  - a. Adjust the fan and balance the return-air ducts and inlets the same as described for constant-volume air systems.
7. Measure static pressure at the most critical terminal unit and adjust the maximum static-pressure set point at the main supply-air sensing station to ensure that adequate static pressure is maintained at the most critical unit. Notify engineer if pressure is above the allowable range before making the adjustment.
8. Record final fan-performance data.

### 3.7 PROCEDURES FOR HYDRONIC SYSTEMS.

- A. Command all systems into full cooling or heating mode (Valves may not be 100% open). Pumps VFCs shall modulate in automatic control to meet the static pressure set point. When pump speed is stable take measurements.
  1. Balance circuit setters for the end of line three-way valves to design flow.
  2. Measure and record water flows at each air handler coil.
  3. Measure flow of each pump.

### 3.8 PROCEDURES FOR MOTORS

- A. Motors, 1/2 HP and Larger: Test at final balanced conditions and record the following data:
  1. Manufacturer's name, model number, and serial number.
  2. Motor horsepower rating.
  3. Motor rpm.
  4. Efficiency rating.
  5. Nameplate and measured voltage, each phase.
  6. Nameplate and measured amperage, each phase.
  7. Starter thermal-protection-element rating.
- B. Motors Driven by Variable-Frequency Controllers: Test for proper operation at speeds varying from minimum to maximum. Test the manual bypass of the controller to prove proper operation. Record observations including name of controller manufacturer, model number, serial number, and nameplate data.

### 3.9 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Before performing testing and balancing of existing systems, inspect existing equipment that is to remain and be reused to verify that existing equipment has been cleaned and refurbished. Verify the following:
  1. New filters are installed.
  2. Coils are clean and fins combed.
  3. Drain pans are clean.
  4. Fans are clean.
  5. Bearings and other parts are properly lubricated.

6. Deficiencies noted in the preconstruction report are corrected.
- B. Perform testing and balancing of existing systems to the extent that existing systems are affected by the renovation work.
1. Compare the indicated airflow of the renovated work to the measured fan airflows, and determine the new fan speed and the face velocity of filters and coils.
  2. Verify that the indicated airflows of the renovated work result in filter and coil face velocities and fan speeds that are within the acceptable limits defined by equipment manufacturer.
  3. If calculations increase or decrease the air flow rates and water flow rates by more than 5 percent, make equipment adjustments to achieve the calculated rates. If increase or decrease is 5 percent or less, equipment adjustments are not required.
  4. Balance each air outlet.
- 3.10 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING HYDRONIC SYSTEMS.
- A. Balancing procedures shall ensure that balancing valves are open as much as possible to minimize system pressure drop
- B. Constant speed primary boiler pumps.
1. Set flow rate to rated GPM.
- C. Variable speed secondary hot water and chilled water systems.
1. All two way valves are pressure-independent self-flow regulating valves which are not manually balanced.
  2. With controls contractor, set systems into automatic control with the VFCs regulating system pressure to maintain the static pressure set point. Close enough two-way control valves closer to the pumps so the system flow rate is approximately 50% of design. All other valves shall be 100% open.
    - a. Balance flow rates through coils with 3-way valves. Adjust BAS DP set point lower if required so at least one of the balancing valves is 100% open.
    - b. Verify that the system DP set point is adequate to provide rated flow through a small sample of the 2-way valves.
  3. Chilled water system:
    - a. With the two-way valve closed and the three-way chilled water valves 100% open;
      - 1) Balance the flows through the three coils served by three-way valves. (One balancing valve shall be 100% open).
      - 2) Determine the minimum pump speed required to maintain the minimum chiller evaporator flow rate. Contractor shall program the minimum pump speed in the VFC at 10% above this flow rate.
    - b. With the chilled water pump at minimum speed, change the three-way valves to the closed position and verify that the system flow rate is the

same or greater than when the control valves are in the open position.

### 3.11 TOLERANCES

- A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
  - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 5 percent.
  - 2. Air Outlets and Inlets: Plus or minus 5 percent.
  - 3. Heating-Water Flow Rate: Plus or minus 5 percent.
  - 4. Cooling-Water Flow Rate: Plus or minus 5 percent.

### 3.12 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
  - 1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
  - 2. Include a list of instruments used for procedures, along with proof of calibration.
- B. Final Report Contents: In addition to certified field-report data, include the following:
  - 1. Pump curves.
  - 2. Fan curves.
  - 3. Manufacturers' test data.
  - 4. Field test reports prepared by system and equipment installers.
  - 5. Other information relative to equipment performance; do not include Shop Drawings and product data.
- C. General Report Data: In addition to form titles and entries, include the following data:
  - 1. Title page.
  - 2. Name and address of the TAB contractor.
  - 3. Project name.
  - 4. Project location.
  - 5. Engineer's name and address.
  - 6. Contractor's name and address.
  - 7. Report date.
  - 8. Signature of TAB supervisor who certifies the report.
  - 9. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
  - 10. Summary of contents including the following:
    - a. Indicated versus final performance.
    - b. Notable characteristics of systems.
    - c. Description of system operation sequence if it varies from the Contract Documents.
  - 11. Nomenclature sheets for each item of equipment.

12. Data for terminal units, including manufacturer's name, type, size, and fittings.
  13. Notes to explain why certain final data in the body of reports vary from indicated values.
  14. Test conditions for fans and pump performance forms including the following:
    - a. Settings for outdoor-, return-, and exhaust-air dampers.
    - b. Conditions of filters.
    - c. Cooling coil, wet- and dry-bulb conditions.
    - d. Face and bypass damper settings at coils.
    - e. Fan drive settings including settings and percentage of maximum pitch diameter.
    - f. Inlet vane settings for variable-air-volume systems.
    - g. Settings for supply-air, static-pressure controller.
    - h. Other system operating conditions that affect performance.
- D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
  2. Water and steam flow rates.
  3. Duct, outlet, and inlet sizes.
  4. Pipe and valve sizes and locations.
  5. Terminal units.
  6. Balancing stations.
  7. Position of balancing devices.
- E. Air-Terminal-Device Reports:
1. Unit Data:
    - a. System and air-handling unit identification.
    - b. Location and zone.
    - c. Apparatus used for test.
    - d. Area served.
    - e. Make.
    - f. Number from system diagram.
    - g. Type and model number.
    - h. Size.
    - i. Effective area in sq. ft.
  2. Test Data (Indicated and Actual Values):

- a. Air flow rate in cfm (L/s).
  - b. Air velocity in fpm (m/s).
  - c. Preliminary air flow rate as needed in cfm (L/s).
  - d. Preliminary velocity as needed in fpm (m/s).
  - e. Final air flow rate in cfm (L/s).
  - f. Final velocity in fpm (m/s).
  - g. Space temperature in deg F (deg C).
- F. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
1. Unit Data:
    - a. System and air-handling-unit identification.
    - b. Location and zone.
    - c. Room or riser served.
    - d. Coil make and size.
    - e. Flowmeter type.
  2. Test Data (Indicated and Actual Values):
    - a. Air flow rate in cfm (L/s).
    - b. Entering-water temperature in deg F (deg C).
    - c. Leaving-water temperature in deg F (deg C).
    - d. Water pressure drop in feet of head or psig (kPa).
    - e. Entering-air temperature in deg F (deg C).
    - f. Leaving-air temperature in deg F (deg C).
- G. Instrument Calibration Reports:
1. Report Data:
    - a. Instrument type and make.
    - b. Serial number.
    - c. Application.
    - d. Dates of use.
    - e. Dates of calibration.

## 3.13 INSPECTIONS

- A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
  2. Check the following for each system:
    - a. Measure airflow of at least 10 percent of air outlets.
    - b. Measure water flow of at least 10 percent of terminals.
    - c. Measure room temperature at each thermostat/temperature sensor. Compare the reading to the set point.
    - d. Verify that balancing devices are marked with final balance position.
    - e. Note deviations from the Contract Documents in the final report.
- B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Engineer.
  2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner.
  3. Engineer shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day.
  4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
  5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.
- C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
  2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's final payment.
- D. Prepare test and inspection reports.

3.14 ADDITIONAL TESTS

- A. The Test and Balance Contractor shall include an extended warranty of 90 days after the completion of the project, during which time the Owner may request a recheck or re-set of any outlet, inlet, control, or mechanical unit.
- B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93



**SECTION 230713 - DUCT INSULATION**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section includes insulating the following duct services:
  - 1. Indoor, concealed supply, return and outdoor air.
- B. Related Sections:
  - 1. Section 230719 "HVAC Piping Insulation."
  - 2. Section 233113 "Metal Ducts" for duct liners.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
  - 1. For adhesives and sealants, documentation including printed statement of VOC content.

## 1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.

## 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.
- B. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## 1.6 DELIVERY, STORAGE, AND HANDLING

- A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

## 1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

## 1.8 SCHEDULING

- A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.
- B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

## PART 2 - PRODUCTS

## 2.1 INSULATION MATERIALS

- A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- F. Provide fiberglass faced duct wrap Type IV with factory applied flame retardant foil reinforced Kraft facing FRK-25, U.L. Label.

## 2.2 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    - b. Eagle Bridges - Marathon Industries; 225.

- c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.Mon-Eco Industries, Inc.; 22-25.
2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

### 2.3 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    - b. Vimasco Corporation; 749.
  2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  3. Service Temperature Range: Minus 20 to plus 180 deg F.
  4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  5. Color: White.

### 2.4 FACTORY-APPLIED JACKETS

- A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
  1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.

### 2.5 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 428 AWF ASJ.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
    - c. Compac Corporation; 104 and 105.
    - d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.
  2. Width: 3 inches.
  3. Thickness: 11.5 mils.
  4. Adhesion: 90 ounces force/inch in width.
  5. Elongation: 2 percent.
  6. Tensile Strength: 40 lbf/inch in width.
  7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
  1. Products: Subject to compliance with requirements, provide one of the following:
    - a. ABI, Ideal Tape Division; 488 AWF.
    - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
    - c. Compac Corporation; 120.
    - d. Venture Tape; 3520 CW.
  2. Width: 2 inches.

3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

## 2.6 SECUREMENTS

### A. Bands:

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. ITW Insulation Systems; Gerrard Strapping and Seals.
  - b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.
2. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide with wing seal or closed seal.
3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.
4. Springs: Twin spring set constructed of stainless steel with ends flat and slotted to accept metal bands. Spring size determined by manufacturer for application.

### B. Insulation Pins and Hangers:

1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CWP-1.
    - 2) GEMCO; CD.
    - 3) Midwest Fasteners, Inc.; CD.
    - 4) Nelson Stud Welding; TPA, TPC, and TPS.
2. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; CHP-1.
    - 2) GEMCO; Cupped Head Weld Pin.
    - 3) Midwest Fasteners, Inc.; Cupped Head.
    - 4) Nelson Stud Welding; CHP.
3. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
    - 2) GEMCO; Perforated Base.
    - 3) Midwest Fasteners, Inc.; Spindle.
  - b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, aluminum, or stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.

- d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
4. Nonmetal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate fastened to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) GEMCO; Nylon Hangers.
    - 2) Midwest Fasteners, Inc.; Nylon Insulation Hangers.
  - b. Baseplate: Perforated, nylon sheet, 0.030 inch thick by 1-1/2 inches in diameter.
  - c. Spindle: Nylon, 0.106-inch- diameter shank, length to suit depth of insulation indicated, up to 2-1/2 inches.
  - d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.
5. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
    - 2) GEMCO; Peel & Press.
    - 3) Midwest Fasteners, Inc.; Self Stick.
  - b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
  - c. Spindle: Copper- or zinc-coated, low-carbon steel, aluminum, or stainless steel, fully annealed, 0.106-inch- diameter shank, length to suit depth of insulation indicated.
  - d. Adhesive-backed base with a peel-off protective cover.
6. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel, aluminum, or stainless-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Products: Subject to compliance with requirements, provide one of the following:
    - 1) AGM Industries, Inc.; RC-150.
    - 2) GEMCO; R-150.
    - 3) Midwest Fasteners, Inc.; WA-150.
    - 4) Nelson Stud Welding; Speed Clips.
  - b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.
7. Nonmetal Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick nylon sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.
  - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - 1) GEMCO.
    - 2) Midwest Fasteners, Inc.

- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.062-inch soft-annealed, stainless steel.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. C & F Wire.

## 2.7 CORNER ANGLES

- A. PVC Corner Angles: 30 mils thick, minimum 1 by 1 inch, PVC according to ASTM D 1784, Class 16354-C. White or color-coded to match adjacent surface.
- B. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.
- C. Stainless-Steel Corner Angles: 0.024 inch thick, minimum 1 by 1 inch, stainless steel according to ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
  - 1. Verify that systems to be insulated have been tested and are free of defects.
  - 2. Verify that surfaces to be insulated are clean and dry.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

### 3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Duct insulation wrap in exposed corridors shall be canvas covered and painted to match existing duct insulation.
- B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- C. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.
- D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- E. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- F. Install multiple layers of insulation with longitudinal and end seams staggered.

- G. Keep insulation materials dry during application and finishing.
  - H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
  - I. Install insulation with least number of joints practical.
  - J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
    - 1. Install insulation continuously through hangers and around anchor attachments.
    - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
    - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
  - K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
  - L. Install insulation with factory-applied jackets as follows:
    - 1. Draw jacket tight and smooth.
    - 2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c. Adhere insulation with 4" strips of Insulation Bonding Adhesive at 8" on center.
    - 3. Overlap jacket longitudinal seams at least 2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches o.c. Adhere insulation with 4" strips of Insulation Bonding Adhesive at 8" on center. Cover longitudinal joints with 3-inch wide strips, of same material as insulation jacket.
      - a. For below ambient services, apply vapor-barrier mastic over staples.
    - 4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
    - 5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.
  - M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
  - N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
  - O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- 3.4 PENETRATIONS
- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
    - 1. Seal penetrations with flashing sealant.

2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
- 3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION
- A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- 3.6 INSTALLATION OF MINERAL-FIBER INSULATION
- A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
  2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.



3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
    - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
    - b. On duct sides with dimensions larger than 18 inches (450 mm), place pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    - d. Do not over-compress insulation during installation.
    - e. Impale insulation over pins and attach speed washers.
    - f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
  4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
    - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
    - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
  5. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches (450 mm) o.c.
  6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
  7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.
- B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
  - a. On duct sides with dimensions 18 inches (450 mm) and smaller, place pins along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
  - b. On duct sides with dimensions larger than 18 inches (450 mm), space pins 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
  - c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
  - d. Do not over-compress insulation during installation.
  - e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch (13-mm) outward-clinching staples, 1 inch (25 mm) o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
  - a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
  - b. Install vapor stops for ductwork and plenums operating below 50 deg F (10 deg C) at 18-foot (5.5-m) intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches (75 mm).
5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- (150-mm-) wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches (150 mm) o.c.

### 3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

- A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.
- B. Insulate duct access panels and doors to achieve same fire rating as duct.

- C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

### 3.8 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."
  - 1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
  - 1. Inspect ductwork, randomly selected by Engineer, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

### 3.10 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
  - 1. Indoor, supply, return and outdoor air.
- B. Items Not Insulated:
  - 1. **Duct liner is not allowed.**
  - 2. Factory-insulated flexible ducts.
  - 3. Flexible connectors.
  - 4. Vibration-control devices.
  - 5. Factory-insulated access panels and doors.

### 3.11 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Concealed, round, rectangular, and flat-oval, supply-air duct insulation shall be the following:

1. Mineral-Fiber Blanket: 1-1/2 inches thick and 0.75-lb/cu. ft. nominal density.

END OF SECTION 230713

**SECTION 230719 - HVAC PIPING INSULATION**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes insulating the following HVAC piping systems:
  - 1. Heating hot-water piping, indoors and outdoors.
- B. Related Sections:
  - 1. Section 23 07 13 "Duct Insulation."

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
  - 1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
  - 2. Detail attachment and covering of heat tracing inside insulation.
  - 3. Detail insulation application at pipe expansion joints for each type of insulation.
  - 4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
  - 5. Detail removable insulation at piping specialties.
  - 6. Detail application of field-applied jackets.
  - 7. Detail application at linkages of control devices.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
  - 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
  - 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

## PART 2 - PRODUCTS

## 2.1 INSULATION MATERIALS

- A. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.
- C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.
- D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- E. Cellular Glass: Inorganic, incombustible, foamed or cellulated glass with annealed, rigid, hermetically sealed cells. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 1. Block Insulation: ASTM C 552, Type I.
  - 2. Special-Shaped Insulation: ASTM C 552, Type III.
  - 3. Board Insulation: ASTM C 552, Type IV.
  - 4. Preformed Pipe Insulation without Jacket: Comply with ASTM C 552, Type II, Class 1.
  - 5. Preformed Pipe Insulation with Factory-Applied ASJ: Comply with ASTM C 552, Type II, Class 2.
  - 6. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 1290, Type I.
- G. Mineral-Fiber, Preformed Pipe Insulation:
  - 1. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
  - 2. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
- H. Mineral-Fiber, Pipe Insulation Wicking System: Preformed pipe insulation complying with ASTM C 547, Type I, Grade A, with absorbent cloth factory-applied to the entire inside surface of preformed pipe insulation and extended through the longitudinal joint to outside surface of insulation under insulation jacket. Factory apply a white, polymer, vapor-retarder jacket with self-sealing adhesive tape seam and evaporation holes running continuously along the longitudinal seam, exposing the absorbent cloth.

## 2.2 INSULATING CEMENTS

- A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

## 2.3 ADHESIVES

- A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.
- B. Cellular-Glass Adhesive: Two-component, thermosetting urethane adhesive containing no flammable solvents, with a service temperature range of minus 100 to plus 200 deg F.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
  - 1. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. PVC Jacket Adhesive: Compatible with PVC jacket.
  - 1. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
  - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
  - 1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
  - 4. Color: White.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
  - 1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
  - 2. Service Temperature Range: Minus 20 to plus 180 deg F.
  - 3. Solids Content: 60 percent by volume and 66 percent by weight.
  - 4. Color: White.

## 2.5 SEALANTS

- A. Joint Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Permanently flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 100 to plus 300 deg F.
  - 4. Color: White or gray.
  - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. FSK and Metal Jacket Flashing Sealants:
  - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
  - 2. Fire- and water-resistant, flexible, elastomeric sealant.
  - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
  - 4. Color: Aluminum.
  - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."



## C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.
5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## 2.6 FACTORY-APPLIED JACKETS

## A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.
3. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
4. FSP Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
5. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
6. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perm when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
7. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.
8. Vinyl Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

## 2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

## 2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

- B. FSK Jacket: Aluminum-foil face, fiberglass-reinforced scrim with kraft-paper backing.
- C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.
  - 1. Adhesive: As recommended by jacket material manufacturer.
  - 2. Color: Color-code jackets based on system. Color as selected by Architect.
  - 3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.
    - a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.
- D. Self-Adhesive Outdoor Jacket: 60-mil-thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a cross-laminated polyethylene film covered with white aluminum-foil facing.
- E. PVDC Jacket for Indoor Applications: 4-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.02 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 20 when tested according to ASTM E 84.
- F. PVDC Jacket for Outdoor Applications: 6-mil-thick, white PVDC biaxially oriented barrier film with a permeance at 0.01 perms when tested according to ASTM E 96/E 96M and with a flame-spread index of 5 and a smoke-developed index of 25 when tested according to ASTM E 84.
- G. PVDC-SSL Jacket: PVDC jacket with a self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip.

## 2.9 TAPES

- A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 11.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.
  - 5. Tensile Strength: 40 lbf/inch in width.
  - 6. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.
- B. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
  - 1. Width: 3 inches.
  - 2. Thickness: 6.5 mils.
  - 3. Adhesion: 90 ounces force/inch in width.
  - 4. Elongation: 2 percent.

5. Tensile Strength: 40 lbf/inch in width.
  6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.
- C. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.
1. Width: 2 inches.
  2. Thickness: 6 mils.
  3. Adhesion: 64 ounces force/inch in width.
  4. Elongation: 500 percent.
  5. Tensile Strength: 18 lbf/inch in width.
- D. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.
1. Width: 2 inches.
  2. Thickness: 3.7 mils.
  3. Adhesion: 100 ounces force/inch in width.
  4. Elongation: 5 percent.
  5. Tensile Strength: 34 lbf/inch in width.
- E. PVDC Tape for Indoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Width: 3 inches.
  2. Film Thickness: 4 mils.
  3. Adhesive Thickness: 1.5 mils.
  4. Elongation at Break: 145 percent.
  5. Tensile Strength: 55 lbf/inch in width.
- F. PVDC Tape for Outdoor Applications: White vapor-retarder PVDC tape with acrylic adhesive.
1. Width: 3 inches.
  2. Film Thickness: 6 mils.
  3. Adhesive Thickness: 1.5 mils.
  4. Elongation at Break: 145 percent.
  5. Tensile Strength: 55 lbf/inch in width.
- 2.10 SECUREMENTS
- A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing seal or closed seal.
  - B. Staples: Outward-clinching insulation staples, nominal 3/4-inch-wide, stainless steel or Monel.
  - C. Wire: 0.080-inch nickel-copper alloy.

## PART 3 - EXECUTION

## 3.1 PREPARATION

- A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.
- B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

## 3.2 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.
- C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.
- D. Install insulation with longitudinal seams at top and bottom of horizontal runs.
- E. Install multiple layers of insulation with longitudinal and end seams staggered.
- F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.
- G. Keep insulation materials dry during application and finishing.
- H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- I. Install insulation with least number of joints practical.
- J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
  - 1. Install insulation continuously through hangers and around anchor attachments.
  - 2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
  - 3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.
- K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- L. Install insulation with factory-applied jackets as follows:
1. Draw jacket tight and smooth.
  2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
  3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches] o.c.
    - a. For below-ambient services, apply vapor-barrier mastic over staples.
  4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
  5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.
- M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.
- P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
  2. Testing agency labels and stamps.
  3. Nameplates and data plates.
  4. Manholes.
  5. Handholes.
  6. Cleanouts.

### 3.3 PENETRATIONS

- A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor

- insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
  4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.
- C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
1. Seal penetrations with flashing sealant.
  2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
  3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
  4. Seal jacket to wall flashing with flashing sealant.
- D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
1. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.
- F. Insulation Installation at Floor Penetrations:
1. Pipe: Install insulation continuously through floor penetrations.
  2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."

### 3.4 GENERAL PIPE INSULATION INSTALLATION

- A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.
- B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
  2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
  4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
  5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
  6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
  7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
  8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
  9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.
- C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.
- D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
  2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
  3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.

4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

### 3.5 INSTALLATION OF CELLULAR-GLASS INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.



### 3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

#### A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

#### B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

#### C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

#### D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

### 3.7 FIELD-APPLIED JACKET INSTALLATION

#### A. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.

4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
  5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.
- B. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.
1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

### 3.8 FINISHES

- A. Pipe Insulation with ASJ or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
    - a. Finish Coat Material: Interior, flat, latex-emulsion size.
- B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.
- C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- D. Do not field paint aluminum or stainless-steel jackets.

### 3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

## 3.10 PIPING INSULATION SCHEDULE, GENERAL

- A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.
- B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
  - 1. Drainage piping located in crawl spaces.
  - 2. Underground piping.
  - 3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

## 3.11 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and Below: Insulation shall be one of the following:
  - 1. Cellular Glass: 2-1/2 inches thick.
  - 2. Mineral-Fiber, Preformed Pipe, Type I: 2 inch thick.

## 3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

- A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.
- B. If more than one material is listed, selection from materials listed is Contractor's option.
- C. Piping, Concealed:
  - 1. PVC: 20 mils thick.
- D. Piping, Exposed:
  - 1. PVC: 20 mils thick.

END OF SECTION 230719

**SECTION 232113 - HYDRONIC PIPING**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes pipe and fitting materials and joining methods for the following:
  - 1. Hot-water heating piping.
  - 2. Chilled-water piping.
  - 3. Air-vent piping.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:
  - 1. Chemical treatment.
- B. Delegated-Design Submittal:
  - 1. Design calculations and detailed fabrication and assembly of pipe anchors and alignment guides, hangers and supports for multiple pipes, expansion joints and loops, and attachments of the same to the building structure.
  - 2. Locations of pipe anchors and alignment guides and expansion joints and loops.
  - 3. Locations of and details for penetrations, including sleeves and sleeve seals for exterior walls, floors, basement, and foundation walls.
  - 4. Locations of and details for penetration and firestopping for fire and smoke-rated wall, floor, and ceiling assemblies.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.4 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:
  - 1. 125 psig (kPa) at 200 deg F (93 deg C).

2. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

## 2.2 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L (ASTM B 88M, Type B).
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K (ASTM B 88M, Type A).
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Grooved, Mechanical-Joint, Wrought-Copper Fittings: ASME B16.22.
  1. Grooved-End Copper Fittings: ASTM B 75 (ASTM B 75M), copper tube or ASTM B 584, bronze casting.
  2. Grooved-End-Tube Couplings: Rigid pattern unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching pipe and fitting grooves, EPDM gasket rated for minimum 230 deg F (110 deg C) for use with housing, and steel bolts and nuts.
- E. Wrought-Copper Unions: ASME B16.22.

## 2.3 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; welded and seamless, Grade B, and wall thickness as indicated in "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in "Piping Applications" Article.
- E. Cast-Iron Pipe Flanges and Flanged Fittings: ASME B16.1, Classes 25, 125, and 250; raised ground face, and bolt holes spot faced as indicated in "Piping Applications" Article.
- F. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
  1. Material Group: 1.1.
  2. End Connections: Butt welding.
  3. Facings: Raised face.
- G. Grooved Mechanical-Joint Fittings and Couplings:
  1. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 47/A 47M, Grade 32510 malleable iron; ASTM A 53/A 53M, Type F, E, or S, Grade B fabricated steel; or ASTM A 106/A 106M, Grade B steel fittings with grooves or shoulders

constructed to accept grooved-end couplings; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

2. Couplings: Ductile- or malleable-iron housing and EPDM gasket of central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure grooved pipe and fittings.

## 2.4 PLASTIC PIPE AND FITTINGS

- A. CPVC Plastic Pipe: ASTM F 441/F 441M, with wall thickness as indicated in "Piping Applications" Article.
  1. CPVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM F 438 for Schedule 40 pipe; ASTM F 439 for Schedule 80 pipe.
- B. PVC Plastic Pipe: ASTM D 1785, with wall thickness as indicated in "Piping Applications" Article.
  1. PVC Plastic Pipe Fittings: Socket-type pipe fittings, ASTM D 2466 for Schedule 40 pipe; ASTM D 2467 for Schedule 80 pipe.
- C. Polypropylene Pipe with faser: ASTM F 2389 or CSA B137.11
  1. Approved manufacturers:
    - a. Aquatherm
    - b. Pestan

## 2.5 JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.
  1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch (3.2-mm) maximum thickness unless otherwise indicated.
    - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
    - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.
- B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.
- C. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
- D. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- F. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- G. Fusion welding: Comply with all manufacturer's requirements.

## H. Solvent Cements for Joining Plastic Piping:

## 1. CPVC Piping: ASTM F 493.

- a. CPVC solvent cement shall have a VOC content of 490 g/L or less.
- b. Adhesive primer shall have a VOC content of 550 g/L or less.
- c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

## 2. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

- a. PVC solvent cement shall have a VOC content of 510 g/L or less.
- b. Adhesive primer shall have a VOC content of 550 g/L or less.
- c. Solvent cement and adhesive primer shall comply with the testing and product requirements of the California Department of Public Health's (formerly, the California Health Services') "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

- I. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

## 2.6 TRANSITION FITTINGS

## A. Plastic-to-Metal Transition Fittings:

1. One-piece fitting with one threaded brass or copper insert and one solvent-cement-joint end of material and wall thickness to match plastic pipe material.

## B. Plastic-to-Metal Transition Unions:

1. Brass or copper end, solvent-cement-joint end of material and wall thickness to match plastic pipe material, rubber gasket, and threaded union.

## 2.7 DIELECTRIC FITTINGS

- A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

## B. Dielectric Unions:

## 1. Description:

- a. Standard: ASSE 1079.
- b. Pressure Rating: 125 psig (860 kPa) minimum at 180 deg F (82 deg C).
- c. End Connections: Solder-joint copper alloy and threaded ferrous.
- d. Gasket: Garlock Gylon gasket

## PART 3 - EXECUTION

## 3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, 3" and smaller shall be the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
  - 2. Polypropylene pipe, fusion welded. Fire wrap piping in return plenums as necessary.
  - 3. Grooved, Mechanical-Joint, Wrought-Copper Fittings
  
- B. Hot-water heating piping, aboveground, larger than 3" shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints
  - 2. Polypropylene pipe, fusion welded. Fire wrap piping in return plenums as necessary.
  
- C. Chilled-water piping, aboveground, 3" and smaller shall be the following:
  - 1. Type L, drawn-temper copper tubing, wrought-copper fittings, and brazed joints.
  - 2. Polypropylene pipe, fusion welded. Fire wrap piping in return plenums as necessary.
  
- D. Chilled-water piping, aboveground, larger than 3" shall be the following:
  - 1. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints
  - 2. Polypropylene pipe, fusion welded. Fire wrap piping in return plenums as necessary.
  
- E. Air-Vent Piping:
  - 1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to piping manufacturer's written instructions.
  - 2. Outlet: Type K (Type A), annealed-temper copper tubing with soldered or flared joints.

## 3.2 PIPING INSTALLATIONS

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
  
- B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
  
- C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
  
- D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.



- E. Install piping to permit valve servicing.
- F. Install piping at indicated slopes.
- G. Install piping free of sags and bends.
- H. Install fittings for changes in direction and branch connections.
- I. Install piping to allow application of insulation.
- J. Select system components with pressure rating equal to or greater than system operating pressure.
- K. Install groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- L. Install drains, consisting of a tee fitting, NPS 3/4 (DN 20) ball valve, and short NPS 3/4 (DN 20) threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- M. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- N. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- O. Install branch connections to mains using mechanically formed tee fittings in main pipe, with the branch connected to the bottom of the main pipe. For up-feed risers, connect the branch to the top of the main pipe.
- P. Install valves according to Section 230523.11 "Globe Valves for HVAC Piping," Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," Section 230523.14 "Check Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
- Q. Install unions in piping, NPS 2 (DN 50) and smaller, adjacent to valves, at final connections of equipment, and elsewhere as indicated.
- R. Install flanges in piping, NPS 2-1/2 (DN 65) and larger, at final connections of equipment and elsewhere as indicated.
- S. Install shutoff valve immediately upstream of each dielectric fitting.
- T. Comply with requirements in Section 230516 "Expansion Fittings and Loops for HVAC Piping" for installation of expansion loops, expansion joints, anchors, and pipe alignment guides.
- U. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for identifying piping.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

### 3.3 DIELECTRIC FITTING INSTALLATION

- A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.
- B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.
- C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric flanges.
- D. Dielectric Fittings for NPS 5 (DN 125) and Larger: Use dielectric flange kits.

### 3.4 HANGERS AND SUPPORTS

- A. Install the following pipe attachments:
  - 1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet (6 m) long.
  - 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet (6 m) or longer.
  - 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet (6 m) or longer, supported on a trapeze.
  - 4. Spring hangers to support vertical runs.
  - 5. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
  - 6. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.
- B. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4 (DN 20): Maximum span, 7 feet (2.1 m).
  - 2. NPS 1 (DN 25): Maximum span, 7 feet (2.1 m).
  - 3. NPS 1-1/2 (DN 40): Maximum span, 9 feet (2.7 m).
  - 4. NPS 2 (DN 50): Maximum span, 10 feet (3 m).
  - 5. NPS 2-1/2 (DN 65): Maximum span, 11 feet (3.4 m).
  - 6. NPS 3 (DN 80) and Larger: Maximum span, 12 feet (3.7 m).
- C. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
  - 1. NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
  - 2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).

3. NPS 1-1/4 (DN 32): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 3 (DN 80) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

- D. Support vertical runs at roof, at each floor, and at 10-foot (3-m) intervals between floors.

### 3.5 PIPE JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.
- D. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8/A5.8M.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
  2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- F. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness. Use grooved-end fittings and rigid, grooved-end-pipe couplings.
- H. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

### 3.6 TERMINAL EQUIPMENT CONNECTIONS

- A. Sizes for supply and return piping connections shall be the same as or larger than equipment connections.

- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure gages and thermometers at coil inlet and outlet connections. Comply with requirements in Section 230519 "Meters and Gages for HVAC Piping."

### 3.7 CHEMICAL TREATMENT

- A. Fill system with fresh water and add liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products from piping. Circulate solution for a minimum of 24 hours, drain, clean strainer screens, and refill with fresh water.
- B. Add initial chemical treatment and maintain water quality in ranges noted above for the first year of operation.

### 3.8 FIELD QUALITY CONTROL

- A. Prepare hydronic piping according to ASME B31.9 and as follows:
  - 1. Leave joints, including welds, uninsulated and exposed for examination during test.
  - 2. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
  - 3. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.
  - 4. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
  - 5. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.
- B. Perform the following tests on hydronic piping:
  - 1. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
  - 2. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
  - 3. Isolate expansion tanks and determine that hydronic system is full of water.
  - 4. Subject piping system to hydrostatic test pressure that is not less than 1.5 times the system's working pressure. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times the "SE" value in Appendix A in ASME B31.9, "Building Services Piping."

5. After hydrostatic test pressure has been applied for at least 10 minutes, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
  6. Prepare written report of testing.
- C. Perform the following before operating the system:
1. Open manual valves fully.
  2. Inspect pumps for proper rotation.
  3. Set makeup pressure-reducing valves for required system pressure.
  4. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
  5. Set temperature controls so all coils are calling for full flow.
  6. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
  7. Verify lubrication of motors and bearings.

END OF SECTION 232113

**SECTION 232116 - HYDRONIC PIPING SPECIALTIES**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section includes special-duty valves and specialties for the following:

1. Hot-water heating piping.
2. Air-vent piping.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of the following:

1. Valves: Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
2. Air-control devices.
3. Hydronic specialties.

## 1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.4 QUALITY ASSURANCE

- A. ASME Compliance: Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Hydronic piping components and installation shall be capable of withstanding the following minimum working pressure and temperature unless otherwise indicated:

1. 125 psig (kPa) at 200 deg F (93 deg C).
2. Safety-Valve-Inlet and -Outlet Piping: Equal to the pressure of the piping system to which it is attached.

## 2.2 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Section 230523.11 "Globe Valves for HVAC Piping," Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," Section 230523.14 "Check Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Section 230923.11 "Control Valves" Section 15901 "Control Valves."
- C. Bronze, Calibrated-Orifice, Balancing Valves:
1. Body: Bronze, ball or plug type with calibrated orifice or venturi.
  2. Ball: Brass or stainless steel.
  3. Plug: Resin.
  4. Seat: PTFE.
  5. End Connections: Threaded or socket.
  6. Pressure Gage Connections: Integral seals for portable differential pressure meter.
  7. Handle Style: Lever, with memory stop to retain set position.
  8. CWP Rating: Minimum 125 psig (860 kPa).
  9. Maximum Operating Temperature: 250 deg F (121 deg C).
- D. Diaphragm-Operated, Pressure-Reducing Valves: ASME labeled.
1. Body: Bronze or brass.
  2. Disc: Glass and carbon-filled PTFE.
  3. Seat: Brass.
  4. Stem Seals: EPDM O-rings.
  5. Diaphragm: EPT.
  6. Low inlet-pressure check valve.
  7. Inlet Strainer: Removable without system shutdown.
  8. Valve Seat and Stem: Noncorrosive.
  9. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- E. Diaphragm-Operated Safety Valves: ASME labeled.
1. Body: Bronze or brass.
  2. Disc: Glass and carbon-filled PTFE.
  3. Seat: Brass.
  4. Stem Seals: EPDM O-rings.
  5. Diaphragm: EPT.
  6. Wetted, Internal Work Parts: Brass and rubber.
  7. Inlet Strainer: Removable without system shutdown.
  8. Valve Seat and Stem: Noncorrosive.
  9. Valve Size, Capacity, and Operating Pressure: Comply with ASME Boiler and Pressure Vessel Code: Section IV, and selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.

## 2.3 AIR-CONTROL DEVICES

### A. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2 (DN 15).
5. Discharge Connection: NPS 1/8 (DN 6).
6. CWP Rating: 150 psig (1035 kPa).
7. Maximum Operating Temperature: 225 deg F (107 deg C).

## 2.4 HYDRONIC PIPING SPECIALTIES

### A. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 (DN 50) and smaller; flanged ends for NPS 2-1/2 (DN 65) and larger.
3. Strainer Screen: Stainless-steel, 60-mesh strainer, or perforated stainless-steel basket.
4. CWP Rating: 125 psig (860 kPa).

## PART 3 - EXECUTION

### 3.1 VALVE APPLICATIONS

- A. Install shutoff-duty valves at each branch connection to supply mains and at supply connection to each piece of equipment.
- B. Install calibrated-orifice, balancing valves at each branch connection to return main.
- C. Install calibrated-orifice, balancing valves in the return pipe of each heating or cooling terminal.
- D. Install check valves at each pump discharge and elsewhere as required to control flow direction.
- E. Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, for installation requirements.
- F. Install pressure-reducing valves at makeup-water connection to regulate system fill pressure.



### 3.2 HYDRONIC SPECIALTIES INSTALLATION

- A. Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting.
- B. Install piping from boiler air outlet, air separator, or air purger to expansion tank with a 2 percent upward slope toward tank.
- C. Install in-line air separators in pump suction. Install drain valve on air separators NPS 2 (DN 50) and larger.
- D. Install expansion tanks above the air separator. Install tank fitting in tank bottom and charge tank. Use manual vent for initial fill to establish proper water level in tank.
  - 1. Install tank fittings that are shipped loose.
  - 2. Support tank from floor or structure above with sufficient strength to carry weight of tank, piping connections, fittings, plus tank full of water. Do not overload building components and structural members.
- E. Install expansion tanks on the floor. Vent and purge air from hydronic system, and ensure that tank is properly charged with air to suit system Project requirements.

END OF SECTION 232116

**SECTION 233113 - METAL DUCTS**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Single-wall rectangular ducts and fittings.
  - 2. Single-wall round ducts and fittings.
  - 3. Sheet metal materials.
  - 4. Sealants and gaskets.
  - 5. Hangers and supports.
  - 6. Seismic-restraint devices.
- B. Related Sections:
  - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
  - 2. Section 233300 "Air Duct Accessories" for dampers, duct-mounting access doors and panels, turning vanes, and flexible ducts.

## 1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
  - 1. Seismic Hazard Level A: Seismic force to weight ratio, 0.48.
  - 2. Seismic Hazard Level B: Seismic force to weight ratio, 0.30.
  - 3. Seismic Hazard Level C: Seismic force to weight ratio, 0.15.
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

## 1.4 QUALITY ASSURANCE

- A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."
- B. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

## PART 2 - PRODUCTS

## 2.1 GENERAL

- A. HVAC Duct shall be fabricated from galvanized steel in accordance with SMACNA requirements. Abrasive, corrosive, or hazardous materials shall be conveyed by systems described in Industrial Ventilation, latest edition, in harmony with the Fume Hood Section of these Design Standards. Nonmetallic duct shall not be used.
- B. All seams of ducts shall be sealed with mastic or mastic plus tape or gasketing as appropriate to limit the air leakage to SMACNA requirements.
- C. Flexible ductwork shall only be used at terminal units and shall not exceed eight feet. Hard turns, offsets, or kinks will not be allowed. Provide duct supports every three feet.
- D. High pressure ductwork shall be galvanized steel spiral lockseam construction.
- E. The high pressure duct and fittings shall be manufactured by the same firm.
- F. High pressure ductwork shall be tested and total allowable leakage of the system shall not exceed SMACNA requirements.

## 2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS – SEAL CLASS A

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Lindab Inc.

- b. McGill AirFlow LLC.
- c. SEMCO Incorporated.
- d. Sheet Metal Connectors, Inc.
- e. Spiral Manufacturing Co., Inc.

- B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Transverse Joints in Ducts Larger Than 60 Inches (1524 mm) in Diameter: Flanged.
- C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  - 1. Fabricate round ducts larger than 90 inches (2286 mm) in diameter with butt-welded longitudinal seams.
  - 2. Fabricate flat-oval ducts larger than 72 inches (1830 mm) in width (major dimension) with butt-welded longitudinal seams.
- D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

## 2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 (Z180).
  - 2. Finishes for Surfaces Exposed to View: Mill phosphatized.

## 2.5 SEALANT AND GASKETS

- A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
- B. Two-Part Tape Sealing System:
  - 1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
  - 2. Tape Width: 3 inches (76 mm).
  - 3. Sealant: Modified styrene acrylic.

4. Water resistant.
  5. Mold and mildew resistant.
  6. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
  7. Service: Indoor and outdoor.
  8. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
  10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Water-Based Joint and Seam Sealant:
1. Application Method: Brush on.
  2. Solids Content: Minimum 65 percent.
  3. Shore A Hardness: Minimum 20.
  4. Water resistant.
  5. Mold and mildew resistant.
  6. VOC: Maximum 75 g/L (less water).
  7. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive and negative.
  8. Service: Indoor or outdoor.
  9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
  10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  11. VOC: Maximum 395 g/L.
  12. Maximum Static-Pressure Class: 10-inch wg (2500 Pa), positive or negative.
  13. Service: Indoor or outdoor.
  14. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- D. Flanged Joint Sealant: Comply with ASTM C 920.
1. General: Single-component, acid-curing, silicone, elastomeric.
  2. Type: S.
  3. Grade: NS.
  4. Class: 25.
  5. Use: O.
  6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg (0.14 L/s per sq. m at 250 Pa) and shall be rated for 10-inch wg (2500-Pa) static-pressure class, positive or negative.
  2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
  3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.
- 2.6 HANGERS AND SUPPORTS
- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

- B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports:
  - 1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
  - 2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
  - 3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

## 2.7 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Cooper B-Line, Inc.; a division of Cooper Industries.
  - 2. Ductmate Industries, Inc.
  - 3. Hilti Corp.
  - 4. Kinetics Noise Control.
  - 5. Loos & Co.; Cableware Division.
  - 6. Mason Industries.
  - 7. TOLCO; a brand of NIBCO INC.
  - 8. Unistrut Corporation; Tyco International, Ltd..
- B. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- D. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; and with an automatic-locking and clamping device or double-cable clips.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

- F. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

## PART 3 - EXECUTION

### 3.1 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.
- B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install round ducts in maximum practical lengths.
- D. Install ducts with fewest possible joints.
- E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- H. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

### 3.2 DUCT SEALING

- A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

- B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
  2. Outdoor, Supply-Air Ducts: Seal Class A.
  3. Outdoor, Exhaust Ducts: Seal Class C.
  4. Outdoor, Return-Air Ducts: Seal Class C.
  5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class B.
  6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class A.
  7. Unconditioned Space, Exhaust Ducts: Seal Class C.
  8. Unconditioned Space, Return-Air Ducts: Seal Class B.
  9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg (500 Pa) and Lower: Seal Class C.
  10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg (500 Pa): Seal Class B.
  11. Conditioned Space, Exhaust Ducts: Seal Class B.
  12. Conditioned Space, Return-Air Ducts: Seal Class C.

### 3.3 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.
  2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches (100 mm) thick.
  4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches (100 mm) thick.
  5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1 (Table 5-1M), "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches (610 mm) of each elbow and within 48 inches (1200 mm) of each branch intersection.
- D. Hangers Exposed to View: Threaded rod and angle or channel supports.
- E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet (5 m).
- F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.



### 3.4 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install ducts with hangers and braces designed to support the duct and to restrain against seismic forces required by applicable building codes. Comply with SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
  - 1. Space lateral supports a maximum of 40 feet (12 m) o.c., and longitudinal supports a maximum of 80 feet (24 m) o.c.
  - 2. Brace a change of direction longer than 12 feet (3.7 m).
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on ducts that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.
- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

### 3.5 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:

1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
  2. Test the following systems:
    - a. Ducts with a Pressure Class Higher Than 3-Inch wg (750 Pa): Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
    - b. Supply Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - c. Return Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - d. Exhaust Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 25 percent of total installed duct area for each designated pressure class.
    - e. Outdoor Air Ducts with a Pressure Class of 2-Inch wg (500 Pa) or Higher: Test representative duct sections totaling no less than 100 percent of total installed duct area for each designated pressure class.
  3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
  4. Test for leaks before applying external insulation.
  5. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
  6. Give seven days' advance notice for testing.
- C. Duct System Cleanliness Tests:
1. Visually inspect duct system to ensure that no visible contaminants are present.
  2. Test sections of metal duct system, chosen randomly by Owner, for cleanliness according to "Vacuum Test" in NADCA ACR, "Assessment, Cleaning and Restoration of HVAC Systems."
    - a. Acceptable Cleanliness Level: Net weight of debris collected on the filter media shall not exceed 0.75 mg/100 sq. cm.
- D. Duct system will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.
- 3.7 DUCT CLEANING
- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
  - B. Use service openings for entry and inspection.
    1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner

- manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
  3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
  2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing 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, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
  6. Supply-air ducts, dampers, actuators, and turning vanes.
  7. Dedicated exhaust and ventilation components and makeup air systems.
- E. 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 duct sections 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, duct liner, or duct accessories.
  4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; 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 drainage and cleanup for wash-down procedures.
  7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.

## 3.8 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner or any ductwork noted on mechanical plans that require painting. Apply one coat of flat, latex paint over a compatible galvanized-steel primer.

## 3.9 START UP

- A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

## 3.10 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:

## 3.11 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
  - 1. Underground Ducts: Concrete-encased, PVC-coated, galvanized sheet steel with thicker coating on duct exterior or pre-insulated high-density polyethylene.
- B. Supply Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 1-inch wg (250 Pa).
    - b. Minimum SMACNA Seal Class: C.
    - c. SMACNA Leakage Class for Rectangular: 24.
    - d. SMACNA Leakage Class for Round and Flat Oval: 24.
  - 2. Ducts Connected to Variable-Air-Volume Air-Handling Units:
    - a. Pressure Class: Positive 4-inch wg (1000 Pa).
    - b. Minimum SMACNA Seal Class: A.
    - c. SMACNA Leakage Class for Rectangular: 6.
    - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- C. Return Ducts:
  - 1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:
    - a. Pressure Class: Positive 1-inch wg (250 Pa).
    - b. Minimum SMACNA Seal Class: C.
    - c. SMACNA Leakage Class for Rectangular: 24.
    - d. SMACNA Leakage Class for Round and Flat Oval: 24.
  - 2. Ducts Connected to Air-Handling Units:
    - a. Pressure Class: Positive or negative 3-inch wg (750 Pa).
    - b. Minimum SMACNA Seal Class: A.
    - c. SMACNA Leakage Class for Rectangular: 6.

- d. SMACNA Leakage Class for Round and Flat Oval: 6.
- D. Exhaust Ducts:
- 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
    - a. Pressure Class: Negative 3-inch wg (750 Pa).
    - b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.
    - c. SMACNA Leakage Class for Rectangular: 12.
    - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- E. Intermediate Reinforcement:
- 1. Galvanized-Steel Ducts: Galvanized steel.
- F. Liner (**Duct liner is not allowed**):
- G. Elbow Configuration:
- 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Velocity 1000 fpm (5 m/s) or Lower:
      - 1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
      - 2) Mitered Type RE 4 without vanes.
    - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s):
      - 1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
    - c. Velocity 1500 fpm (7.6 m/s) or Higher:
      - 1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
      - 2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
      - 3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
  - 2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
    - a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
    - b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
    - c.
  - 3. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."
    - a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.
      - 1) Velocity 1000 fpm (5 m/s) or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
      - 2) Velocity 1000 to 1500 fpm (5 to 7.6 m/s): 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.

- 3) Velocity 1500 fpm (7.6 m/s) or Higher: 1.5 radius-to-diameter ratio and five segments for 90-degree elbow.
  - 4) Radius-to Diameter Ratio: 1.5.
  - b. Round Elbows, 12 Inches (305 mm) and Smaller in Diameter: Stamped or pleated.
  - c. Round Elbows, 14 Inches (356 mm) and Larger in Diameter.
- H. Branch Configuration:
1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    - a. Rectangular Main to Rectangular Branch: 45-degree entry.
  2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    - a. Velocity 1000 fpm (5 m/s) or Lower: 90-degree tap.
    - b. Velocity 1000 to 1500 fpm (5 to 7.6 m/s): Conical tap.
    - c. Velocity 1500 fpm (7.6 m/s) or Higher: 45-degree lateral.

END OF SECTION 233113

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**SECTION 233300 - AIR DUCT ACCESSORIES**

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
  - 1. Manual volume dampers.
  - 2. Fire dampers.
  - 3. Combination fire and smoke dampers.
  - 4. Turning vanes.
  - 5. Duct-mounted access doors.
  - 6. Flexible connectors.
  - 7. Flexible ducts.
  - 8. Duct accessory hardware.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
  - 1. Galvanized Coating Designation: G60 (Z180).
  - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2.



- C. Aluminum Sheets: Comply with ASTM B 209 (ASTM B 209M), Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221 (ASTM B 221M), Alloy 6063, Temper T6.
- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch (6-mm) minimum diameter for lengths 36 inches (900 mm) or less; 3/8-inch (10-mm) minimum diameter for lengths longer than 36 inches (900 mm).

## 2.3 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Air Balance Inc.; a division of Mestek, Inc.
    - b. American Warming and Ventilating; a division of Mestek, Inc.
    - c. Flexmaster U.S.A., Inc.
    - d. McGill AirFlow LLC.
    - e. Nailor Industries Inc.
    - f. Pottorff.
    - g. Ruskin Company.
    - h. Trox USA Inc.
    - i. Vent Products Company, Inc.
  - 2. Standard leakage rating
  - 3. Suitable for horizontal or vertical applications.
  - 4. Frames:
    - a. Frame: Hat-shaped, 0.094-inch- (2.4-mm-) thick, galvanized sheet steel.
    - b. Mitered and welded corners.
    - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
  - 5. Blades:
    - a. Multiple or single blade.
    - b. Parallel- or opposed-blade design.
    - c. Stiffen damper blades for stability.
    - d. Galvanized-steel, 0.064 inch (1.62 mm) thick.
  - 6. Blade Axles: Galvanized steel.
  - 7. Bearings:
    - a. Oil-impregnated bronze.
    - b. Dampers in ducts with pressure classes of 3-inch wg (750 Pa) or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
  - 8. Tie Bars and Brackets: Galvanized steel.

## 2.4 FIRE DAMPERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
  - 1. Greenheck Fan Corporation.
  - 2. Nailor Industries Inc.

3. Pottorff.
4. Ruskin Company.

- B. Type: Static and dynamic; rated and labeled in accordance with UL 555 by an NRTL.
- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000 fpm (1 m/s) velocity.
- D. Fire Rating: 1-1/2 hours.
- E. Frame: Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed galvanized steel; with mitered and interlocking corners; gauge in accordance with UL listing.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel; gauge in accordance with UL listing.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. Blades: Roll-formed galvanized sheet steel, interlocking full-length steel blade connectors. Material gauge is to be in accordance with UL listing.
- I. Horizontal Dampers: Include blade lock and stainless steel closure spring.
- J. Heat-Responsive Device:
  1. Replaceable, 165 deg F (74 deg C) rated, fusible links.

## 2.5 COMBINATION FIRE AND SMOKE DAMPERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide or comparable product by one of the following:
  1. Greenheck Fan Corporation.
  2. Nailor Industries Inc.
  3. Pottorff.
  4. Ruskin Company.
- B. General Requirements:
  1. Label to indicate conformance to UL 555 and UL 555S by an NRTL.
  2. Label to indicate conformance to NFPA 80 and NFPA 90A by an NRTL.
  3. Unless otherwise indicated, use parallel-blade configuration.
- C. Closing rating in ducts up to 4-inch wg (1-kPa) static pressure class and minimum 2000 fpm (10 m/s) velocity.
- D. Fire Rating: 1-1/2
- E. Performance:
  1. AMCA Certification: Test and rate in accordance with AMCE Publication 511.

2. Leakage:
    - a. Class I: Leakage shall not exceed 4 cfm/sq. ft. (20 L/s/ per sq. m) against 1-inch wg (250-Pa) differential static pressure.
  3. Pressure Drop: 0.05 in. wg (12.5 Pa) at 1500 fpm (7.6 m/s) across a 24-by-24-inch (600-by-600-mm) damper when tested in accordance with AMCA 500-D, Figure 5.3.
  4. Velocity: Up to 3000 fpm (15 m/s).
  5. Temperature: Minus 25 to plus 180 deg F (Minus 32 to plus 83 deg C).
  6. Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
- F. Construction:
1. Suitable for horizontal or vertical airflow applications.
  2. Linkage out of airstream.
  3. Frame:
    - a. Hat shaped.
    - b. Galvanized sheet steel, with welded interlocking, gusseted or mechanically attached corners and mounting flange.
    - c. Gauge is to be in accordance with UL listing.
  4. Blades:
    - a. Roll-formed, horizontal, airfoil or extruded aluminum.
    - b. Maximum width and gauge in accordance with UL listing.
  5. Blade Edging Seals:
    - a. Silicone rubber.
  6. Blade Jamb Seal: Flexible stainless steel, compression type.
  7. Blade Axles: 1/2-inch- (13-mm-) diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings. Linkage mounted out of airstream.
  8. Bearings:
    - a. Molded synthetic.
- G. Mounting Sleeve:
1. Factory installed, galvanized sheet steel.
  2. Length to suit wall or floor application.
  3. Gauge in accordance with UL listing.
- H. Heat-Responsive Device:
1. Electric resettable device and switch package, factory installed, rated.
- I. Master control panel for use in dynamic smoke-management systems.
- J. Damper Actuator - Electric:

1. Electric - 24 V ac.
2. UL 873, plenum rated.
3. Designed to operate in smoke-control systems complying with UL 555S requirements.
4. Two position with fail-safe spring return.
  - a. Sufficient motor torque and spring torque to drive damper fully open and fully closed with adequate force to achieve required damper seal.
  - b. Maximum 15-second full-stroke closure.
  - c. Minimum 90-degree drive rotation.
5. Clockwise or counterclockwise drive rotation as required for application.
6. Environmental Operating Range:
  - a. Temperature: Minus 40 to plus 130 deg F ((Minus 40 to plus 55 deg C)).
  - b. Humidity: 5 to 95 percent relative humidity noncondensing.
7. Environmental Enclosure: NEMA 2.
8. Actuator to be factory mounted and provided with single-point wiring connection.

K. Controllers, Electrical Devices, and Wiring:

1. Comply with requirements for electrical devices and connections specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."
2. Electrical Connection: 24 V, 60 Hz.

L. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Momentary test switch Test and reset switches, damper remote mounted.
3. Smoke Detector: Integral, factory wired for single-point connection.

## 2.6 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Elgen Manufacturing.
4. METALAIRE, Inc.
5. SEMCO Incorporated.
6. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vaness and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Single wall.
- E. Vane Construction: Single wall for ducts up to 48 inches (1200 mm) wide and double wall for larger dimensions.

## 2.7 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Pottorff.
  - 2. Ventfabrics, Inc.
  - 3. Young Regulator Company..
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.
- E. Wall-Box Mounting: Recessed.
- F. Wall-Box Cover-Plate Material: Steel.

## 2.8 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. American Warming and Ventilating; a division of Mestek, Inc.
  - 2. Cesco Products; a division of Mestek, Inc.
  - 3. Ductmate Industries, Inc.
  - 4. Elgen Manufacturing.
  - 5. Flexmaster U.S.A., Inc.
  - 6. Greenheck Fan Corporation.
  - 7. McGill AirFlow LLC.
  - 8. Nailor Industries Inc.
  - 9. Pottorff.
  - 10. Ventfabrics, Inc.
  - 11. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2 (7-2M), "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."
  - 1. Door:
    - a. Double wall, rectangular.
    - b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
    - c. Vision panel.

- d. Hinges and Latches: 1-by-1-inch (25-by-25-mm) butt or piano hinge and cam latches.
- e. Fabricate doors airtight and suitable for duct pressure class.
2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:
  - a. Access Doors Less Than 12 Inches (300 mm) Square: No hinges and two sash locks.
  - b. Access Doors up to 18 Inches (460 mm) Square: Continuous and two sash locks.
  - c. Access Doors up to 24 by 48 Inches (600 by 1200 mm): Continuous and two compression latches with outside and inside handles.
  - d. Access Doors Larger Than 24 by 48 Inches (600 by 1200 mm): Continuous and two compression latches with outside and inside handles.

## 2.9 FLEXIBLE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Ductmate Industries, Inc.
  2. Duro Dyne Inc.
  3. Elgen Manufacturing.
  4. Ventfabrics, Inc.
  5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Materials: Flame-retardant or noncombustible fabrics.
- C. Coatings and Adhesives: Comply with UL 181, Class 1.
- D. Metal-Edged Connectors: Factory fabricated with a fabric strip 3-1/2 inches (89 mm) wide attached to two strips of 2-3/4-inch- (70-mm-) wide, 0.028-inch- (0.7-mm-) thick, galvanized sheet steel or 0.032-inch- (0.8-mm-) thick aluminum sheets. Provide metal compatible with connected ducts.
- E. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.
  1. Minimum Weight: 26 oz./sq. yd. (880 g/sq. m).
  2. Tensile Strength: 480 lbf/inch (84 N/mm) in the warp and 360 lbf/inch (63 N/mm) in the filling.
  3. Service Temperature: Minus 40 to plus 200 deg F (Minus 40 to plus 93 deg C).

## 2.10 FLEXIBLE DUCTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  1. Flexmaster U.S.A., Inc.
  2. McGill AirFlow LLC.
  3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Insulated, Flexible Duct: UL 181, Class 1, black polymer film supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene vapor-barrier film.
  1. Pressure Rating: 4-inch wg (1000 Pa) positive and 0.5-inch wg (125 Pa) negative.
  2. Maximum Air Velocity: 4000 fpm (20 m/s).

3. Temperature Range: Minus 20 to plus 175 deg F (Minus 29 to plus 79 deg C).
4. Insulation R-Value: Comply with ASHRAE/IESNA 90.1.

C. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches (75 through 460 mm), to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
  1. Install steel volume dampers in steel ducts.
- D. Set dampers to fully open position before testing, adjusting, and balancing.
- E. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
- F. Install access doors with swing against duct static pressure.
- G. Access Door Sizes:
  1. One-Hand or Inspection Access: 8 by 5 inches (200 by 125 mm).
  2. Two-Hand Access: 12 by 6 inches (300 by 150 mm).
  3. Head and Hand Access: 18 by 10 inches (460 by 250 mm).
  4. Head and Shoulders Access: 21 by 14 inches (530 by 355 mm).
  5. Body Access: 25 by 14 inches (635 by 355 mm).
  6. Body plus Ladder Access: 25 by 17 inches (635 by 430 mm).
- H. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- I. Install flexible connectors to connect ducts to equipment.
- J. For fans developing static pressures of 5-inch wg (1250 Pa) and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- K. Connect terminal units to supply ducts with maximum 12-inch (300-mm) lengths of flexible duct. Do not use flexible ducts to change directions.

- L. Connect diffusers or light troffer boots to ducts in-directly with maximum 36-inch (900-mm) lengths of flexible duct clamped or strapped in place. Do not use flexible ducts to change directions.
- M. Connect flexible ducts to metal ducts with liquid adhesive plus clamp-type draw bands.
- N. Install thrust limits at centerline of thrust, symmetrical on both sides of equipment. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop of fans.

### 3.2 FIELD QUALITY CONTROL

- A. Tests and Inspections:
  - 1. Operate dampers to verify full range of movement.
  - 2. Inspect locations of access doors and verify that purpose of access door can be performed.
  - 3. Inspect turning vanes for proper and secure installation.
  - 4. Operate remote damper operators to verify full range of movement of operator and damper.

END OF SECTION 233300



**SECTION 233600 - AIR TERMINAL UNITS**

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. Section Includes:
  - 1. Modulating, single-duct air terminal units.

## 1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. LEED Submittals:
  - 1. Product Data for Prerequisite EQ 1: Documentation indicating that units comply with ASHRAE 62.1, Section 5 - "Systems and Equipment."
- C. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
- D. Delegated-Design Submittal:
  - 1. Materials, fabrication, assembly, and spacing of hangers and supports.
  - 2. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers and supports and seismic restraints.

## 1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

## 1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

## 1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-Up."

## PART 2 - PRODUCTS

## 2.1 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Hangers and supports and seismic restraints shall withstand the effects of gravity and seismic loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and ASCE/SEI 7.

## 2.2 MODULATING, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Krueger.
  2. Price Industries.
  3. Titus.
  4. Trane.
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.032-inch (0.8-mm) aluminum, single wall.
1. Casing Lining: Adhesive attached, 1-inch- (25-mm-) thick, polyurethane foam insulation complying with UL 181 erosion requirements, and having a maximum flame-spread index of 25 and a maximum smoke-developed index of 50, for both insulation and adhesive, when tested according to ASTM E 84.
  2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
  3. Air Outlet: S-slip and drive connections, size matching inlet size.
  4. Access: Removable panels for access to parts requiring service, adjustment, or maintenance; with airtight gasket.
  5. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, percent of nominal airflow at 6-inch wg (1500-Pa) inlet static pressure.
  2. Damper Position: Normally closed.
- E. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch (2.5 mm), and rated for a minimum working pressure of 200 psig (1380 kPa) and a maximum entering-water temperature of 220 deg F (104 deg C). Include manual air vent and drain valve.
- F. Direct Digital Controls: Single-package unitary controller and actuator specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

## 2.3 HANGERS AND SUPPORTS

- A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

- B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.
- C. Steel Cables: Galvanized steel complying with ASTM A 603.
- D. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.
- E. Air Terminal Unit Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- F. Trapeze and Riser Supports: Steel shapes and plates for units with steel casings; aluminum for units with aluminum casings.

#### 2.4 SEISMIC-RESTRAINT DEVICES

- A. General Requirements for Restraint Components: Rated strengths, features, and applications shall be as defined in reports by an agency acceptable to authorities having jurisdiction.
  - 1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- B. Channel Support System: Shop- or field-fabricated support assembly made of slotted steel channels rated in tension, compression, and torsion forces and with accessories for attachment to braced component at one end and to building structure at the other end. Include matching components and corrosion-resistant coating.
- C. Restraint Cables: ASTM A 603, galvanized-steel cables with end connections made of cadmium-plated steel assemblies with brackets, swivel, and bolts designed for restraining cable service; with an automatic-locking and clamping device or double-cable clips.
- D. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

#### 2.5 SOURCE QUALITY CONTROL

- A. Factory Tests: Test assembled air terminal units according to ARI 880.
  - 1. Label each air terminal unit with plan number, nominal airflow, maximum and minimum factory-set airflows, coil type, and ARI certification seal.

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. Install air terminal units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems."
- B. Install air terminal units level and plumb. Maintain sufficient clearance for normal service and maintenance.
- C. Install wall-mounted thermostats.

## 3.2 HANGER AND SUPPORT INSTALLATION

- A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."
- B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
  - 1. Where practical, install concrete inserts before placing concrete.
  - 2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
  - 3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes and for slabs more than 4 inches (100 mm) thick.
  - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches (100 mm) thick.
  - 5. Do not use powder-actuated concrete fasteners for seismic restraints.
- C. Hangers Exposed to View: Threaded rod and angle or channel supports.
- D. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

## 3.3 SEISMIC-RESTRAINT-DEVICE INSTALLATION

- A. Install hangers and braces designed to support the air terminal units and to restrain against seismic forces required by applicable building codes. Comply with ASCE/SEI 7.
- B. Select seismic-restraint devices with capacities adequate to carry present and future static and seismic loads.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install cable restraints on air terminal units that are suspended with vibration isolators.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction.

- F. Attachment to Structure: If specific attachment is not indicated, anchor bracing and restraints to structure, to flanges of beams, to upper truss chords of bar joists, or to concrete members.
- G. Drilling for and Setting Anchors:
  - 1. Identify position of reinforcing steel and other embedded items before drilling holes for anchors. Do not damage existing reinforcement or embedded items during drilling. Notify the Architect if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
  - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
  - 3. Wedge Anchors: Protect threads from damage during anchor installation. Install heavy-duty sleeve anchors with sleeve fully engaged in the structural element to which anchor is to be fastened.
  - 4. Set anchors to manufacturer's recommended torque, using a torque wrench.
  - 5. Install zinc-coated steel anchors for interior applications and stainless-steel anchors for applications exposed to weather.

### 3.4 CONNECTIONS

- A. Install piping adjacent to air terminal unit to allow service and maintenance.
- B. Hot-Water Piping: In addition to requirements in Section 232113 "Hydronic Piping" and Section 232116 "Hydronic Piping Specialties," Section 15179 "Hydronic Piping Specialties," connect heating coils to supply with shutoff valve, strainer, control valve, and union or flange; and to return with balancing valve and union or flange.
- C. Connect ducts to air terminal units according to
- D. Make connections to air terminal units with flexible connectors complying with requirements in Section 233300 "Air Duct Accessories."

### 3.5 IDENTIFICATION

- A. Label each air terminal unit with plan number, nominal airflow, and maximum and minimum factory-set airflows. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

### 3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
  - 1. After installing air terminal units and after electrical circuitry has been energized, test for compliance with requirements.

2. Leak Test: After installation, fill water coils and test for leaks. Repair leaks and retest until no leaks exist.
  3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
  4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Air terminal unit will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

### 3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
1. Complete installation and startup checks according to manufacturer's written instructions.
  2. Verify that inlet duct connections are as recommended by air terminal unit manufacturer to achieve proper performance.
  3. Verify that controls and control enclosure are accessible.
  4. Verify that control connections are complete.
  5. Verify that nameplate and identification tag are visible.
  6. Verify that controls respond to inputs as specified.
  - 7.

### 3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air terminal units.

END OF SECTION 233600

**SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES**

## PART 1 - GENERAL

## 1.1 SUMMARY

## A. Section Includes:

1. Laminar Flow Diffusers
2. Fixed face grilles.

## B. Related Sections:

1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

## 1.2 ACTION SUBMITTALS

## A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

## B. Samples: For each exposed product and for each color and texture specified.

## PART 2 - PRODUCTS

## 2.1 CEILING DIFFUSERS

## A. Laminar Flow Diffusers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Krueger.
  - b. Price Industries.
  - c. Titus.
  - d. Tuttle & Bailey.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, color selected by Architect.

5. Face Size: See drawings
6. Face Style: See drawings
7. Mounting: See drawings
8. Pattern: See drawings
9. Dampers: Radial opposed blade.
10. Accessories:
  - a. Equalizing grid.
  - b. Plaster ring.
  - c. Safety chain.
  - d. Wire guard.
  - e. Sectorizing baffles.
  - f. Operating rod extension.

## 2.2 REGISTERS AND GRILLES

### A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - a. Anemostat Products; a Mestek company.
  - b. Carnes Company.
  - c. Hart & Cooley Inc.
  - d. Krueger.
  - e. Nailor Industries Inc.
  - f. Price Industries.
  - g. Shoemaker Mfg. Co.
  - h. Titus.
  - i. Tuttle & Bailey.
2. Material: Aluminum.
3. Finish: Baked enamel, color selected by Architect.
4. Face Blade Arrangement: Horizontal spaced 1/2 inch (13 mm) apart.
5. Core Construction: Integral.

## 2.3 SOURCE QUALITY CONTROL

- A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- 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, as much as practical. 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.

### 3.2 ADJUSTING

- A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

**SECTION 26 05 19**  
**LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Building wires and cables rated 600 V and less.
  2. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
1. Section 26 05 33 "Raceways and Boxes for Electrical Systems"
  2. Section 26 09 23 "Lighting Control Devices"
  3. Section 26 09 36 "Standalone Modular Preset Dimming Controls"
  4. Section 26 09 43 "Relay-Based Lighting Controls"
  5. Section 27 41 33 "Master Antenna Television System"
  6. Section 27 51 17 "Networked Public Address and Paging System"
  7. Section 27 51 19 "Sound Masking Systems"
  8. Section 28 13 00 "Access Control"
  9. Section 28 31 11 "Digital, Addressable Fire-Alarm System"
  10. Section 27 00 00 "Intermountain Healthcare Networked Structured Cable & Standards" for cabling used for voice and data circuits.

**1.3 DEFINITIONS**

- A. Outlet Box: Electrical box used to support utilization equipment such as a receptacle or light fixture.
- B. Pull Box: Electrical box through which branch circuit or feeder conductors are run but are not spliced.
- C. Junction Box: Electrical box used for splicing branch circuit or feeder conductors.
- D. Multiwire Branch Circuit: A branch circuit as defined by the National Electrical Code that shares a grounded conductor between two or more phase conductors.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**PART 2 - PRODUCTS****2.1 SINGLE CONDUCTORS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Alpha Wire Company.
  2. Belden Inc.
  3. Cerro Wire LLC.
  4. Encore Wire Corporation.
  5. General Cable; General Cable Corporation.
  6. Southwire Company.
  7. Thomas & Betts Corporation; A Member of the ABB Group.
- B. Aluminum and Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.

**2.2 MULTI-CONDUCTOR CABLES**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Southwire Company.
  2. AFC Cable Systems.
- B. Copper Conductors: Comply with NEMA WC 70/ICEA S-95-658.
- C. Conductor Insulation: Comply with NEMA WC 70/ICEA S-95-658 for Type THHN/THWN-2, Type XHHW-2 and Type SO.
- D. Multi-conductor Cable, Type AC-HCF:
1. Armor: Galvanized Interlocking Steel Strip (green striped or solid green).
  2. Conductors: Solid Copper
  3. Conductor Insulation: THHN-2 with individual moisture resistant, fire retardant paper wrap on each individual conductor.
  4. Grounding: 16 AWG integral bond wire and insulated green copper grounding conductor.
  5. Neutral (Grounded) Conductor: White for 120Y/208 volt systems and Grey 480Y/277 volt systems.
  6. Maximum Voltage Rating: 600 volts.
  7. References and Ratings:
    - a. UL 4, 83, 1479, 1581, 2556, File Reference E7330
    - b. NEC 250.118(8), 300.22(C), 392, 320, 517.13, 518, 645
    - c. Federal Specification A-A-59544 (formerly J-C-30B)
    - d. UL Classified 1, 2, and 3-hour through (Fire) penetration product, R-14141
    - e. Environmental Air-Handling Space Installation per NEC 300.22(C)

- E. Other Multi-conductor Cable: Comply with NEMA WC 70/ICEA S-95-658 for Type SO with ground wire.

### 2.3 CONNECTORS AND SPLICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. 3M.
  2. AFC Cable Systems; a part of Atkore International.
  3. Hubbell Power Systems, Inc.
  4. Ideal Industries, Inc.
  5. ILSCO.
  6. O-Z/Gedney; a brand of Emerson Industrial Automation.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

### 2.4 CORD REELS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
  1. APC Group; Kitchen Leash
- B. Case (housing):
  1. Dimensions: 9" x 12" x 3'
  2. Material: Molded Polypropylene 3.175 mm thickness
  3. 94v-2 flammability rating
- C. Power Cord
  1. Conductors: 14/3 AWG copper type SJOW
  2. Length: 10 feet
  3. Rating: 200 degrees F
- D. Receptacle/Plug
  1. Rated: 125vac/20 amp
  2. Receptacle: NEMA 5-15P
  3. Plug: Dual Duplex rated 20 amp
- E. Mounting Bracket: Designed for installation on the ceiling type where the cord reel will be installed.

### 2.5 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.

**2.6 FIRE-ALARM WIRE AND CABLE**

- A. General Wire and Cable Requirements: NRTL listed and labeled as complying with NFPA 70, Article 760.
- B. Signaling Line Circuits: Twisted, shielded pair, size as recommended by system manufacturer.
  - 1. Circuit Integrity Cable: Twisted shielded pair, NFPA 70, Article 760, Classification CI, for power-limited fire-alarm signal service Type FPL. NRTL listed and labeled as complying with UL 1424 and UL 2196 for a two-hour rating.
- C. Non-Power-Limited Circuits: Solid-copper conductors with 600-V rated, 75 deg C, color-coded insulation, and complying with requirements in UL 2196 for a two-hour rating.
  - 1. Low-Voltage Circuits: No. 14 AWG, minimum, in pathway.
  - 2. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.

**PART 3 - EXECUTION****3.1 CONDUCTOR MATERIAL APPLICATIONS**

- A. Feeders: Copper for feeders smaller than No. 4 AWG; for feeders No. 4 AWG and larger provide copper feeders unless aluminum is specifically indicated on the one-line diagrams. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger. Aluminum conductors may not be installed for circuiting to imaging and mechanical equipment.
- B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

**3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS**

- A. Refer to Section 26 05 33 "Raceways and Boxes for Electrical Systems" for raceway types and applications.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders below Slabs-On-Grade, and Underground: Type THWN-2, single conductors in raceway.
- E. Multiwire Circuits: may not be used for branch circuit wiring. All 120 volt and 277 volt circuits shall be provided with a dedicated grounded conductor (neutral) for each phase conductor. Up to three of these circuits may be installed in a single conduit but not more than one conductor of each phase may be installed in a single conduit.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
  - 1. Armored cable, Type AC-HCF may be installed for normal and equipment system single branch circuits concealed in walls, and partitions in lengths between outlet boxes 30' or less and not as homeruns or wiring between pullboxes or junction boxes.

2. Armored cable, Type AC-HCF may be installed between the first outlet box concealed in a wall or partition and a junction box above an accessible ceiling immediately above the location where the cable exits the wall or partition framing.
- G. Branch Circuits below Slabs-on-Grade and Underground: Type THHN/THWN-2, single conductors in raceway. Installation of raceways within any concrete slab or composite concrete and steel deck is prohibited. NEC 517.13 (A) requires that all branch circuits serving patient care areas are provided with an effective ground-fault current path by installation in a metal raceway system, or a cable having a metallic armor or sheath assembly that qualifies as an equipment grounding conductor. Metallic raceways are not a specified raceway for branch circuits installed below slabs-on-grade. To assure compliance with the NEC requirement, both initially and when remodels occur in the future, the installation of branch circuit wiring under slabs-on-grade is limited to circuits supplying only the following rooms and area types without extension beyond the room or area to a room or area not listed here:
  1. Mechanical Spaces.
  2. Electrical Rooms.
  3. Food Service.
- H. Branch circuit wiring may also be installed under slabs-on-grade to supply power for the following:
  1. Systems Furniture.
  2. Floor Boxes.
  3. Direct wired equipment that is not located against a wall.
- I. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain-relief device at terminations to suit application.
- J. Isolated Power System Conductors: #10 AWG, Type XHHW-2 stranded with cross-linked PE insulation and a dielectric constant of 3.5 or less, installed in EMT conduit. To limit leakage-current the branch circuit conductors must be reduced to the shortest overall length possible. Install conduits for Isolated Power System branch circuits in the most direct path between the panel and the outlet box, which is not necessarily parallel and perpendicular to the structure and framing, to reduce conductor length. Install only one circuit in per conduit. Do not use pulling compounds when installing the branch circuit conductors of Isolated Power Systems.

### **3.3 INSTALLATION OF CONDUCTORS AND CABLES**

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 26 05 33 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. 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. Do not use pulling compounds or lubricant for installation of branch circuit conductors for Isolated Power Systems.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

- F. Support cables according to Section 26 05 29 "Hangers and Supports for Electrical Systems."

### **3.4 CORD REELS**

- A. Coordinate location of cord reels to align with kitchen equipment supplied by the cord reel.
- B. Fasten brackets to structure using minimum 3/8" threaded rod and to rigidly support the cord reel. Minimum of 2 rods per bracket with addition if required to provide a rigid support.
- C. Adjust cord stopper as coordinated with owner.

### **3.5 CONNECTIONS**

- A. 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-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
  - 1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
- D. Comply with requirements in Section 283111 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.

### **3.6 IDENTIFICATION**

- A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with panel and circuit number and identify as spare conductor.

### **3.7 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

### **3.8 FIRESTOPPING**

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 07 84 13 "Penetration Firestopping."

### **3.9 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors and conductors feeding the following critical equipment and services for compliance with requirements.
    - a. Imaging Equipment
  2. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each splice in conductors No. 3 AWG and larger. Remove box and equipment covers so splices are accessible to portable scanner. Correct deficiencies determined during the scan.
    - a. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each splice 11 months after date of Substantial Completion.
    - b. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
    - c. Record of Infrared Scanning: Prepare a certified report that identifies splices checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- B. Test and Inspection Reports: Prepare a written report to record the following:
1. Procedures used.
  2. Results that comply with requirements.
  3. Results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Cables will be considered defective if they do not pass tests and inspections.

END OF SECTION



**SECTION 26 05 26**  
**GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes grounding and bonding systems and equipment.
- B. Section includes grounding and bonding systems and equipment, plus the following special applications:
1. Installation and Bonding of Grounding Electrodes including:
    - a. Metal Underground Water Pipe
    - b. Metal Frame of the Structure
    - c. Concrete-Encased Electrodes including UFER Grounds
    - d. Ground Ring
    - e. Rod Electrodes
  2. Ground bonding common with lightning protection system.
  3. Foundation steel electrodes.
  4. Electrical Room Ground Bus.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product indicated.

**1.4 INFORMATIONAL SUBMITTALS**

- A. As-Built Data: Plans showing dimensioned as-built locations of grounding features specified in "Field Quality Control" Article, including the following:
1. Test wells.
  2. Grounding Electrodes
  3. Bonding Jumpers
  4. Electrical Room Grounding Bus.
  5. TEC and TDR Grounding Bus.
- B. Field quality-control reports.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  - a. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.
    - 1) Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
    - 2) Include recommended testing intervals.

## 1.6 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

## PART 2 - PRODUCTS

### 2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

### 2.2 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
  1. Stranded Conductors: ASTM B 8.
  2. Tinned Conductors: ASTM B 33.
  3. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
- C. Electrical Room Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 20 inches.
- D. TEC and TDR Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) in cross section, with 9/32-inch (7.14-mm) holes spaced 1-1/8 inches (28 mm) apart. Stand-off insulators for mounting shall comply with UL 891 for use in switchboards, 600 V and shall be Lexan or PVC, impulse tested at 5000 V. Length as required for all specified terminations plus 25% spare but not less than 12 inches.

### 2.3 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- D. Bus-Bar Connectors: Mechanical type, cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.

### 2.4 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel; 3/4 inch by 10 feet (19 mm by 3 m).

## PART 3 - EXECUTION

### 3.1 APPLICATIONS

- A. Conductors: Install stranded conductors unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 4/0 AWG minimum.
  - 1. Bury at least 18 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Grounding Bus: Install in Normal Power Electrical Room, Essential Power Electrical Room, TEC and all TDR. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 96 inches (2400 mm) above finished floor unless otherwise indicated.
- E. Conductor Terminations and Connections:
  - 1. Pipe Terminations: Bolted connectors.
  - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
  - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
  - 4. Connections to Structural Steel: Welded connectors.

### 3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Pad-Mounted Transformers and Switches: Install tinned-copper conductor not less than No. 4/0 AWG from equipment grounding terminals to ground ring. Bury ground ring not less 18 inches below finished grade.

### 3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
  - 1. Feeders and branch circuits.
  - 2. Lighting circuits.
  - 3. Receptacle circuits.
  - 4. Single-phase motor and appliance branch circuits.
  - 5. Three-phase motor and appliance branch circuits.
  - 6. Flexible raceway runs.
  - 7. Armored and metal-clad cable runs.
  - 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
  - 9. X-Ray Equipment Circuits: Install insulated equipment grounding conductor in circuits supplying x-ray equipment.
- C. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- D. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- E. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- F. Isolated Equipment Enclosure Circuits: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service unless otherwise indicated.
- G. Metallic Fences: Comply with requirements of IEEE C2.
  - 1. Grounding Conductor: Bare, tinned copper, not less than No. 8 AWG.
  - 2. Gates: Shall be bonded to the grounding conductor with a flexible bonding jumper.

### 3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service

- grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
- C. Ground Rods: Drive rods until tops are **2 inches (50 mm)** below finished floor or final grade unless otherwise indicated.
1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are shall be at least **12 inches (300 mm)** deep, with cover.
1. Test Wells: Install one test well at the ground rod location indicated on the drawings.
- E. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through concrete footings.
1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
  2. Use exothermic-welded connectors; if a disconnect-type connection is required, use a bolted clamp.
- F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate interior and exterior columns at distances not more than **60 feet (18 m)** apart.
- 1.
- G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod.
1. Install tinned-copper conductor not less than No. 4/0 AWG for bond to ground ring and for taps to building steel.
  2. Bury ground ring not less than **24 inches (600 mm)** from building's foundation.
- H. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; use a minimum of **20 feet (6 m)** of bare copper conductor not smaller than No. 4/0 AWG.
1. If concrete foundation is less than **20 feet (6 m)** long, coil excess conductor within base of foundation.
  2. Bond grounding conductor to reinforcing steel in at least four locations in mat footing and at four spread footing locations evenly distributed throughout building. Extend grounding conductor below grade and connect to building's grounding grid or to grounding electrode external to concrete.
- I. Grounding and Bonding for Piping:
1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
  2. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
  3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- J. Panelboard Bonding: To comply with NEC 517.14 panelboard bonding requirements install a minimum #10 AWG copper conductor between all branch-circuit panelboard grounding terminal buses in each electrical room. The conductor may be installed in ½" EMT conduit or may be exposed where securely fastened to the walls.

**3.5 FIELD QUALITY CONTROL**

- A. Tests and Inspections:
1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
  2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
  3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding conductor, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.
    - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without 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.
    - b. Perform tests by fall-of-potential method according to IEEE 81.
  4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed 3 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

**END OF SECTION**

**SECTION 26 05 29**  
**HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Hangers and supports for electrical equipment and systems.
  2. Construction requirements for concrete bases.
- B. Related Requirements:
1. Section 260548.16 "Seismic Controls for Electrical Systems" for products and installation requirements necessary for compliance with seismic criteria.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
    - a. Hangers.
    - b. Steel slotted support systems.
    - c. Nonmetallic support systems.
    - d. Trapeze hangers.
    - e. Clamps.
    - f. Turnbuckles.
    - g. Sockets.
    - h. Eye nuts.
    - i. Saddles.
    - j. Brackets.
  2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. For fabrication and installation details for electrical hangers and support systems.
1. Trapeze hangers. Include product data for components.
  2. Steel slotted-channel systems.
  - 3.
  4. Nonmetallic slotted-channel systems.
  5. Equipment supports.
  6. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
- C. Delegated-Design Submittal: For hangers and supports for electrical systems.
1. Include design calculations and details of trapeze hangers.

2. Include design calculations for seismic restraints.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
  1. Suspended ceiling components.
  2. Structural members to which hangers and supports will be attached.
  3. Size and location of initial access modules for acoustical tile.
  4. Items penetrating finished ceiling, including the following:
    - a. Lighting fixtures and lighting control.
    - b. Electrical power devices
    - c. Communications devices.
    - d. Air outlets and inlets.
    - e. Speakers.
    - f. Fire sprinklers.
    - g. Access panels.
    - h. Projectors.
    - i. Fire alarm system devices.
    - j. Nurse call system devices.
- B. Seismic Qualification Certificates: For hangers and supports for electrical equipment and systems, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Welding certificates.

#### **1.5 QUALITY ASSURANCE**

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design hanger and support system.
- B. Seismic Performance: Hangers and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  1. The term "withstand" means "the supported equipment and systems will remain in place without separation of any parts when subjected to the seismic forces specified and the system will be fully operational after the seismic event."
  2. Component Importance Factor: 1.5.



- C. Surface-Burning Characteristics: Comply with ASTM E 84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
  - 1. Flame Rating: Class 1.
  - 2. Self-extinguishing according to ASTM D 635.

## 2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4 factory-fabricated components for field assembly.
  - 1. Material: Galvanized steel.
  - 2. Channel Width: Use 1-1/4 inches (31.75 mm) where possible and minimum 13/16 inches (20.64 mm) where necessary due to space restrictions.
  - 3. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
  - 4. Channel Dimensions: Selected for applicable load criteria.
- B. Conduit and Cable Support Devices: Steel hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- C. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for electrical conductors in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be made of malleable iron.
- D. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M steel plates, shapes, and bars; black and galvanized.
- E. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include and are limited to the following:
  - 1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 2. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
  - 3. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
  - 4. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
  - 5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
  - 6. Hanger Rods: Threaded steel.

## 2.3 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Section 05 50 00 "Metal Fabrications" for steel shapes and plates.

**PART 3 - EXECUTION****3.1 APPLICATION**

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems unless requirements in this Section are stricter.
- B. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- C. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMTs, IMCs, and RMCs as scheduled in NECA 1, where Table 1 lists maximum spacings that are less than those stated in NFPA 70. Minimum rod size shall be **3/8 inch (9 mm)** in diameter.
- D. Multiple Raceways: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
  - 1. Secure raceways and cables to these supports with single-bolt conduit clamps.
- E. Spring-steel clamps designed for supporting single conduits without bolts may be used for **1-1/2-inch (38-mm)** and smaller raceways serving branch circuits and communication systems above suspended ceilings and for fastening raceways to trapeze supports.

**3.2 SUPPORT INSTALLATION**

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMTs, IMCs, and RMCs may be supported by openings through structure members, according to NFPA 70. Only prefabricated openings in structure members may be used. Do not create openings in structure members unless directed to do so by the structural engineer of record.
- C. Cable Support Methods: Cables used for Circuits and Equipment Operating at Less Than 50 Volts and Class 1, 2 or 3 Remote-Control, Signaling and Power-Limited Circuits shall be installed in J-hooks. Where cables extend from J-hooks to equipment cables shall be supported from the structure by straps, hangers, cable ties or similar fittings designed and installed so as not to damage the cable. Do not fasten or secure cables to the raceways of the power system.
- D. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus **200 lb (90 kg)**.
- E. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
  - 1. To Wood: Fasten with lag screws or through bolts.
  - 2. To New Concrete: Bolt to concrete inserts.
  - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
  - 4. To Existing Concrete: Expansion anchor fasteners.

5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete **4 inches (100 mm)** thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than **4 inches (100 mm)** thick.
  6. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
  7. To Light Steel: Sheet metal screws.
  8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on **13/16 inches (20.64 mm)** slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.
- F. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

### 3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Section 055000 "Metal Fabrications" for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

### 3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than **4 inches (100 mm)** larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use **3000-psi (20.7-MPa)**, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 03 30 00 "Cast-in-Place Concrete" or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
  1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
  2. Install anchor bolts to elevations required for proper attachment to supported equipment.
  3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

### 3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
  1. Apply paint by brush or spray to provide minimum dry film thickness of **2.0 mils (0.05 mm)**.

- B. Touchup: Comply with requirements in Section 09 91 13 "Exterior Painting", Section 099123 "Interior Painting" and Section 099600 "High-Performance Coatings" for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

**END OF SECTION**

**SECTION 26 05 33**  
**RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Metal conduits, tubing, and fittings.
  2. Nonmetal conduits, tubing, and fittings.
  3. Metal wireways and auxiliary gutters.
  4. Surface raceways.
  5. Boxes, enclosures, and cabinets.
  6. Handholes and boxes for exterior underground cabling.
- B. Related Requirements:
1. Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks, manholes, and underground utility construction.

**1.3 DEFINITIONS**

- A. ARC: Aluminum Rigid Conduit.
- B. EMT: Electrical Metallic Tubing.
- C. GRC: Galvanized rigid steel conduit.
- D. IMC: Intermediate metal conduit.
- E. RTRC: Reinforced Thermosetting Resin Conduit.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For color coded EMT conduit, surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. LEED Submittals:
1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
  2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of

Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

- C. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- D. Samples: For receptacle raceways and for each color and texture specified, 12 inches (300 mm) long.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of items involved:
  - 1. Structural members in paths of conduit groups with common supports.
  - 2. HVAC and plumbing items and architectural features in paths of conduit groups with common supports.
- B. Qualification Data: For professional engineer.
- C. Seismic Qualification Certificates: For enclosures, cabinets, and conduit racks and their mounting provisions, including those for internal components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
  - 4. Detailed description of conduit support devices and interconnections on which the certification is based and their installation requirements.
- D. Source quality-control reports.

## PART 2 - PRODUCTS

### 2.1 METAL CONDUITS, TUBING, AND FITTINGS

- A. Listing and Labeling: Metal conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. GRC: Comply with ANSI C80.1 and UL 6.
- C. ARC: Comply with ANSI C80.5 and UL 6A.
- D. IMC: Comply with ANSI C80.6 and UL 1242.
- E. EMT: Comply with ANSI C80.3 and UL 797. Factory applied color finish available in black, orange, green, purple, red, yellow, blue, and white. Refer to Specification Section 26 05 53 "Identification for Electrical Systems" for color coding of raceways.
- F. FMC: Comply with UL 1; zinc-coated steel.
- G. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.

- H. Fittings for Metal Conduit: Comply with NEMA FB 1 and UL 514B.
  - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886 and NFPA 70.
  - 2. Fittings for EMT:
    - a. Material: Steel.
    - b. Type: compression.
  - 3. Expansion Fittings: PVC or steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- I. Joint Compound for IMC, GRC, or ARC: Approved, as defined in NFPA 70, by authorities having jurisdiction for use in conduit assemblies, and compounded for use to lubricate and protect threaded conduit joints from corrosion and to enhance their conductivity.

## **2.2 NONMETALLIC CONDUITS, TUBING, AND FITTINGS**

- A. Listing and Labeling: Nonmetallic conduits, tubing, and fittings shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. RNC: Type EPC-40-PVC, complying with NEMA TC 2 and UL 651 unless otherwise indicated.
- C. Continuous HDPE: Comply with UL 651B.
- D. RTRC: Comply with UL 1684A and NEMA TC 14.
- E. Fittings for RNC: Comply with NEMA TC 3; match to conduit or tubing type and material.
- F. Solvent cements and adhesive primers shall have a VOC content of 510 and 550 g/L or less, respectively, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- G. Solvent cements and adhesive primers shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

## **2.3 METAL WIREWAYS AND AUXILIARY GUTTERS**

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 unless otherwise indicated, and sized according to NFPA 70.
  - 1. Metal wireways installed outdoors shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Fittings and Accessories: Include covers, 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.
- C. Wireway Covers: Hinged type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

## 2.4 RECEPTACLE RACEWAYS

- A. Listing and Labeling: Receptacle raceways shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Surface Metal Raceways: Aluminum with snap-on covers complying with UL. Clear anodized finish.
  - 1. Raceways for receptacles only: Wiremold AL3300 series.
  - 2. Raceways for applications where both receptacles and data devices are installed in the raceway and at all laboratory locations: Wiremold ALA4800 series two-channel and dual-cover. Satin anodized finish.
  - 3. Provide duplex receptacles at 12 inches on center in all receptacle raceways. Provide GFCI receptacles as noted on drawings.

## 2.5 BOXES, ENCLOSURES, AND CABINETS

- A. General Requirements for Boxes, Enclosures, and Cabinets: Boxes, enclosures, and cabinets installed in wet locations shall be listed for use in wet locations.
- B. Sheet Metal Outlet and Device Boxes: Comply with NEMA OS 1 and UL 514A.
- C. Cast-Metal Outlet and Device Boxes: Comply with NEMA FB 1, aluminum, Type FD, with gasketed cover.
- D. Nonmetallic Outlet and Device Boxes: Comply with NEMA OS 2 and UL 514C.
- E. Floor Boxes and Poke-Through Devices: Refer to Specification Section 26 27 26 "Wiring Devices" for floor boxes and poke-through devices
- F. Luminaire Outlet Boxes: Nonadjustable, designed for attachment of luminaire weighing **50 lb (23 kg)**. Outlet boxes designed for attachment of luminaires weighing more than **50 lb (23 kg)** shall be listed and marked for the maximum allowable weight.
- G. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- H. Cast-Metal Access, Pull, and Junction Boxes: Comply with NEMA FB 1 and UL 1773, cast aluminum with gasketed cover.
- I. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- J. Device Box Dimensions:
  - 1. **Wiring Devices other than data or communications devices: Minimum 4 inches square by 2-1/8 inches deep** with switch ring as required for the device configuration and wall or ceiling surface. Where light switches are indicated at a common location provide multi-gang boxes to accommodate the quantity and type of switches indicated. Where deeper boxes are required provide masonry type boxes which do not require a separate switch ring.
  - 2. Data and communications devices: Minimum 4-11/16 inches square by 3 inches deep with single-gang 5/8 inch deep (or deeper if wall or ceiling finish is deeper) ring.
- K. Pull boxes behind monitors: Minimum 6 inches square by 3-1/2 inches deep with two-gang ring.
- L. Gangable boxes are prohibited.



- M. Partitions: Provide partitions to separate emergency system conductors from conductors or other systems, where voltage between adjacent switches exceeds 300 volts and where switches controlling Low Voltage Controllers for interface to Nurse Call systems are installed in common boxes with line voltage switches.
- N. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250.
  - 1. Indoor: Type 1 with continuous-hinge cover with flush latch unless otherwise indicated. Steel, finished inside and out with manufacturer's standard enamel.
  - 2. Outdoor: Type 4X with continuous-hinge cover with flush latch unless otherwise indicated. 304 stainless steel with smooth brushed finish.
  - 3. Interior Panels: Steel; all sides finished with manufacturer's standard enamel. Provide interior panels when there are control devices or power blocks located inside the enclosure.
- O. Handholes and Boxes for Exterior Underground Wiring: Refer to Specification Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems".

## 2.6 PUTTY PADS

- A. Moldable intumescent wall opening-protective pads designed for application to the back of electrical outlet boxes prior to installation of the wall finish to provide up to 2-hour fire barrier ratings and minimum Sound Transmission Class (STC) of 52 when tested in an STC-53 rated wall assembly or 59 according to ASTM E90-97.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. 3M Company.
  - 2. Hilti

## PART 3 - EXECUTION

### 3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed Conduit: GRC or IMC.
  - 2. Concealed Conduit, Aboveground: EMT.
  - 3. Underground Conduit for branch circuits: RNC, Type EPC-40-PVC, direct buried.
  - 4. Underground Conduit for feeders: Refer to Specification Section 26 05 43 "Underground Ducts and Raceways for Electrical Systems".
  - 5. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
  - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
  - 7. Boxes and Enclosures, Aboveground: NEMA 250, Type 4X, 304 stainless steel.
- B. Indoors: Apply raceway products as specified below unless otherwise indicated:
  - 1. Exposed, Not Subject to Physical Damage: EMT.
  - 2. Exposed, Not Subject to Severe Physical Damage: EMT.
  - 3. Exposed and Subject to Severe Physical Damage: GRC or IMC. Raceway locations include the following:
    - a. Loading dock.
    - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
    - c. Mechanical rooms below 8 feet.
    - d. Gymnasiums.

4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
  5. Feeder Raceways under Slabs: RNC, Type EPC-40-PVC encased in not less than 2 inches of 3000 psi concrete. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
  6. Branch Circuit Raceways under Slabs: Refer to Specifications Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for allowable application of under slab raceways. RNC, Type EPC-40-PVC direct buried. Change from RNC, Type EPC-40-PVC to GRC or IMC before rising above floor.
  7. Raceways Embedded in slabs or composite steel and concrete decks are prohibited.
  8. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
  9. Damp or Wet Locations: GRC or IMC.
  10. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4X, 304 stainless steel in kitchens and damp or wet locations.
  - 11.
- C. Minimum Raceway Size: 3/4-inch (21-mm) trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
  2. EMT: Use setscrew or compression, steel fittings. Comply with NEMA FB 2.10.
  3. Flexible Conduit: Use only fittings listed for use with flexible conduit. Comply with NEMA FB 2.20.
- E. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.
- F. Do not install aluminum conduits, boxes, or fittings in contact with concrete or earth.
- G. Install surface raceways only where indicated on Drawings.

### 3.2 INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NECA 102 for aluminum conduits. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- B. Separation of Life Safety and Critical Branch Wiring: Comply with NFPA 70 Article 517.
- C. 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.
- D. Complete raceway installation before starting conductor installation.
- E. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for hangers and supports.
- F. Arrange stub-ups so curved portions of bends are not visible above finished slab except where concealed in chases.

- G. Install no more than the equivalent of three 90-degree bends in any conduit run except for control wiring conduits, for which fewer bends are allowed. Support within **12 inches (300 mm)** of changes in direction.
- H. Conceal conduit and EMT within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- I. Support conduit within **12 inches (300 mm)** of enclosures to which attached.
- J. Raceways Embedded in Slabs are prohibited.
- K. Stub-ups to Above Recessed Ceilings:
  - 1. Use EMT, IMC, or RMC for raceways.
  - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- L. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- M. Coat field-cut threads on PVC-coated raceway with a corrosion-preventing conductive compound prior to assembly.
- N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors including conductors smaller than No. 4 AWG.
- O. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to **1-1/4-inch (35mm)** trade size and insulated throat metal bushings on **1-1/2-inch (41-mm)** trade size and larger conduits terminated with locknuts. Install insulated throat metal grounding bushings on service conduits.
- P. Install raceways square to the enclosure and terminate at enclosures with locknuts. Install locknuts hand tight plus 1/4 turn more.
- Q. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to assure a continuous ground path.
- R. Cut conduit perpendicular to the length. For conduits **2-inch (53-mm)** trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length.
- S. Install pull wires in empty raceways. Use polypropylene 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 pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- T. Surface Raceways:
  - 1. Install surface raceway with a minimum **2-inch (50-mm)** radius control at bend points.
  - 2. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding **48 inches (1200 mm)** and with no less than two supports per straight raceway section. Support surface raceway according to manufacturer's written instructions. Tape and glue are not acceptable support methods.
- U. Install raceway sealing fittings at accessible locations according to NFPA 70 and fill them with 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 according to NFPA 70.

- V. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal the interior of all raceways at the following points:
    - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    - 2. Where an underground service raceway enters a building or structure.
    - 3. Where otherwise required by NFPA 70.
  - W. Comply with manufacturer's written instructions for solvent welding RNC and fittings.
  - X. Expansion(Seismic)-Joint Fittings:
    - 1. Install flexible metal conduit at all locations where conduits cross building or structure expansion joints. Allow for minimum 4 inches deflection in all directions or greater if expansion joint exceeds 4 inches. Provide droop in flexible conduit to accommodate movement. Do not loop the flexible conduit. When calculating total bend degrees in conduit runs with expansion fittings use minimum 60 degrees for each expansion-joint fitting
    - 2. Install each expansion-joint fitting with position, mounting, and piston setting selected according to manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
  - Y. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of **72 inches (1830 mm)** of flexible conduit for recessed and semi-recessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
    - 1. Use LFMC in damp or wet locations.
  - Z. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
  - AA. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box.
  - BB. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
  - CC. Locate boxes so that cover or plate will not span different building finishes.
  - DD. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
  - EE. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
  - FF. Set metal floor boxes level and flush with finished floor surface.
  - GG. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- 3.3 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS**
- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 26 05 44 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

**3.4 FIRESTOPPING AND SOUND TRANSMISSION MITIGATION**

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 07 84 13 "Penetration Firestopping."
- B. Install putty pads with acoustical and firestopping capabilities on all boxes that are installed in wall or partition cavities and in gypsum board ceilings.

**3.5 PROTECTION**

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
  - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
  - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

**END OF SECTION**

**SECTION 26 05 44****SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
  - 2. Sleeve-seal systems.
  - 3. Sleeve-seal fittings.
  - 4. Grout.
  - 5. Silicone sealants.
- B. Related Requirements:
  - 1. Section 07 84 13 "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. LEED Submittals:
  - 1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
  - 2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

**PART 2 - PRODUCTS****2.1 SLEEVES**

- A. Wall Sleeves:
  - 1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.
  - 2. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; **0.0239-inch (0.6-mm)** minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. PVC-Pipe Sleeves: ASTM D 1785, Schedule 40.
- D. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- E. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.
- F. Sleeves for Rectangular Openings:
  - 1. Material: Galvanized sheet steel.
  - 2. Minimum Metal Thickness:
    - a. For sleeve cross-section rectangle perimeter less than **50 inches (1270 mm)** and with no side larger than **16 inches (400 mm)**, thickness shall be **0.052 inch (1.3 mm)**.
    - b. For sleeve cross-section rectangle perimeter **50 inches (1270 mm)** or more and one or more sides larger than **16 inches (400 mm)**, thickness shall be **0.138 inch (3.5 mm)**.

## 2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
  - 1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
  - 2. Pressure Plates: Stainless steel.
  - 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

## 2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.

## 2.4 GROUT

- A. Description: Nonshrink; recommended for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: **5000-psi (34.5-MPa)**, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

## 2.5 SILICONE SEALANTS

- A. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants of grade indicated below.
  - 1. Grade: Pourable (self-leveling) formulation for openings in floors and other horizontal surfaces that are not fire rated.
  - 2. Sealant shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
  - 3. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- B. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.

## PART 3 - EXECUTION

### 3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
  - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
    - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Section 079200 "Joint Sealants."
    - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
  - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 3. Size pipe sleeves to provide **1/4-inch (6.4-mm)** annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
  - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
  - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 4 inches above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:
  - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
  - 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for **1-inch (25-mm)** annular clear space between pipe and sleeve for installing mechanical sleeve seals.



- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for **1-inch (25-mm)** annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

### **3.2 SLEEVE-SEAL-SYSTEM INSTALLATION**

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

### **3.3 SLEEVE-SEAL-FITTING INSTALLATION**

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

**END OF SECTION**

**SECTION 26 05 48**  
**SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Restraint channel bracings.
  2. Restraint cables.
  3. Seismic-restraint accessories.
  4. Mechanical anchor bolts.
  5. Adhesive anchor bolts.
- B. Related Requirements:
1. Section 26 05 29 "Hangers and Supports for Electrical Systems" for commonly used electrical supports and installation requirements.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
    - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
    - b. Annotate to indicate application of each product submitted and compliance with requirements.
- B. Delegated-Design Submittal: For each seismic-restraint device.
1. Include design calculations and details for selecting seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional or structural engineer responsible for their preparation.
  2. Design Calculations: Calculate static and dynamic loading caused by equipment weight, operation, and seismic forces required to select seismic restraints and for designing vibration isolation bases.
    - a. Coordinate design calculations with wind load calculations required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
  3. Seismic-Restraint Details:
    - a. Design Analysis: To support selection and arrangement of seismic restraints. Include calculations of combined tensile and shear loads.
    - b. Details: Indicate fabrication and arrangement. Detail attachments of restraints to the restrained items and to the structure. Show attachment locations, methods, and spacings. Identify components, list their strengths, and indicate directions and

- values of forces transmitted to the structure during seismic events. Indicate association with vibration isolation devices.
- c. Coordinate seismic-restraint and vibration isolation details with wind-restraint details required for equipment mounted outdoors. Comply with requirements in other Sections for equipment mounted outdoors.
  - d. Preapproval and Evaluation Documentation: By an evaluation service member of ICC-ES, showing maximum ratings of restraint items and the basis for approval (tests or calculations).

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Coordination Drawings: Show coordination of seismic bracing for electrical components with other systems and equipment in the vicinity, including other supports and seismic restraints.
- B. Qualification Data: For professional or structural engineer.
- C. Welding certificates.
- D. Field quality-control reports.

#### **1.5 CLOSEOUT SUBMITTALS**

- A. Observation Report signed by the professional or structural engineer responsible for the design calculations and details for the seismic restraint devices indicating that all restraints have been installed and tested per the approved action submittal documents.

#### **1.6 QUALITY ASSURANCE**

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval, showing maximum seismic-restraint ratings, by ICC-ES or another agency acceptable to authorities having jurisdiction. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) that support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- D. Comply with NFPA 70.

### **PART 2 - PRODUCTS**

#### **2.1 PERFORMANCE REQUIREMENTS**

- A. Seismic-Restraint Loading: Refer to Structural criteria for the project.

**2.2 RESTRAINT CHANNEL BRACINGS**

- A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end, with other matching components, and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

**2.3 RESTRAINT CABLES**

- A. Restraint Cables: ASTM A 492 stainless-steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

**2.4 SEISMIC-RESTRAINT ACCESSORIES**

- A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.
- B. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- C. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings and matched to type and size of anchor bolts and studs.
- D. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings and matched to type and size of attachment devices used.
- E. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

**2.5 MECHANICAL ANCHOR BOLTS**

- A. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

**2.6 ADHESIVE ANCHOR BOLTS**

- A. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing PVC or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine areas and equipment to receive vibration isolation and seismic-control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for reinforcement and cast-in-place anchors to verify actual locations before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 APPLICATIONS**

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods caused by seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

**3.3 SEISMIC-RESTRAINT DEVICE INSTALLATION**

- A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 03 30 00 "Cast-in-Place Concrete" and Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
- B. Equipment and Hanger Restraints:
  - 1. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds **0.125 inch (3.2 mm)**.
  - 2. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- C. Install cables so they do not bend across edges of adjacent equipment or building structure.
- D. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- E. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- F. Drilled-in Anchors:
  - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
5. Set anchors to manufacturer's recommended torque using a torque wrench.
6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

### **3.4 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION**

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where connection is terminated to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

### **3.5 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
  1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.
  2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.
  3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
  4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
  5. Test to 90 percent of rated proof load of device.
- B. Seismic controls will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

### **3.6 ADJUSTING**

- A. Adjust restraints to permit free movement of equipment within normal mode of operation.

**END OF SECTION**

**SECTION 26 05 53**  
**IDENTIFICATION FOR ELECTRICAL SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Identification for raceways.
  - 2. Identification of power and control cables.
  - 3. Identification for conductors.
  - 4. Underground-line warning tape.
  - 5. Warning labels and signs.
  - 6. Instruction signs.
  - 7. Equipment identification labels, including arc-flash warning labels.
  - 8. Miscellaneous identification products.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- D. Delegated-Design Submittal: For arc-flash hazard study.

**PART 2 - PRODUCTS**

**2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- F. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
  - 1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

## 2.2 COLOR AND LEGEND REQUIREMENTS

- A. Use the following color code for all electrical equipment and junction boxes that are specified to be labeled:
  - 1. Standby Power Circuits: Black letters on red field.
  - 2. Life Safety Branch Circuits: White letters on orange Field
  - 3. Critical Branch Circuits: White letters on red Field
  - 4. Equipment System Circuits: White letters on green field.
  - 5. Normal Power Circuits: White letters on black field.
  - 6. Uninterruptible Power Supply (UPS):
    - a. UPS-A: Blue letters on a grey field.
    - b. UPS-B: Red letters on a grey field.
  - 7. Fire Alarm: Red letters on white field.
  - 8. Communications: White letters on blue field.
- B. Warning labels and signs shall include, but are not limited to, the following legends:
  - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
  - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR XX INCHES" where XX is replaced by the clearance requirements of NFPA 70.
- C. Use the following color code for all electrical raceways that are specified to be labeled:
  - 1. Color Coding for Raceways:
    - a. Standby Power: Black
    - b. Life Safety Branch: Yellow
    - c. Critical Branch: Orange
    - d. Equipment Branch: Green
    - e. UPS: White
    - f. Fire alarm: Red
    - g. Communications: Blue
    - h. Access Control: Purple
  - 2. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: where voltage, system type, or other written information is required, black lettering on orange background.

## 2.3 LABELS

- A. Vinyl Labels for Raceways Carrying Circuits at 600 V or Less: printed, flexible labels laminated with a clear, weather- and chemical-resistant coating and matching wraparound clear adhesive tape for securing label ends.



- B. Indoor Equipment Labels: Self-adhesive, engraved, laminated acrylic or melamine plastic label. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high. Color coded as indicated in Color and Legend Requirements.
- C. Outdoor Equipment: Engraved, laminated acrylic or melamine plastic label, punched or drilled for mechanical fasteners. Unless otherwise indicated, provide a single line of text with **1/2-inch- (13-mm-)** high letters on **1-1/2-inch- (38-mm-)** high label; where two lines of text are required, use labels **2 inches (50 mm)** high. Color coded as indicated in Color and Legend Requirements.

#### **2.4 BANDS AND TUBES:**

- A. Snap-Around, Color-Coding Bands for Cables: Slit, pretensioned, flexible, solid-colored acrylic sleeves, **2 inches (50 mm)** long, with diameters sized to suit diameters of raceways or cables they identify, and that stay in place by gripping action.

#### **2.5 TAPES AND STENCILS:**

- A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

#### **2.6 SIGNS**

- A. Laminated Acrylic or Melamine Plastic Signs:
  - 1. Engraved legend.
  - 2. Thickness:
    - a. For signs up to **20 sq. inches (129 sq. cm)**, minimum **1/16-inch- (1.6-mm-)**.
    - b. For signs larger than **20 sq. inches (129 sq. cm)**, **1/8 inch (3.2 mm)** thick.
    - c. Engraved legend with white letters on a dark grey background.
    - d. Punched or drilled for mechanical fasteners.
    - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

#### **2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS**

- A. Paint: Comply with requirements in painting Sections for paint materials and application requirements. Retain paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

### **3.2 INSTALLATION**

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustical ceilings and similar concealment.
- C. Verify identity of each item before installing identification products.
- D. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- G. Attach plastic raceway and cable labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- H. System Identification for Feeder Raceways: Each color-coding band shall completely encircle cable or conduit. Place adjacent bands of two-color markings in contact, side by side. 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-foot (7.6-m)** maximum intervals in congested areas.
- I. Fire Alarm: Provide raceway with factory applied finish or paint conduit in field.
- J. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at **6 to 8 inches (150 to 200 mm)** below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds **16 inches (400 mm)** overall.

### **3.3 IDENTIFICATION SCHEDULE**

- A. Switchboards and Panelboards: Include Identification per the One-Line Diagrams and the Source Location, including the circuit number.
- B. Disconnect Switches, Enclosed Circuits Breakers and Motor Controllers. Identify the equipment that is controlled and the Source, including the circuit number.

- C. Accessible Raceways, including above accessible ceilings, for all Feeder Circuits and for Branch Circuit rated more than 30A: Identify with self-adhesive tape or vinyl label. Install labels at **30-foot (10-m)** maximum intervals.
- D. Accessible Raceways and Cables, including above accessible ceilings, within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive vinyl labels indicating the wiring system and system voltage. Conform to system color legend/schedule.
1. Standby Power
  2. Life Safety Branch
  3. Critical Branch
  4. Equipment System
  5. Normal Power
  6. UPS
  7. Fire Alarm
  8. Communications
  9. Access Control
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
1. Grounded Systems: Color-Coding for Phase-, Neutral- and Voltage-Level Identification: Use colors listed below for feeder and branch-circuit conductors.
    - a. Colors for 208/120-V Circuits:
      - 1) Phase A: Black.
      - 2) Phase B: Red.
      - 3) Phase C: Blue.
      - 4) Feeder Neutral: White
      - 5) Branch Circuit Neutral: White with colored stripe matching the color of the phase circuit that is paired with the neutral.
    - b. Colors for 480/277-V Circuits:
      - 1) Phase A: Brown.
      - 2) Phase B: Orange.
      - 3) Phase C: Yellow.
      - 4) Feeder Neutral: Grey
      - 5) Branch Circuit Neutral: Grey with colored stripe matching the color of the phase circuit that is paired with the neutral.
  2. Isolated Power Systems: Color-Coding for Circuit Identification: Use colors listed below for Isolated Power conductors.
    - a. Isolated Conductor No.1: Orange with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
    - b. Isolated Conductor No. 2: Brown with at least one distinctive colored stripe other than white, green, or grey along the entire length of the conductor.
  3. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities having jurisdiction permit.
    - a. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of **6 inches (150 mm)** from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
  4. Provide a sign at each panelboard identifying the color coding scheme.
- F. Install instructional sign, including the color code for grounded and ungrounded conductors using adhesive-film-type labels.
- G. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive vinyl labels with the conductor or cable designation, origin, and destination.

- H. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive vinyl labels with the conductor designation.
- I. Conductors To Be Extended in the Future: Attach write-on tags to conductors and list source.
- J. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
  - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
  - 2. Use system of marker-tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
  - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- K. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
  - 1. Limit use of underground-line warning tape to direct-buried cables.
  - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- L. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall comply with NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- M. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive warning labels.
  - 1. Comply with 29 CFR 1910.145.
  - 2. Identify system voltage with black letters on an orange background.
  - 3. Apply to exterior of door, cover, or other access.
  - 4. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
    - a. Power-transfer switches.
    - b. Controls with external control power connections.
- N. Arc Flash Warning Labeling: Self-adhesive thermal transfer vinyl labels.
  - 1. Comply with NFPA 70E and ANSI Z535.4.
  - 2. Comply with Section 26 05 74 "Overcurrent Protective Device Arc-Flash Study" requirements for arc-flash warning labels.
- O. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- P. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum ~~3/8-inch~~ (10-mm) high letters for emergency instructions at equipment used for power transfer or load shedding.
- Q. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm unless equipment is provided with its own identification.
  - 1. Labeling Instructions:

- a. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
  - b. Fasten mechanically fastened labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
2. Equipment To Be Labeled:
- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer.
  - b. Enclosures and electrical cabinets.
  - c. Lighting control relay cabinets.
  - d. Access doors and panels for concealed electrical items.
  - e. Switchgear.
  - f. Switchboards.
  - g. Transformers: Label that includes tag designation shown on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
  - h. Emergency system boxes and enclosures.
  - i. Motor-control centers.
  - j. Enclosed switches.
  - k. Enclosed circuit breakers.
  - l. Enclosed controllers.
  - m. Variable-speed controllers.
  - n. Push-button stations.
  - o. Power-transfer equipment.
  - p. Contactors.
  - q. Remote-controlled switches, dimmer modules, and control devices.
  - r. Battery-inverter units.
  - s. Battery racks.
  - t. Power-generating units.
  - u. Monitoring and control equipment.
  - v. UPS equipment.
  - w. Communications Equipment Racks.
  - x. Fire Alarm System.
  - y. Access Control System.
  - z. Overhead Paging System.
  - aa. Nurse Call System.

**END OF SECTION**

**SECTION 26 05 72**  
**OVERCURRENT PROTECTION DEVICE SHORT-CIRCUIT STUDY**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

**1.3 DEFINITIONS**

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
  - 1. Short-circuit study input data, including completed computer program input data sheets.
  - 2. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
    - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.
    - b. Revised single-line diagram, reflecting field investigation results and results of short-circuit study.

3. Electronic copies of all studies that are performed and reports that are produced by SKM software in a format that is useable by SKM Power Tools Deliver on thumb drive or external hard drive which will not be returned.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Short-Circuit Study Specialist.
- B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

## 1.6 QUALITY ASSURANCE

- A. Studies shall SKM Power Tools Software. Manual calculations are unacceptable.
- B. Short-Circuit Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- C. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.1 COMPUTER SOFTWARE

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. SKM Systems Analysis, Inc.

### 2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of the computer printout.
- C. One-line diagram, showing the following:
  1. Protective device designations and ampere ratings.
  2. Cable size and lengths.
  3. Transformer kilovolt ampere (kVA) and voltage ratings.
  4. Motor and generator designations and kVA ratings.
  5. Switchgear, switchboard, motor-control center, and panelboard designations.
- D. Comments and recommendations for system improvements, where needed.
- E. Protective Device Evaluation:
  1. Evaluate equipment and protective devices and compare to short-circuit ratings.

2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
  3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
  4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
  5. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data: As described in "Power System Data" Article in the Evaluations.
- G. Short-Circuit Study Output:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. Equivalent impedance.
  2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. Calculated asymmetrical fault currents:
      - 1) Based on fault-point X/R ratio.
      - 2) Based on calculated symmetrical value multiplied by 1.6.
      - 3) Based on calculated symmetrical value multiplied by 2.7.
  3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. No AC Decrement (NACD) ratio.
    - e. Equivalent impedance.
    - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Obtain all data necessary for the conduct of the study.
1. Verify completeness of data supplied on the one-line diagram. Call any discrepancies to the attention of Architect.
  2. For equipment provided that is Work of this Project, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
  3. For relocated equipment and that which is existing to remain or to modified, obtain required electrical distribution system data by field investigation and surveys, conducted



by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.

- B. Gather and tabulate the following input data to support the short-circuit study. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Obtain electrical power utility impedance at the service.
  3. Power sources and ties.
  4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
  6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
  7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
  9. Motor horsepower and NEMA MG 1 code letter designation.
  10. Cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).

### 3.2 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on the device characteristics supplied by device manufacturer.
- D. The extent of the electrical power system to be studied is indicated on Drawings.
- E. Begin short-circuit current analysis at the secondary of the point of connection to Provo City Power which is at the line side of the existing primary meter and at the generator outputs, extending down to the system overcurrent protective devices as follows:
1. To normal system low-voltage load buses where fault current is 10 kA or less.
  2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.

1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- H. Assume 10 kA
- I. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault at each of the following:
1. Electric utility's supply termination point.
  2. Incoming switchgear.
  3. Medium voltage transformer primary and secondary terminals.
  4. Low-voltage switchgear.
  5. Motor-control centers.
  6. Control panels.
  7. Standby generators and automatic transfer switches.
  8. Branch circuit panelboards.
  9. Disconnect switches.
  10. Power Transfer equipment.

### **3.3 ADJUSTING**

- A. Make minor modifications to equipment as required to accomplish compliance with short-circuit study.

### **3.4 DEMONSTRATION**

- A. Train Owner's operating and maintenance personnel in the use of study results.

**END OF SECTION**

**SECTION 26 05 73**  
**OVERCURRENT PROTECTIVE DEVICE COORDINATION STUDY**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

**1.3 DEFINITIONS**

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
  - 1. Coordination-study input data, including completed computer program input data sheets.
  - 2. Study and equipment evaluation reports.
  - 3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
    - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Coordination Study Specialist and Field Adjusting Agency.
- B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

**1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For the overcurrent protective devices to include in emergency, operation, and maintenance manuals.
  - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
    - a. The following parts from the Protective Device Coordination Study Report:
      - 1) One-line diagram.
      - 2) Protective device coordination study.
      - 3) Time-current coordination curves.
    - b. Power system data.
  - 2. Electronic copies of all studies that are performed and reports that are produced by SKM software in a format that is useable by SKM Power Tools Deliver on thumb drive or external hard drive which will not be returned.

**1.7 QUALITY ASSURANCE**

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Coordination Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
  - 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Coordination Study Specialist Qualifications: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

**PART 2 - PRODUCTS****2.1 COMPUTER SOFTWARE DEVELOPERS**

- A. Software Developers:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
  - a. SKM Systems Analysis, Inc.
- B. Comply with IEEE 242 and IEEE 399.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
  1. Optional Features:
    - a. Arcing faults.
    - b. Simultaneous faults.
    - c. Explicit negative sequence.
    - d. Mutual coupling in zero sequence.

## 2.2 PROTECTIVE DEVICE COORDINATION STUDY REPORT CONTENTS

- A. Executive summary.
- B. Study descriptions, purpose, basis and scope. Include case descriptions, definition of terms and guide for interpretation of the computer printout.
- C. One-line diagram, showing the following:
  1. Protective device designations and ampere ratings.
  2. Cable size and lengths.
  3. Transformer kilovolt ampere (kVA) and voltage ratings.
  4. Motor and generator designations and kVA ratings.
  5. Switchgear, switchboard, motor-control center, and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 72 "Overcurrent Protective Device Short-Circuit Study."
- F. Protective Device Coordination Study:
  1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
    - a. Phase and Ground Relays:
      - 1) Device tag.
      - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
      - 3) Recommendations on improved relaying systems, if applicable.
    - b. Circuit Breakers:
      - 1) Adjustable pickups and time delays (long time, short time, ground).
      - 2) Adjustable time-current characteristic.
      - 3) Adjustable instantaneous pickup.
      - 4) Recommendations on improved trip systems, if applicable.

- c. Fuses: Show current rating, voltage, and class.
- G. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination for the period of time that a fault's duration extends beyond 0.1 second. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:
1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
  2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
  3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
  4. Plot the following listed characteristic curves, as applicable:
    - a. Power utility's overcurrent protective device.
    - b. Medium-voltage equipment overcurrent relays.
    - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
    - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
    - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
    - f. Cables and conductors damage curves.
    - g. Ground-fault protective devices.
    - h. Motor-starting characteristics and motor damage points.
    - i. Generator short-circuit decrement curve and generator damage point.
    - j. The largest feeder circuit breaker in each motor-control center and panelboard.
  5. Provide adequate time margins between device characteristics such that selective operation is achieved.
  6. Comments and recommendations for system improvements.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.
  1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

#### **3.2 PROTECTIVE DEVICE COORDINATION STUDY**

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. The study shall be based on the device characteristics supplied by device manufacturer.

- D. The extent of the electrical power system to be studied is indicated on Drawings.
- E. Begin analysis at the service, extending down to the system overcurrent protective devices as follows:
  - 1. To normal and emergency systems low-voltage load buses where fault current is 10 kA or less.
  - 2. Exclude equipment rated 240-V ac or less when supplied by a single transformer rated less than 125 kVA.
- F. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- G. Transformer Primary Overcurrent Protective Devices:
  - 1. Device shall not operate in response to the following:
    - a. Inrush current when first energized.
    - b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
    - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
  - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
- H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
- I. Generator Protection: Select protection according to manufacturer's written recommendations and to IEEE 242.
- J. The calculations shall include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and shall apply to low- and medium-voltage, three-phase ac systems. The calculations shall also account for the fault-current dc decrement, to address the asymmetrical requirements of the interrupting equipment.
  - 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- K. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and single line-to-ground fault at each of the following:
  - 1. Electric utility's supply termination point.
  - 2. Switchgear.
  - 3. Low-voltage switchgear.
  - 4. Motor-control centers.
  - 5. Standby generators and automatic transfer switches.
  - 6. Branch circuit panelboards.
- L. Protective Device Evaluation:
  - 1. Evaluate equipment and protective devices and compare to short-circuit ratings.
  - 2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.

### 3.3 LOAD-FLOW AND VOLTAGE-DROP STUDY

- A. Perform a load-flow and voltage-drop study to determine the steady-state loading profile of the system. Analyze power system performance two times as follows:
1. Determine load-flow and voltage drop based on full-load currents obtained in "Power System Data" Article.
  2. Determine load-flow and voltage drop based on 80 percent of the design capacity of the load buses.
  3. Prepare the load-flow and voltage-drop analysis and report to show power system components that are overloaded, or might become overloaded; show bus voltages that are less than as prescribed by NFPA 70.

### 3.4 POWER SYSTEM DATA

- A. Obtain all data necessary for the conduct of the overcurrent protective device study.
1. Verify completeness of data supplied in the one-line diagram on Drawings. Call discrepancies to the attention of Architect.
  2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
  3. For existing equipment, whether or not relocated obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. The qualifications of technicians and engineers shall be qualified as defined by NFPA 70E.
- B. Gather and tabulate the following input data to support coordination study. The list below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  2. Electrical power utility impedance at the service.
  3. Power sources and ties.
  4. Short-circuit current at each system bus, three phase and line-to-ground.
  5. Full-load current of all loads.
  6. Voltage level at each bus.
  7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
  8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
  9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
  10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
  11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
  12. Maximum demands from service meters.
  13. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
  14. Motor horsepower and NEMA MG 1 code letter designation.



15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
16. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.
17. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:
  - a. Special load considerations, including starting inrush currents and frequent starting and stopping.
  - b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
  - c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
  - d. Generator thermal-damage curve.
  - e. Ratings, types, and settings of utility company's overcurrent protective devices.
  - f. Special overcurrent protective device settings or types stipulated by utility company.
  - g. Time-current-characteristic curves of devices indicated to be coordinated.
  - h. Manufacturer, frame size, interrupting rating in amperes rms symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
  - i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
  - j. Panelboards, switchboards, motor-control center ampacity, and SCCR in amperes rms symmetrical.

### **3.5 FIELD ADJUSTING**

- A. Adjust relay and protective device settings according to the recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.
- C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
  1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

### **3.6 DEMONSTRATION**

- A. Engage the Coordination Study Specialist to train Owner's maintenance personnel in the following:
  1. Acquaint personnel in the fundamentals of operating the power system in normal and emergency modes.
  2. Hand-out and explain the objectives of the coordination study, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting the time-current coordination curves.
  3. Adjust, operate, and maintain overcurrent protective device settings.

**END OF SECTION**

**SECTION 26 05 74**  
**OVERCURRENT PROTECTIVE DEVICE ARC-FLASH STUDY**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

**1.3 DEFINITIONS**

- A. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.
- B. One-Line Diagram: A diagram which shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- D. SCCR: Short-circuit current rating.
- E. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For computer software program to be used for studies.
- B. Other Action Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form.
  - 1. Arc-flash study input data, including completed computer program input data sheets.
  - 2. Arc-flash study report; signed, dated, and sealed by a qualified professional engineer.
    - a. Submit study report for action prior to receiving final approval of the distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that the selection of devices and associated characteristics is satisfactory.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For Arc-Flash Study Specialist.

- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

## 1.6 CLOSEOUT SUBMITTALS

- A. Maintenance procedures according to requirements in NFPA 70E shall be provided in the equipment manuals.
- B. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.
- C. Electronic copies of all studies that are performed and reports that are produced by SKM software in a format that is useable by SKM Power Tools Deliver on thumb drive or external hard drive which will not be returned.

## 1.7 QUALITY ASSURANCE

- A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are unacceptable.
- B. Arc-Flash Study Software Developer Qualifications: An entity that owns and markets computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.
  - 1. The computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- C. Arc-Flash Study Specialist Qualifications: Professional engineer in charge of performing the study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- D. Field Adjusting Agency Qualifications: An independent agency, with the experience and capability to adjust overcurrent devices and to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

## PART 2 - PRODUCTS

### 2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Software Developers:
  - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
    - a. SKM Systems Analysis, Inc.
- B. Comply with IEEE 1584 and NFPA 70E.

- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

## 2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary.
- B. Study descriptions, purpose, basis and scope.
- C. One-line diagram, showing the following:
  - 1. Protective device designations and ampere ratings.
  - 2. Cable size and lengths.
  - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
  - 4. Motor and generator designations and kVA ratings.
  - 5. Switchgear, switchboard, motor-control center and panelboard designations.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output: As specified in "Short Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260572 "Overcurrent Protective Device Short-Circuit Study."
- F. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 260573 "Overcurrent Protective Device Coordination Study."
- G. Arc-Flash Study Output:
  - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
    - a. Voltage.
    - b. Calculated symmetrical fault-current magnitude and angle.
    - c. Fault-point X/R ratio.
    - d. No AC Decrement (NACD) ratio.
    - e. Equivalent impedance.
    - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
    - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.
- H. Incident Energy and Flash Protection Boundary Calculations:
  - 1. Arcing fault magnitude.
  - 2. Protective device clearing time.
  - 3. Duration of arc.
  - 4. Arc-flash boundary.
  - 5. Working distance.
  - 6. Incident energy.
  - 7. Hazard risk category.
  - 8. Recommendations for arc-flash energy reduction.
- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of the computer printout.

**2.3 ARC-FLASH WARNING LABELS**

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a **3.5-by-5-inch (76-by-127-mm)** thermal transfer label of high-adhesion polyester for each work location included in the analysis.
- B. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
  - 1. Location designation.
  - 2. Nominal voltage.
  - 3. Flash protection boundary.
  - 4. Hazard risk category.
  - 5. Incident energy.
  - 6. Working distance.
  - 7. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

**PART 3 - EXECUTION****3.1 EXAMINATION**

- A. Examine Project overcurrent protective device submittals. Proceed with arc-flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

**3.2 ARC-FLASH HAZARD ANALYSIS**

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies:
  - 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output" Paragraph in "Short-Circuit Study Report Contents" Article in Section 26 05 72 "Overcurrent Protective Device Short-Circuit Study."
  - 2. Protective Device Coordination Study Report Contents: As specified in "Protective Device Coordination Study Report Contents" Article in Section 26 05 73 "Overcurrent Protective Device Coordination Study."
- C. Calculate maximum and minimum contributions of fault-current size.
  - 1. The minimum calculation shall assume that the utility contribution is at a minimum and shall assume no motor load.
  - 2. The maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
- D. Calculate the arc-flash protection boundary and incident energy at locations in the electrical distribution system where personnel could perform work on energized parts.
- E. Include medium- and low-voltage equipment locations, except equipment rated 240-V ac or less fed from transformers less than 125 kVA.

- F. Safe working distances shall be specified for calculated fault locations based on the calculated arc-flash boundary, considering incident energy of 1.2 cal/sq.cm.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
  - 1. Fault contribution from induction motors should not be considered beyond three to five cycles.
  - 2. Fault contribution from synchronous motors and generators should be decayed to match the actual decrement of each as closely as possible (e.g., contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash computation shall include both line and load side of a circuit breaker as follows:
  - 1. When the circuit breaker is in a separate enclosure.
  - 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

### 3.3 POWER SYSTEM DATA

- A. Obtain all data necessary for the conduct of the arc-flash hazard analysis.
  - 1. Verify completeness of data supplied on the one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to the attention of Architect.
  - 2. For new equipment, use characteristics submitted under the provisions of action submittals and information submittals for this Project.
  - 3. For existing equipment, whether or not relocated, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers.
- B. Electrical Survey Data: Gather and tabulate the following input data to support study. Comply with recommendations in IEEE 1584 and NFPA 70E as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under the direct supervision and control of the engineer in charge of performing the study, and shall be by the engineer or its representative who holds NETA ETT Level III certification or NICET Electrical Power Testing Level III certification.
  - 1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
  - 2. Obtain electrical power utility impedance at the service.
  - 3. Power sources and ties.
  - 4. Short-circuit current at each system bus, three phase and line-to-ground.
  - 5. Full-load current of all loads.
  - 6. Voltage level at each bus.
  - 7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in per cent, and phase shift.
  - 8. For reactors, provide manufacturer and model designation, voltage rating and impedance.
  - 9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.

10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
12. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage cable sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage cable sizes, lengths, conductor material, and cable construction and metallic shield performance parameters.

### **3.4 LABELING**

- A. Apply one arc-flash label for 600-V ac, 480-V ac, and applicable 208-V ac panelboards and disconnects and for each of the following locations:
  1. Motor-control center.
  2. Low-voltage switchboard.
  3. Switchgear.
  4. Medium-voltage switch.
  5. Control panel.

### **3.5 APPLICATION OF WARNING LABELS**

- A. Install the arc-fault warning labels under the direct supervision and control of the Arc-Flash Study Specialist.

### **3.6 DEMONSTRATION**

- A. Engage the Arc-Flash Study Specialist to train Owner's maintenance personnel in the potential arc-flash hazards associated with working on energized equipment and the significance of the arc-flash warning labels.

**END OF SECTION**



**SECTION 26 09 23**  
**LIGHTING CONTROL DEVICES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Photoelectric switches.
  2. Standalone daylight-harvesting switching controls.
  3. Daylight-harvesting dimming controls.
  4. Room Controllers.
  5. Stand Alone Indoor occupancy sensors.
  6. Lighting contactors.
  7. Emergency shunt relays.
  8. Low-Voltage Controllers
- B. Related Requirements:
1. Section 26 27 26 "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

**1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Shop Drawings: Show installation details for occupancy and light-level sensors.
1. Submit complete scale drawing showing recommended location for each sensor, optimized for project conditions and coverage patterns for submitted devices.
  2. Interconnection diagrams showing field-installed wiring.
  3. Include diagrams for power, signal, and control wiring.

**1.4 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.5 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For each type of lighting control device to include in emergency, operation, and maintenance manuals.

**PART 2 - PRODUCTS****2.1 OUTDOOR PHOTOELECTRIC SWITCHES**

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. [Cooper Industries, Inc.](#)
  2. [Intermatic, Inc.](#)
  3. [Leviton Manufacturing Co., Inc.](#)
  4. [NSi Industries LLC.](#)
  5. [TE Connectivity Ltd.](#)
- B. Description: Solid state, with SPST dry contacts rated for 1800 VA, to operate connected load, complying with UL 773.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Light-Level Monitoring Range: **1.5 to 10 fc (16.14 to 108 lux)**, with an adjustment for turn-on and turn-off levels within that range.
  3. Time Delay: Thirty-second minimum, to prevent false operation.
  4. Lightning Arrester: Air-gap type.
  5. Mounting: Twist lock complying with NEMA C136.10, with base.

**2.2 DAYLIGHT-HARVESTING SWITCHING CONTROLS**

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.
- B. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. [Eaton \(Cooper Controls\), Inc.](#)
  2. [Lutron, Inc.](#)
  3. [Leviton Manufacturing Co., Inc.](#)
  4. Philips Controls
  5. Acuity Controls
  6. Nextlite
  7. ETC
  8. Douglas Controls
  9. WattStopper
- C. Ceiling-Mounted Switching Controls: Solid-state, light-level sensor unit, with separate power pack, to detect changes in indoor lighting levels that are perceived by the eye.
- D. Electrical Components, Devices, and Accessories:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Operating Ambient Conditions: Dry interior conditions, **32 to 120 deg F (0 to 49 deg C)**.
  3. Sensor Output: Contacts rated to operate the associated power pack, complying with UL 773A. Sensor is powered by the power pack.
  4. Power Pack: Dry contacts rated for **20-A** ballast load at 120- and 277-V ac. Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  5. General Space Sensors Light-Level Monitoring Range: **10 to 200 fc (108 to 2152 lux)**, with an adjustment for turn-on and turn-off levels within that range.

6. Atrium Space Sensors Light-Level Monitoring Range: 100 to 1000 fc (1080 to 10 800 lux), with an adjustment for turn-on and turn-off levels within that range.
7. Skylight Sensors Light-Level Monitoring Range: 1000 to 10,000 fc (10 800 to 108 000 lux), with an adjustment for turn-on and turn-off levels within that range.
8. Time Delay: Adjustable from 5 to 300 seconds to prevent cycling.
9. Set-Point Adjustment: Equip with deadband adjustment of 25, 50, and 75 percent above the "on" set point, or provide with separate adjustable "on" and "off" set points.
10. Test Mode: User selectable, overriding programmed time delay to allow settings check.
11. Control Load Status: User selectable to confirm that load wiring is correct.
12. Indicator: Two digital displays to indicate the beginning of on-off cycles.

### 2.3 DAYLIGHT-HARVESTING DIMMING CONTROLS

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.
- B. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
  1. [Eaton \(Cooper Controls\), Inc.](#)
  2. [Lutron, Inc.](#)
  3. [Leviton Manufacturing Co., Inc.](#)
  4. Philips Controls
  5. Acuity Controls
  6. NextLite
  7. Douglas Controls
  8. ETC
  9. WattStopper
- C. System Description: Sensing daylight and electrical lighting levels, the system adjusts the indoor electrical lighting levels. As daylight increases, the lights are dimmed.
  1. Lighting control set point is based on two lighting conditions:
    - a. When no daylight is present (target level).
    - b. When significant daylight is present.
  2. System programming is done with two hand-held, remote-control tools.
    - a. Initial setup tool.
    - b. Tool for occupants to adjust the target levels by increasing the set point up to 25 percent, or by minimizing the electric lighting level.
- D. Ceiling-Mounted Dimming Controls: Solid-state, light-level sensor unit, with separate controller unit, to detect changes in lighting levels that are perceived by the eye. The separate dimming control may be located in the appropriate relay cabinet for these circuits.
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Sensor Output: 0- to 10-V dc to operate electronic dimming ballasts. Sensor is powered by controller unit.
  3. Power Pack: Sensor has 24-V dc, Class 2 power source, as defined by NFPA 70.
  4. Light-Level Sensor Set-Point Adjustment Range: 20 to 100 fc (120 to 600 lux).

### 2.4 ROOM CONTROLLERS

- A. Room Controllers are used to independently control lighting and switched receptacles.

- B. Provide products that are compatible with Indoor Occupancy Sensors.
- C. Digitally addressable room controller with the following functions.
  - 1. Autonomous space control.
  - 2. Networking to a central Dialog control system.
  - 3. Networking to a central BACnet based management system.
- D. The Room Controller shall consist of:
  - 1. A universal voltage type (120Vac/277Vac/347Vac) power supply.
  - 2. Four 20A rated relays complete with manual override. Circuit Load rating dependent on usage. One circuit dedicated for 20A receptacle control.
  - 3. Four 0-10V control channels, capable of 100mA current sinking
  - 4. A port to connect downstream switches, occupancy sensors and daylight sensors.
  - 5. A port to connect upstream to BACnet IP building management system. The Controller shall communicate using native BACnet command objects appropriate for the application.
  - 6. An indicating LED to aid in locating the controller in a darkened ceiling space.
  - 7. Circuit testing buttons
  - 8. Capable of connecting with WUL-3924
  - 9. Output 24Vac 120mA
  - 10. Relay Ratings
    - a. 20A Suitable for General Purpose Loads @ 120/277 VAC
    - b. 20A Suitable for Standard Ballasts and Tungsten Loads @ 120/277 VAC
    - c. 16A Suitable for Electronic Ballasts @ 120/277 VAC
    - d. 0.5HP @120/277 VAC.
  - 11. The Room Controller relays shall be connected such that 120Vac plug load(s) and 277Vac lighting loads can be switched by a single Controller with no additional add-ons or remote modules
  - 12. The Room Controller shall mount to electrical junction box via threaded ½” chase nipple. No other mounting hardware shall be required.
  - 13. Switches shall connect to the lighting control network via a common low voltage, 2-wire, non-polarized data line.
    - a. Switches shall be factory configured and programmed to control one or more outputs in the lighting control system.
    - b. Switches can be programmed for preset control to set a specific lighting scene.
    - c. Switches, with LED indicators to indicate both ON and OFF output/group status, shall be available with 2 or 4 single button switches per gang. Switch to fit standard Decora opening.
    - d. Switches and switch hardware shall mount to standard wall boxes.
    - e. Each switch shall provide a location for a label to identify function. The label shall be under a clear plastic cover and shall be field replaceable should the operation of the switch change. Permanently etched switches are not acceptable.
  - 14. Dimmer switches shall be connected to the lighting control network via a common low voltage 2-wire, non-polarized data line.
    - a. Dimmer switches shall be capable of raising or lowering light levels of individual or groups of lighting fixtures.
  - 15. Space Control Requirements:
    - a. Provide manual-on / auto-off control for lighting in all spaces that are controlled by a Room Controller.
    - b. Provide auto-on / auto-off control for all switched receptacles that are controlled by a Room Controller.
    - c. Provide auto-on / auto-off control for HVAC serving all spaces that contain a Room Controller. Control to be provided by either two-wire signal based on relay contact position or direct communication with the building management system using BACnet commands. Coordinate with building management system installer.

16. Shall have a built in dimmer memory, the light output will remain at the previous setting when the lights are turned off and back on.

## 2.5 INDOOR OCCUPANCY SENSORS

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 26 09 43, Relay Based Lighting Controls.
- B. General Requirements for Sensors: Wall- or ceiling-mounted, solid-state indoor occupancy sensors with a separate power pack.
  1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
  2. Operation: Unless otherwise indicated, turn lights on when coverage area is occupied, and turn them off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
  3. In locations where the sensor or the local switch is/are marked "VS" the sensor shall turn the lights off automatically upon room vacancy. The lights shall turn on only upon activation from the associated wall station.
  4. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor is powered from the power pack.
  5. Power Pack: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac Sensor has 24-V dc, 150-mA, Class 2 power source, as defined by NFPA 70.
  6. Mounting:
    - a. Sensor: Suitable for mounting in any position on a standard outlet box.
    - b. Relay: Externally mounted through a **1/2-inch (13-mm)** knockout in a standard electrical enclosure.
    - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
  7. Indicator: Digital display, to show when motion is detected during testing and normal operation of sensor.
  8. Bypass Switch: Override the "on" function in case of sensor failure.
  9. Automatic Light-Level Sensor: Adjustable from **2 to 200 fc (21.5 to 2152 lux)**; turn lights off when selected lighting level is present.
- C. Dual-Technology Type: Ceiling mounted; detect occupants in coverage area using both PIR and ultrasonic detection methods. The particular technology or combination of technologies that control on-off functions is selectable in the field by operating controls on unit.
  1. Sensitivity Adjustment: Separate for each sensing technology.
  2. Detector Sensitivity: Detect occurrences of **6-inch- (150-mm-)** minimum movement of any portion of a human body that presents a target of not less than **36 sq. in. (232 sq. cm)**, and detect a person of average size and weight moving not less than **12 inches (305 mm)** in either a horizontal or a vertical manner at an approximate speed of **12 inches/s (305 mm/s)**.
  3. Detection Coverage (Standard Room): Detect occupancy anywhere within a circular area of **1000 sq. ft. (93 sq. m)** when mounted on a **96-inch- (2440-mm-)** high ceiling.
  4. Remote powerpacks using one or more sensors shall be used to cover space as indicated on drawings.
  5. Device shall be vacancy sensing (in conjunction with local wall station) if marked "VS". Otherwise device shall be occupancy sensing.

**2.6 SWITCHBOX-MOUNTED OCCUPANCY SENSORS**

- A. Provide products that are of the same manufacturer or compatible with the manufacturers listed in Section 260943, Relay Based Lighting Controls.
- B. General Requirements for Sensors: Automatic-wall-switch occupancy sensor, suitable for mounting in a single gang switchbox.
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application,
  2. Operating Ambient Conditions: Dry interior conditions, **32 to 120 deg F (0 to 49 deg C)**.
  3. Switch Rating: Not less than 800-VA LED at 120 V, 1200-VA LED loads at 277 V,
- C. Wall-Switch Sensor:
1. Standard Range: 180-degree field of view, field adjustable from 180 to 40 degrees; with a minimum coverage area of **900 sq. ft. (84 sq. m)**.
  2. Sensing Technology: Dual technology - PIR and ultrasonic.
  3. Switch Type: SP. SP, manual "on," automatic "off."
  4. Voltage: Dual voltage, 120 and 277 V;
  5. Ambient-Light Override: Concealed, field-adjustable, light-level sensor from **10 to 150 fc (108 to 1600 lux)**. The switch prevents the lights from turning on when the light level is higher than the set point of the sensor.
  6. Concealed, field-adjustable, "off" time-delay selector at up to 30 minutes.
  7. Adaptive Technology: Self-adjusting circuitry detects and memorizes usage patterns of the space and helps eliminate false "off" switching.
  8. Device shall be Vacancy sensing if marked VS or occupancy sensing if not otherwise marked.

**2.7 LIGHTING CONTACTORS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. [Allen-Bradley/Rockwell Automation](#).
  2. [ASCO Power Technologies, LP; a division of Emerson Electric Co.](#)
  3. [Eaton Corporation](#).
  4. GE Industrial Systems; Total Lighting Control.
  5. [Square D; a brand of Schneider Electric](#).
- B. Description: Electrically operated, electrically held, combination-type lighting contactors with fusible switch complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
  2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
  3. Enclosure: Comply with NEMA 250.
  4. Provide with control and pilot devices as indicated on Drawings, matching the NEMA type specified for the enclosure.
- C. Interface with DDC System for HVAC: Provide hardware interface to enable the DDC system for HVAC to monitor and control lighting control systems and contactors.
1. Monitoring: On-off status
  2. Control: On-off operation

**2.8 EMERGENCY SHUNT RELAY**

- A. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
1. [Eaton \(Cooper Controls\), Inc.](#)
  2. [Lutron, Inc.](#)
  3. [Leviton Manufacturing Co., Inc.](#)
  4. Philips Controls
  5. Acuity Controls
  6. NextLite
  7. Douglas Controls
  8. Wattstopper
- B. Description: Normally closed, electrically held relay, arranged for wiring in parallel with automatic switching contacts; complying with UL 924.
1. Coil Rating: as scheduled.

**2.9 LOW-VOLTAGE CONTROLLERS**

- A. Low-Voltage Controllers are used to turn on and dim line voltage lighting safely when used with Nurse Call Pillow Speakers, Bed Side-Rail Controls and Momentary Dry Contact Switches.
- B. Manufacturers: Subject to compliance with requirements, provide the following:
1. Curbell Medical Products (Basis of Design is # LVC-2000-001)
- C. Description: 3 Channel lighting controller to continuously dim 2 channels using 0-10 vdc signals to the dimming LED drivers for the ambient light and reading light channels in the luminaire and to switch one channel via the LED driver(s) for the exam light portion of the luminaire. Controller shall have control inputs from nurse call pillow speaker contacts and also be switched from wall switches as shown.
- D. Installation: Lighting Controller shall be installed above the accessible ceiling outside the patient room for ease of access. All leads shall be extended from the switches, luminaire and nurse call system in an approved manner. Installer shall provide a NEMA 12 enclosure suitable for the purpose and mount the controller in this box. Observe required high and low voltage separation and physical barriers. Label the cover with the words "LIGHTING CONTROLLER FOR ROOM #####".

**2.10 CONDUCTORS AND CABLES**

- A. Power Wiring to Supply Side of Remote-Control Power Sources: Not smaller than No. 12 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- B. Classes 2 and 3 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 22 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cable: Multiconductor cable with stranded-copper conductors not smaller than No. 18 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

**PART 3 - EXECUTION****3.1 SENSOR INSTALLATION**

- A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.
- B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

**3.2 CONTACTOR INSTALLATION**

- A. Mount electrically held lighting contactors with elastomeric isolator pads to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

**3.3 WIRING INSTALLATION**

- A. Wiring Method: Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size is **1/2 inch (13 mm)**.
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.
- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

**3.4 IDENTIFICATION**

- A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."
  - 1. Identify controlled circuits in lighting contactors.
  - 2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.
- B. Label time switches and contactors with a unique designation.

**3.5 FIELD QUALITY CONTROL**

- A. Testing Agency: Owner will engage a qualified commissioning agent to evaluate lighting control devices and perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.



- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
  - 1. Operational Test: After installing time switches and sensors, and after electrical circuitry has been energized, start units to confirm proper unit operation.
  - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Lighting control devices will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

### **3.6 ADJUSTING**

- A. Occupancy Adjustments: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions. Provide up to **two** visits to Project during other-than-normal occupancy hours for this purpose.
  - 1. For occupancy and motion sensors, verify operation at outer limits of detector range. Set time delay to suit Owner's operations.
  - 2. For daylighting controls, adjust set points and deadband controls to suit Owner's operations.
  - 3. Align high-bay occupancy sensors using manufacturer's laser aiming tool.

### **3.7 DEMONSTRATION**

- A. Coordinate demonstration of products specified in this Section with demonstration requirements for low-voltage, programmable lighting control systems specified in Section 260943.13 "Addressable-Fixture Lighting Controls" and Section 26 09 43 "Relay-Based Lighting Controls."
- B. Train Owner's maintenance personnel to adjust, operate, and maintain lighting control devices.

**END OF SECTION**

**SECTION 26 24 16**  
**PANELBOARDS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Distribution panelboards.
  - 2. Lighting and appliance branch-circuit panelboards.

**1.3 DEFINITIONS**

- A. GFCI: Ground-fault circuit interrupter.
- B. GFEP: Ground-fault equipment protection.
- C. MCCB: Molded-case circuit breaker.
- D. SPD: Surge protective device.
- E. VPR: Voltage protection rating.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of panelboard.
  - 1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
  - 2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
  - 1. Include dimensioned plans, elevations, sections, and details.
  - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
  - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
  - 4. Detail bus configuration, current, and voltage ratings.
  - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
  - 6. Include evidence of NRTL listing for SPD as installed in panelboard.
  - 7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

**1.5 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards.

**1.6 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
  - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
  - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

**1.7 MAINTENANCE MATERIAL SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Keys: Two spares for each type of panelboard cabinet lock.

**1.8 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

**1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

**1.10 FIELD CONDITIONS**

- A. Environmental Limitations:
  - 1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
  - 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Not exceeding 23 deg F (minus 5 deg C) to plus 104 deg F (plus 40 deg C).
    - b. Altitude: Not exceeding 6600 feet (2000 m).
- B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
  - 1. Ambient temperatures within limits specified.
  - 2. Altitude not exceeding 6600 feet (2000 m).

- C. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  1. Notify Owner no fewer than two weeks in advance of proposed interruption of electric service.
  2. Do not proceed with interruption of electric service without Owner's written permission.
  3. Comply with NFPA 70E.

## 1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
  1. Panelboard Warranty Period: 18 months from date of Substantial Completion.
- B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
  1. SPD Warranty Period: Five years from date of Substantial Completion.

## PART 2 - PRODUCTS

### 2.1 PANELBOARDS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 26 05 48 "Seismic Controls for Electrical Systems."
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMA PB 1.
- E. Comply with NFPA 70.
- F. Enclosures: Flush and Surface-mounted, dead-front cabinets as indicated on drawings.
  1. Rated for environmental conditions at installed location.
    - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
    - b. Outdoor Locations including in water feature vaults: NEMA 250, Type 4X, stainless steel.
    - c. Kitchen Areas: NEMA 1, stainless steel.
    - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4X.
  2. Height: **84 inches (2.13 m)** maximum.
  3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
  4. Finishes:
    - a. Panels and Trim: Steel and galvanized steel, unless stainless steel is specified elsewhere, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.

- b. Back Boxes: Galvanized steel.
- G. Incoming Mains:
- 1. Location: Convertible between top and bottom.
- H. Phase, Neutral, and Ground Buses:
- 1. Material: Hard-drawn copper, 98 percent conductivity.
    - a. Plating shall run entire length of bus.
    - b. Bus shall be fully rated the entire length.
  - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
  - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
  - 4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box. Only required where indicated on drawings.
  - 5. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- I. Conductor Connectors: Suitable for use with conductor material and sizes.
- 1. Material: Hard-drawn copper, 98 percent conductivity.
  - 2. Terminations shall allow use of 75 deg C rated conductors without derating.
  - 3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
  - 4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
  - 5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
  - 6. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- J. NRTL Label: Panelboards shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- K. Future Devices: Panelboards shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices at all locations that are indicated in schedules as space or provision. Note that schedules may include provisions or spaces that are not shown on the one-line diagrams.
- L. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
- 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings not lower than the calculated symmetrical fault current magnitude as calculated in the Short Circuit Study required by Specification Section 26 05 72, but not less than 10,000 A rms symmetrical.
  - 2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings not lower than the calculated symmetrical fault current magnitude as calculated in the Short Circuit Study required by Specification Section 26 05 72, but not less than 14,000 A rms symmetrical.

- M. SPD.
1. Peak Surge Current Rating: The minimum single-pulse surge current withstand rating per phase shall not be less than 100 kA. The peak surge current rating shall be the arithmetic sum of the ratings of the individual MOVs in a given mode.
  2. Protection modes and UL 1449 VPR for grounded wye circuits with 480Y/277 V and 208Y/120 V, three-phase, four-wire circuits shall not exceed the following:
    - a. Line to Neutral: 1200 V for 480Y/277 V / 700 V for 208Y/120 V.
    - b. Line to Ground: 1200 V for 480Y/277 V / 700 V for 208Y/120 V.
    - c. Neutral to Ground: 1200 V for 480Y/277 V / 700 V for 208Y/120 V.
    - d. Line to Line: 2000 V for 480Y/277 V / 1200 V for 208Y/120 V.
  3. SCCR: Equal to the SCCR of the panelboard in which installed or exceed 100 kA.

## 2.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to ASCE/SEI 7
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and will continue to function after the seismic event."
- B. Surge Suppression: Factory installed as an integral part of indicated panelboards, complying with UL 1449 SPD Type 1.

## 2.3 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
  2. General Electric Company; GE Energy Management - Electrical Distribution.
  3. Siemens Energy.
  4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Mains: Circuit breaker or Lugs only as indicated on drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers.

## 2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
  2. General Electric Company; GE Energy Management - Electrical Distribution.
  3. Siemens Energy.
  4. Square D; by Schneider Electric.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker or lugs only as indicated on drawings.

- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

## 2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. General Electric Company; GE Energy Management - Electrical Distribution.
  - 3. Siemens Energy.
  - 4. Square D; by Schneider Electric.
- B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
  - 1. Thermal-Magnetic Circuit Breakers:
    - a. Inverse time-current element for low-level overloads.
    - b. Instantaneous magnetic trip element for short circuits.
    - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
  - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
  - 3. Electronic Trip Circuit Breakers:
    - a. RMS sensing.
    - b. Field-replaceable rating plug or electronic trip.
    - c. Digital display of settings, trip targets, and indicated metering displays.
    - d. Multi-button keypad to access programmable functions and monitored data.
    - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
    - f. Integral test jack for connection to portable test set or laptop computer.
    - g. Field-Adjustable Settings:
      - 1) Instantaneous trip.
      - 2) Long- and short-time pickup levels.
      - 3) Long and short time adjustments.
      - 4) Ground-fault pickup level, time delay, and I squared T response.
  - 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
  - 5. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
  - 6. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
  - 7. MCCB Features and Accessories:
    - a. Standard frame sizes, trip ratings, and number of poles.
    - b. Breaker handle indicates tripped status.
    - c. UL listed for reverse connection without restrictive line or load ratings.
    - d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
    - e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
    - f. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

- g. Shunt Trip: 120-V trip coil energized from separate circuit, set to trip at 55 percent of rated voltage.
- h. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage with field-adjustable 0.1- to 0.6-second time delay.
- i. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- j. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

## 2.6 INSTRUMENTATION

- A. Instrument Transformers: NEMA EI 21.1, and the following:
  - 1. Potential Transformers: NEMA EI 21.1; 120 V, 60 Hz, single secondary; disconnecting type with integral fuse mountings. Burden and accuracy shall be consistent with connected metering and relay devices.
  - 2. Current Transformers: NEMA EI 21.1; 5 A, 60 Hz, secondary; wound type; single secondary winding and secondary shorting device. Burden and accuracy shall be consistent with connected metering and relay devices.
- B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
  - 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
    - a. Phase Currents, Each Phase and Neutral: Plus or minus 0.5 percent.
    - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
    - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
    - d. Megawatts: Plus or minus 1 percent.
    - e. Megavars: Plus or minus 1 percent.
    - f. Power Factor: Plus or minus 1 percent.
    - g. Frequency: Plus or minus 0.1 percent.
    - h. Phase-to-Neutral % Total Harmonic Distortion (THD)
    - i. Phase Current % Total Harmonic Distortion (THD)
    - j. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
    - k. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
  - 2. Mounting: Display and control unit flush or semiflush mounted in instrument compartment door or remote mounted adjacent to panelboard. Where multiple panelboard meters are located within the same electrical room the meters may be mounted in a single enclosure with identification that clearly indicates the panelboard associated with the meter. Provide a separate meter for each panelboard that is indicated to have a meter installed.
  - 3. Communication Format: BACnet / IP Ethernet.

## 2.7 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.



- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
  - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

## 2.8 ISOLATED POWER SYSTEM PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Square D; by Schneider Electric.
  - 2. Isotrol/Bender
  - 3. PG LifeLink
- B. This section covers Isolated Power Panels Dual Systems that incorporate two (2) isolation transformers, two (2) primary circuit breaker, two (2) or more isolated ungrounded secondary circuits connected by conduit to remotely located receptacles, two (2) reference ground buses, and two (2) Line Isolation Monitors (LIM). There must be provisions for connection to remote indicators.
- C. The equipment must be listed under UL1047 - Isolated Power Systems Equipment. The Components of these products covered under this standard are judged to include, but are not necessarily limited to the following:
  - 1. Article 517 of the National Electric Code, NFPA 70
  - 2. Standard for Health Care Facilities, NFPA 99
  - 3. Standard for Line Isolation Monitors, UL 1022
  - 4. Standard for Specialty Transformers, UL 506
  - 5. Standard for Cabinets and Boxes, UL 50
- D. Product: this section imposes additional constraints on the product addressing such topics as construction details, size, operator interface, and component performance. This information is intended to supplement the requirements imposed by UL 1047 which is the guiding and governing document in all matters concerning this specification.
- E. Enclosure for single phase isolated power panels dual systems up to 10kva:
  - 1. Backbox: flush mounted units shall be fabricated from 14GA galvanized sheet steel. There shall be a space for a backplate and a transformer shelf to mount an upright isolation transformer. The dimensions of the backbox shall be 71"H x 34"W x 8"D.
  - 2. Backplate: fabricated from 12GA galvanized sheet steel. The backplate shall provide a mounting surface for all isolated power panel components except for the isolation transformer. The backplate shall be mounted to the backbox by means of four (4) 1/4" - 20 studs.
  - 3. Heat Shield (Vertical & Horizontal): The vertical heat shield shall be .090" aluminum and the horizontal heat shield shall be 14GA galvanized sheet steel.
- F. Front Trim: Shall be fabricated from 14GA Type 304 Stainless Steel, with #4 brushed finish and shall contain a flush door covering each circuit breaker section. Each door shall contain a flush, keylocking slam-latch capable of being latched whether the latches are locked or not. A door stop shall be firmly attached to the interior of the front trim. All panels shall be keyed alike. Front trim shall contain one (1) cut out for each LIM, which shall remain visible at all times. The front trim for flush mounted units extends 1" on all sides of the backbox. The front trim shall be attached to the backbox by means of twenty (20) #10-32 x 1" Stainless Steel Oval Head Phillips machine screws and twenty (20) #10 Stainless Steel finishing washers.

- G. Isolation Transformers:
1. Two (2) single phase, 50 or 60Hz with 480 volt, single phase, primary and 120 volt secondary.
  2. Class H rated insulation.
  3. Electrostatic shield between primary and secondary windings grounded to enclosure.
  4. Electrostatic shield designed so that it will prevent direct shorting of primary winding to secondary winding, and will reduce the coupling of harmonic distortions between the primary and secondary circuits.
  5. Core is of stacked design, securely clamped.
  6. Core and coil vacuum impregnated with final wrap of insulating material.
  7. Core and coils isolated from enclosure by means of a vibration dampening system.
  8. Total leakage current to ground from transformer secondary winding in compliance with UL1047, Tables 30.1 and 30.2.
  9. Maximum sound level of transformer: 35dB for 10 kVA units.
  10. Temperature rise limited to 115 degree C above ambient under full load conditions.
  11. Transformers UL listed or recognized as a component for the voltages, amperages, and kVA ratings required.
- H. Line Isolation Monitors (LIM):
1. Solid state modular assembly of printed circuit boards utilizing SMD technology.
  2. Continuous monitoring of the impedance of each phase to ground.
  3. Must be capable of detecting all combinations of capacitive, resistive, balanced, unbalanced and hybrid faults.
  4. Total Hazard Current (THC) set at the factory to either 2mA or 5mA and shall be field adjustable to either milliampere.
  5. Combined analog and digital display of THC.
  6. Audible alarm which sounds in the event of a hazardous condition.
  7. Indicating LEDs to visually indicate the status of the system. Green to indicate "SAFE", red to indicate "HAZARD" and amber to indicate that the audible alarm is in the "MUTE" mode. All LEDs and buttons shall be flush with the face of the LIM.
  8. A "TEST" button on the LIM faces shall be activated to test all LIM functions. It shall not be possible to leave the button in the "TEST" position.
  9. The LIMs shall perform an automatic self-calibration and self-check every twelve hours. An error code display shall alert the staff of an anomaly in the LIM / System operation.
  10. Shall contain overload protection with an automatic reset feature.
  11. It shall be possible to order the LIMs with an optional RS485 communication port and load monitoring.
  12. Field terminals shall be available for wiring remote LIM indicators with or without a display of THC.
  13. Shall be UL Recognized as a component.
  14. Shall have an easy to clean rugged Lexon front foil.
- I. Primary Circuit Breaker: Shall be one in each section, two-pole sized in accordance with NFPA 70 (N.E.C.) and UL 1047 Standard and selected based on the transformer 480 volt primary voltage on the one-line diagrams. Full size, thermal magnetic type, with minimum 14,000 AIC rating. Primary breaker shall be from same manufacturer that is used for all other panelboards and switchboards.
- J. Secondary Branch Circuit Breakers: Two-pole, bolt-on type, ampacities, and quantities based on the contract documents for each section. Sized in accordance with NFPA 70-2011 (N.E.C.) and UL 1047 Standard. Full size, thermal magnetic type with minimum 10,000 AIC. Secondary breakers shall be from same manufacturer that is used for all other panelboards and switchboards. Minimum 16 each for per isolation transformer.
- K. Bus Bars: Copper.

- L. Reference Ground Bus: Shall be copper and shall contain one (1) reference grounding buses for each section, each with a minimum of one (1) #4-2/0 main lugs and nineteen (19) #14-4 grounding lugs.
- M. Remote Indicators for line isolation monitors: For each section of each Isolated Power Panel provide a single or multiple gang remote indicator which duplicates the audible and visual alarm indications of the LIM installed in the Isolated Power Panel Dual System. The remote indicator shall contain a green "SAFE" LED a red "HAZARD" LED and a "MUTE" button with integral amber LED. The remote indicator shall function as follows:
  - 1. The green LED stays illuminated when the leakage current is within predetermined limits.
  - 2. The green LED extinguishes and the red LED illuminates when the predetermined limit is exceeded; an audible alarm also sounds.
  - 3. When depressed, the "MUTE" button shall mute the audible alarm signal. Actuation of this button shall cause the integral amber LED to illuminate, indicating that the audible alarm has been silenced.
  - 4. When the leakage current has returned to the acceptable limit level, the alarm indicators shall automatically reset.
  - 5. Provide THC digital display.

## **2.9 ACCESSORY COMPONENTS AND FEATURES**

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
  - 1. Install panelboards on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 03 30 00 "Cast-in-Place Concrete" or Section 03 30 53 "Miscellaneous Cast-in-Place Concrete."
  - 2. Attach panelboard to the vertical finished or structural surface behind the panelboard.
  - 3. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Comply with mounting and anchoring requirements specified in Section 26 05 48 "Seismic Controls for Electrical Systems."
- G. Mount top of trim **90 inches (2286 mm)** above finished floor unless otherwise indicated.
- H. Mount panelboard cabinet plumb and rigid without distortion of box.
- I. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- J. Mounting panelboards with space behind is recommended for damp, wet, or dirty locations. The steel slotted supports in the following paragraph provide an even mounting surface and the recommended space behind to prevent moisture or dirt collection.
- K. Mount surface-mounted panelboards to steel slotted supports **5/8 inch (16 mm)** in depth. Orient steel slotted supports vertically.
- L. Install overcurrent protective devices and controllers not already factory installed.
  - 1. Set field-adjustable, circuit-breaker trip ranges.
  - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- M. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- N. Install filler plates in unused spaces.
- O. For flush mounted panels only stub four **1-inch (27-EMT)** empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four **1-inch (27-EMT)** empty conduits into raised floor space or below slab not on grade.

- P. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- Q. **Isolated Power System Installation:**
  - 1. **Type XHHW wire with crosslinked polyethylene insulation and a dielectric constant of 3.5 or less shall be used for all branch circuit wiring.**

### 3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

### 3.4 FIELD QUALITY CONTROL

- A. **Comply with commissioning requirements in specification section 019113 -General Commissioning Requirements, and specification section 260800 (BA2)**
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- E. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test for low-voltage surge arrestors stated in NETA ATS, Paragraph 7.19.1 Surge Arrestors, Low-Voltage. Do not perform optional tests. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:

- a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove front panels so joints and connections are accessible to portable scanner.
  - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.
  - c. Instruments and Equipment:
    - 1) Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
- F. Panelboards will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### **3.5 TESTING AND CERTIFICATIONS FOR ISOLATED POWER SYSTEMS**

- A. An engineer or senior technician shall be provided by the manufacturer for final testing and acceptance of the Isolated Power System. The following tasks shall be performed:
1. Simulate faults using the manufacturer's test kit, or equivalent.
  2. Repeat this test at each receptacle to ascertain that the LIM and associated branch circuit are functioning properly.
  3. Check the calibration of the LIM meter using the manufacturer's test kit, or equivalent, and record the readings. Record the date and data in a permanent log book.
  4. Certify that the system is properly installed and in correct working order.

### **3.6 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

**END OF SECTION**

**SECTION 26 27 26**  
**WIRING DEVICES****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
  - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
  - 2. Twist-locking receptacles.
  - 3. USB charger devices.
  - 4. Isolated-ground receptacles.
  - 5. Hospital-grade receptacles.
  - 6. Tamper-resistant receptacles.
  - 7. Weather-resistant receptacles.
  - 8. Snap switches and wall-box dimmers.
  - 9. Floor service outlets (floor boxes) and poke-through assemblies.
  - 10. Pendant Cord Connector Devices (Drop Cords).
  - 11. Cord Reels

**1.3 DEFINITIONS**

- A. EMI: Electromagnetic interference.
- B. GFCI: Ground-fault circuit interrupter.
- C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- D. RFI: Radio-frequency interference.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Coordination:
  - 1. Receptacles for Owner-Furnished Equipment: Match plug configurations.
  - 2. Cord and Plug Sets: Match equipment requirements.

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of product.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Field quality-control reports.

**1.7 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton (Arrow Hart).
  - 2. Hubbell Incorporated; Wiring Device-Kellems.
  - 3. Leviton Manufacturing Co., Inc.
  - 4. Pass & Seymour/Legrand (Pass & Seymour).
- B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

**2.2 GENERAL WIRING-DEVICE REQUIREMENTS**

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NFPA 70.
- C. All devices must be manufactured for use with modular plug-in connectors, shall comply with UL 2459 and shall be made with stranded building wire. Devices shall comply with the requirements in this Section.

**2.3 STRAIGHT-BLADE RECEPTACLES**

- A. Hospital-Grade, Tamper Resistant, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
  - 1. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Mechanical shutter system to help prevent insertion of foreign objects. Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.
- B. Isolated-Ground, Duplex Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498, and FS W-C-596.
  - 1. Description: Straight blade; equipment grounding contacts shall be connected only to the green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts.



- C. Tamper-Resistant Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.
  - 1. Description: Labeled shall comply with NFPA 70, "Health Care Facilities" Article, "Pediatric Locations" Section.

## 2.4 GFCI RECEPTACLES

- A. General Description:
  - 1. Straight blade, non-feed-through type.
  - 2. Comply with NEMA WD 1, NEMA WD 6, UL 498, UL 943 Class A, and FS W-C-596.
  - 3. Include indicator light that illuminates only when the GFCI has malfunctioned or tripped and no longer provides proper GFCI protection.
- B. Tamper-Resistant GFCI Convenience Receptacles, 125 V, 20 A:
- C. Hospital-Grade, Tamper Resistant, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 Configuration 5-20R, UL 498 Supplement sd, and FS W-C-596.

## 2.5 TWIST-LOCKING RECEPTACLES

- A. Provide NEMA configurations as indicated on drawings.

## 2.6 PENDANT CORD-CONNECTOR DEVICES

- A. Description:
  - 1. Matching, locking-type plug and receptacle body connector.
  - 2. NEMA WD 6 Configurations L5-20P and L5-20R, heavy-duty grade, and FS W-C-596.
  - 3. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
  - 4. External Cable Grip: Woven wire-mesh type made of high-strength, galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

## 2.7 CORD REELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Kitchen Leash by APC Group
- B. Description:
  - 1. Molded Polypropylene Housing.
  - 2. Retracting cord with adjustable stop.
  - 3. SJOW Power cord, 10 foot; rated 200 degrees.
  - 4. Receptacles Dual Duplex NEMA 5-20R unless noted otherwise.
  - 5. Impact: UL746C
  - 6. Hose Down: CSA 6.8.2
  - 7. Strain Relief: CSA 6.4
  - 8. Flame Retardant: UL 94-94V-2
  - 9. Mounting Bracket for ceiling mount.

## 2.8 CORD AND PLUG SETS

- A. Description:
1. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
  2. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
  3. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

## 2.9 TOGGLE SWITCHES

- A. Comply with NEMA WD 1, UL 20, and FS W-S-896.
- B. Switches, 120/277 V, 20 A:
1. Single Pole and Three Way:
    - a. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
      - 1) [Eaton \(Arrow Hart\)](#).
      - 2) [Hubbell Incorporated; Wiring Device-Kellems](#).
      - 3) [Leviton Manufacturing Co., Inc.](#)
      - 4) [Pass & Seymour/Legrand \(Pass & Seymour\)](#).
- C. Key-Operated Switches, 120/277 V, 20 A:
1. Description: Single pole, with factory-supplied key in lieu of switch handle.
    - a. Public Restrooms and Other Spaces: Keyed switch, heavy duty specification grade (Pass & Seymour PS20AC1-WL or equivalent).
    - b. Behavioral Health Patient Accessible Spaces: Keyed locking switch, extra heavy duty specification grade security switch (Pass & Seymour PS20AC1-KL or equivalent). Coordinate common or differentiated keying of multiple switches with owner.
- D. Momentary Contact Switches: 2-Button, Single Pole, Low-voltage switch, mounts in standard single gang ring.
- E. Key-Operated, Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches: 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

## 2.10 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Incandescent Lamp Dimmers: 120 V; control shall follow square-law dimming curve. On-off switch positions shall bypass dimmer module for off.

- 1. These shall be used to control power modules driving large quantity of LED drivers using 0-10VDC control signals. This interface shall operate either 120 or 277 volt circuits, 200 ma rating.
- D. LED Dimmer Switches: Modular; compatible with LED drivers; trim potentiometer to adjust low-end dimming used where “LR” is shown, otherwise full range of 1% to 100% light or as noted. This dimmer shall operate either 120 or 277 volt circuits, 28 ma minimum rating.

**2.11 WALL PLATES**

- A. Single and combination types shall match corresponding wiring devices.
  - 1. Plate-Securing Screws: Metal with head color to match plate finish.
  - 2. Material for Finished Spaces, except Operating Rooms, Food Service Kitchens, and Behavioral Health Spaces: Smooth, high-impact thermoplastic.
  - 3. Material for Operating Rooms and Food Service Kitchen: **0.035-inch- (1-mm-)** thick, satin-finished, Type 302 stainless steel.
  - 4. Material for Behavioral Health Spaces: Smooth, nylon, unbreakable, with a minimum of two (2) screw locations; provide Torx head tamper resistant screws.
  - 5. Material for Unfinished Spaces: Galvanized steel.
  - 6. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant, die-cast aluminum with lockable, weatherproof-in-use cover.

**2.12 FLOOR SERVICE FITTINGS**

- A. **Manufacturers:** Subject to compliance with requirements, provide products by the following:
  - 1. **Wiremold / Legrand.**
- B. Type: Modular, flush-type, dual- or multi- service units suitable for wiring method used.
- C. Compartments: Barrier separates power from voice and data communication cabling.
- D. Service Plate: Round, die-cast aluminum with satin finish.
- E. Power Receptacle: NEMA WD 6 Configuration 5-20R, gray finish, unless otherwise indicated.
- F. Voice and Data Communication Outlet: Two modular, keyed, color-coded, RJ-45 jacks for UTP cable complying with requirements in owner’s Section 27 00 00 requirements.
- G. Description by Device Type:

FB1	Flush, Dual Service, Furniture Feed. One .75” conduit for power and One 2” conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFBFF Hubbell CFB2G30/2GCFVCVR
FB4	Flush, Dual Service, one piece finish flange. Four gang capacity. One .75” conduit for power and one 2” conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFG45S Hubbell CFB2G30/24GCCVR
FB6	Flush, Dual Service, one piece finish flange. Six gang capacity. One .75” conduit for power and one 2” conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB6S Evolution Hubbell CFB6G30/610GCCVR

FB8	Flush, Dual Service, one piece finish flange. Eight gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB8S Evolution
FB10	Flush, Dual Service, one piece finish flange. Ten gang capacity. One .75" conduit for power and one 2" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand EFB10S Evolution Hubbell CFB10G30/610GCCVR
FB11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers. Housing material shall be stamped steel above grade and cast iron at grade. Provide appropriate carpet and tile flanges.	Legrand 880MS(CS)/817/828 Hubbell B2431/S3825

**2.13 POKE-THROUGH ASSEMBLIES**

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Wiremold / Legrand.

B. Description:

1. Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
2. Comply with UL 514 scrub water exclusion requirements.
3. Size: Selected to fit cored holes in floor and matched to floor thickness.
4. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
5. Closure Plug: Arranged to close unused cored openings and reestablish fire rating of floor.

C. Description by Device Type:

PT1	Flush, Dual Service, 4" Diameter Furniture Feed Poke-Thru. One piece finish flange. One .75" conduit for power, One 1.5" conduit for data cabling. See plans for circuits and data drops. Finish selected by architect.	Legrand 4FFATC Hubbell PT73FFS/FRF3
PT2	Flush, Dual Service Capable, 4"Diameter Poke-Thru. One .75" conduit for power, one 1.5" conduit for data cabling. Two Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 4AT Evolution Hubbell S1R4PT
PT3	Flush, Dual Service Capable, 6"Diameter Poke-Thru. One .75" conduit for power, one 1.5" conduit for data cabling. Three Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 6AT Evolution Hubbell S1R6PT
PT8	Flush, Dual Service Capable, 8"Diameter Poke-Thru. One .75" conduit for power, one 2" conduit for data cabling. Five Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 8AT Evolution Hubbell S1R8PT
PT10	Flush, Dual Service Capable, 10"Diameter Poke-Thru. One .75" conduit for power, one 2" conduit for data cabling. Eight Gang Capacity. See plans for circuits and data drops. Receptacles shall be NEMA 5-20R, Finish selected by architect.	Legrand 10AT Evolution Hubbell S1R10PT
PT11	Flush single service floor box suitable for the wiring method used. NEMA 5-20R duplex receptacle with brushed aluminum flange and cover plate. Hinged receptacle covers.	Legrand RC7CTC Hubbell PT7FS/FRF

**2.14 FINISHES**

- A. Device Color:
  - 1. Wiring Devices Connected to Normal Power System: Gray in Food Service Kitchen. As selected by Architect in other finished spaces unless otherwise indicated or required by NFPA 70 or device listing.
  - 2. Wiring Devices Connected to Essential Power System: Red.
  - 3. Isolated-Ground Receptacles: Orange.
  
- B. Wall Plate Color:
  - 1. Plastic covers: Match device color.
  - 2. Cover plates for receptacles mounted above data racks in TEC and TDR rooms: Provide blue cover plates for receptacles served by UPS-A and red cover plates for receptacles served by UPS-B.

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
  
- B. Coordination with Other Trades:
  - 1. Protect installed devices and their boxes. 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 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 right 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. Pigtail existing conductors is permitted, provided the outlet box is large enough.
  
- D. Device Installation:
  - 1. Replace devices that have been in temporary use during construction and that 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, two-thirds to three-fourths of the way around terminal screw.
  6. Use a torque screwdriver when a torque is recommended or required by 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. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.
  3. Install 0-10VDC control wiring in conduit with power wiring. Use conductors with insulation equivalent to insulation of power wiring.
- 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 boxes and pokethroughs to suit arrangement of partitions and furnishings.

### **3.2 GFCI RECEPTACLES**

- A. Install non-feed-through-type GFCI receptacles where protection of downstream receptacles is not required.

### **3.3 IDENTIFICATION**

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
  2. Test Instruments: Use instruments that comply with UL 1436.
  3. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- B. Tests for Convenience Receptacles:
1. Line Voltage: Acceptable range is 105 to 132 V.
  2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
  3. Ground Impedance: Values of up to 2 ohms are acceptable.
  4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
  5. Using the test plug, verify that the device and its outlet box are securely mounted.
  6. 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.
- C. Test straight-blade convenience outlets in patient-care areas for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than **4 oz. (115 g)**. Submit test report indicating each receptacle and test result.
- D. Wiring device will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

**END OF SECTION**

**SECTION 26 28 13**  
**FUSES**

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 SUMMARY

- A. Section Includes:
  - 1. Cartridge fuses rated 600-V ac and less for use in enclosed switches, panelboards and enclosed controllers.,
  - 2. Spare-fuse cabinets.

## 1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material, dimensions, descriptions of individual components, and finishes for spare-fuse cabinets. Include the following for each fuse type indicated:
  - 1. Ambient Temperature Adjustment Information: If ratings of fuses have been adjusted to accommodate ambient temperatures, provide list of fuses with adjusted ratings.
    - a. For each fuse having adjusted ratings, include location of fuse, original fuse rating, local ambient temperature, and adjusted fuse rating.
    - b. Provide manufacturer's technical data on which ambient temperature adjustment calculations are based.
  - 2. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
  - 3. Fuse sizes for elevator feeders and elevator disconnect switches.

## 1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Ambient temperature adjustment information.
  - 2. Coordination charts and tables and related data.

## 1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

## 1.6 QUALITY ASSURANCE

- A. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Comply with UL 248-11 for plug fuses.



## 1.7 PROJECT CONDITIONS

- A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

## 1.8 COORDINATION

- A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

## PART 2 - PRODUCTS

## 2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Cooper Bussmann, Inc.
  2. Edison Fuse, Inc.
  3. Ferraz Shawmut, Inc.
  4. Littelfuse, Inc.

## 2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

## 2.3 PLUG FUSES

- A. Characteristics: UL 248-11, nonrenewable plug fuses; 125-V ac.

## 2.4 PLUG-FUSE ADAPTERS

- A. Characteristics: Adapters for using Type S, rejection-base plug fuses in Edison-base fuseholders or sockets; ampere ratings matching fuse ratings; irremovable once installed.

## 2.5 SPARE-FUSE CABINET

- A. Characteristics: Wall-mounted steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.
1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
  2. Finish: Gray, baked enamel.
  3. Identification: "SPARE FUSES" in 1-1/2-inch- (38-mm-) high letters on exterior of door.
  4. Fuse Pullers: For each size of fuse, where applicable and available, from fuse manufacturer.

## PART 3 - EXECUTION

## 3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:
  - 1. Feeders: Class J, time delay.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.
- B. Install spare-fuse cabinet(s).

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block, socket, and holder.

**END OF SECTION**

**SECTION 26 28 16**  
**ENCLOSED SWITCHES AND CIRCUIT BREAKERS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Fusible switches.
  2. Nonfusible switches.
  3. Receptacle switches.
  4. Shunt trip switches.
  5. Molded-case circuit breakers (MCCBs).
  6. Enclosures.

**1.3 DEFINITIONS**

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Enclosed switches and circuit breakers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
1. Enclosure types and details for types other than NEMA 250, Type 1.
  2. Current and voltage ratings.
  3. Short-circuit current ratings (interrupting and withstand, as appropriate).
  4. Include evidence of NRTL listing for series rating of installed devices.
  5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.

6. Include time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

## **1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed switches and circuit breakers, accessories, and components, from manufacturer.
  1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
  1. Test procedures used.
  2. Test results that comply with requirements.
  3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.
- D. Manufacturer's field service report.

## **1.7 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
  2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

## **1.8 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- E. Comply with NFPA 70.

## 1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
  - 2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
  - 1. Notify Owner no fewer than 2 weeks days in advance of proposed interruption of electric service.
  - 2. Indicate method of providing temporary electric service.
  - 3. Do not proceed with interruption of electric service without Owner's written permission.
  - 4. Comply with NFPA 70E.

## 1.10 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

## PART 2 - PRODUCTS

### 2.1 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Eaton.
  - 2. General Electric Company.
  - 3. Siemens Industry, Inc.
  - 4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate indicated fuses, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
  - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  - 3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  - 4. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
  - 5. Lugs: Mechanical type, suitable for number, size, and conductor material.

6. Service-Rated Switches: Labeled for use as service equipment.
7. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

## 2.2 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
  2. General Electric Company.
  3. Siemens Industry, Inc.
  4. Square D; by Schneider Electric.
- B. Type HD, Heavy Duty, Single Throw, 240, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- C. Accessories:
1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
  2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
  3. Auxiliary Contact Kit: Two NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open.
  4. Lugs: Mechanical type, suitable for number, size, and conductor material.
  5. Accessory Control Power Voltage: Remote mounted and powered; 120-V ac.

## 2.3 MOLDED-CASE CIRCUIT BREAKERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton.
  2. General Electric Company.
  3. Siemens Industry, Inc.
  4. Square D; by Schneider Electric.
- B. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- C. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- D. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- E. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
1. Instantaneous trip.
  2. Long- and short-time pickup levels.
  3. Long- and short-time time adjustments.
  4. Ground-fault pickup level, time delay, and  $I^2t$  response.

- F. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- G. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- H. Ground-Fault, Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- I. Ground-Fault, Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- J. Features and Accessories:
  - 1. Standard frame sizes, trip ratings, and number of poles.
  - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
  - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
  - 4. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
  - 5. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.

## **2.4 ENCLOSURES**

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
  - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
  - 2. Outdoor Locations: NEMA 250, Type 3R.
  - 3. Kitchen Locations (other than Wash Down Areas): NEMA 250, Type 4X, stainless steel.
  - 4. Kitchen Wash Down Areas: NEMA 250, Type 4X, stainless steel.
  - 5. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.
  - 6. Imaging Rooms: Flush Mount.

## **PART 3 - EXECUTION**

### **3.1 EXAMINATION**

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

### **3.2 INSTALLATION**

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."

- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Install fuses in fusible devices.
- E. Comply with NECA 1.

### **3.3 IDENTIFICATION**

- A. Comply with requirements in Section 26 05 53 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- C. Tests and Inspections:
  - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 3. Perform the following infrared scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each enclosed switch and circuit breaker. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each enclosed switch and circuit breaker 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 4. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.



**3.5 ADJUSTING**

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

**END OF SECTION**

**SECTION 26 29 13**  
**ENCLOSED CONTROLLERS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section includes the following enclosed controllers rated 600 V and less:
  - 1. Full-voltage magnetic.
- B. Related Section:
  - 1. Section 26 29 23 "Variable-Frequency Motor Controllers" for general-purpose, ac, adjustable-frequency, pulse-width-modulated controllers for use on variable torque loads in ranges up to 200 hp.

**1.3 DEFINITIONS**

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuit breaker.
- C. MCP: Motor circuit protector.
- D. N.C.: Normally closed.
- E. N.O.: Normally open.
- F. OCPD: Overcurrent protective device.
- G. SCR: Silicon-controlled rectifier.

**1.4 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Enclosed controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
  - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

**1.5 ACTION SUBMITTALS**

- A. Product Data: For each type of enclosed controller. Include manufacturer's technical data on features, performance, electrical characteristics, ratings, and enclosure types and finishes.
- B. Shop Drawings: For each enclosed controller. Include dimensioned plans, elevations, sections, details, and required clearances and service spaces around controller enclosures.
  - 1. Show tabulations of the following:
    - a. Each installed unit's type and details.
    - b. Factory-installed devices.
    - c. Nameplate legends.
    - d. Short-circuit current rating of integrated unit.
    - e. Listed and labeled for integrated short-circuit current (withstand) rating of OCPDs in combination controllers by an NRTL acceptable to authorities having jurisdiction.
    - f. Features, characteristics, ratings, and factory settings of individual OCPDs in combination controllers.
  - 2. Wiring Diagrams: For power, signal, and control wiring.

**1.6 INFORMATIONAL SUBMITTALS**

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Certificates: For enclosed controllers, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
  - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- C. Field quality-control reports.
- D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed, and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
- E. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed, and arrange to demonstrate that switch settings for motor running overload protection suit actual motors to be protected.

**1.7 CLOSEOUT SUBMITTALS**

- A. Operation and Maintenance Data: For enclosed controllers to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
  - 1. Routine maintenance requirements for enclosed controllers and installed components.
  - 2. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
  - 3. Manufacturer's written instructions for setting field-adjustable overload relays.
  - 4. Manufacturer's written instructions for testing, adjusting, and reprogramming reduced-voltage solid-state controllers.

**1.8 MATERIALS MAINTENANCE SUBMITTALS**

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
  - 1. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
  - 2. Control Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
  - 3. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
  - 4. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

**1.9 QUALITY ASSURANCE**

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
  - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NFPA 70.
- D. IEEE Compliance: Fabricate and test enclosed controllers according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "Seismic Controls for Electrical Systems."

**1.10 DELIVERY, STORAGE, AND HANDLING**

- A. Store enclosed controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect enclosed controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

**1.11 PROJECT CONDITIONS**

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
  - 1. Ambient Temperature: Not less than **minus 22 deg F (minus 30 deg C)** and not exceeding **104 deg F (40 deg C)**.
  - 2. Altitude: Not exceeding **6600 feet (2010 m)**.
- B. Interruption of Existing Electrical Systems: Do not interrupt electrical systems in facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
  - 1. Notify Owner no fewer than two weeks in advance of proposed interruption of electrical systems.
  - 2. Indicate method of providing temporary utilities.
  - 3. Do not proceed with interruption of electrical systems without Owner's written permission.
  - 4. Comply with NFPA 70E.

**1.12 COORDINATION**

- A. Coordinate layout and installation of enclosed controllers with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Coordinate installation of roof curbs, equipment supports, and roof penetrations.

**PART 2 - PRODUCTS****2.1 FULL-VOLTAGE CONTROLLERS**

- A. General Requirements for Full-Voltage Controllers: Comply with NEMA ICS 2, general purpose, Class A.
- B. Magnetic Controllers: Full voltage, across the line, electrically held.
  - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Eaton.
    - b. General Electric Company.
    - c. Siemens Industry, Inc.
    - d. Square D; by Schneider Electric.
  - 2. Configuration: Nonreversing.
  - 3. Contactor Coils: Pressure-encapsulated type.
    - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
  - 4. Power Contacts: Totally enclosed, double-break, silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
  - 5. Control Circuits: 120 -V ac; obtained from integral CPT, with primary and secondary fuses, with CPT control power source of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
    - a. CPT Spare Capacity: 50 VA.
  - 6. Solid-State Overload Relay:
    - a. Switch or dial selectable for motor running overload protection.
    - b. Sensors in each phase.
    - c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
  - 7. External overload reset push button.

**2.2 ACCESSORIES**

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
  - 1. Selector Switches: Heavy-duty, oiltight type.
    - a. Pilot Lights: LED types; colors as indicated.
    - b. Selector Switches: Rotary type.
- B. Reversible N.C./N.O. auxiliary contact(s).

- C. Phase-Failure, Phase-Reversal, and Undervoltage and Overvoltage Relays: Solid-state sensing circuit with isolated output contacts for hard-wired connections. Provide adjustable undervoltage, overvoltage, and time-delay settings.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine areas and surfaces to receive enclosed controllers, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine enclosed controllers before installation. Reject enclosed controllers that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 INSTALLATION**

- A. Wall-Mounted Controllers: Install enclosed controllers on walls with tops at uniform height unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Install fuses in each fusible-switch enclosed controller.

#### **3.3 IDENTIFICATION**

- A. Identify enclosed controllers, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
  - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
  - 2. Label each enclosure with engraved nameplate.
  - 3. Label each enclosure-mounted control and pilot device.

#### **3.4 CONTROL WIRING INSTALLATION**

- A. Install wiring between enclosed controllers and remote devices and facility's central control system.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control selection devices where applicable.
  - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switch is in manual-control position.
  - 2. Connect selector switches with enclosed-controller circuit in both manual and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

### 3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
  - 1. Test insulation resistance for each enclosed controller, component, connecting supply, feeder, and control circuit.
  - 2. Test continuity of each circuit.
- D. Tests and Inspections:
  - 1. Inspect controllers, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
  - 2. Test insulation resistance for each enclosed-controller element, component, connecting motor supply, feeder, and control circuits.
  - 3. Test continuity of each circuit.
  - 4. Verify that voltages at controller locations are within plus or minus 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Owner before starting the motor(s).
  - 5. Test each motor for proper phase rotation.
  - 6. Perform each electrical test and visual and mechanical inspection stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
  - 7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
  - 8. Perform the following infrared (thermographic) scan tests and inspections and prepare reports:
    - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each multi-pole enclosed controller. Remove front panels so joints and connections are accessible to portable scanner.
    - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each multi-pole enclosed controller 11 months after date of Substantial Completion.
    - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
  - 9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed controllers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports including a certified report that identifies enclosed controllers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

### 3.6 ADJUSTING

- A. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

- B. Adjust overload-relay heaters or settings if power factor correction capacitors are connected to the load side of the overload relays.
- C. Adjust the trip settings of MCPs and thermal-magnetic circuit breakers with adjustable instantaneous trip elements. Initially adjust to six times the motor nameplate full-load ampere ratings and attempt to start motors several times, allowing for motor cooldown between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed eight times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Owner before increasing settings.
- D. Set field-adjustable circuit-breaker trip ranges as specified in Section 26 05 73 "Overcurrent Protective Device Coordination Study."

**END OF SECTION**



**SECTION 26 51 19**  
**LED INTERIOR LIGHTING**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

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

**1.2 SUMMARY**

- A. Section Includes:
1. Interior solid-state luminaires that use LED technology.
  2. Lighting fixture supports.
  3. Standby Emergency Power supplies for individual luminaires
- B. Related Requirements:
1. Section 26 09 23 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.
  2. Section 26 09 36 "Standalone Multipreset Modular Dimming Controls" for architectural dimming systems and for fluorescent dimming controls with dimming ballasts specified in interior lighting Sections.
  3. Section 26 09 43 "Relay-Based Lighting Controls" for manual or programmable control systems with low-voltage control wiring or data communication circuits.

**1.3 DEFINITIONS**

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

**1.4 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
1. Arrange in order of luminaire designation.
  2. Include data on features, accessories, and finishes.

3. Include physical description and dimensions of luminaires.
  4. Include emergency lighting units, including batteries and chargers.
  5. Include life, output (lumens, CCT, and CRI), and energy efficiency data.
  6. Photometric data and adjustment factors based on laboratory tests, complying with IESNA Lighting Measurements Testing and Calculation Guides, of each lighting fixture type. The adjustment factors shall be for lamps and accessories identical to those indicated for the lighting fixture as applied in this Project. Report data compliant with IES LM-79 and IES LM-80. Only Absolute Photometry is acceptable.
    - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products (NVLAP).
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
  2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
  3. Include diagrams for power, signal, and control wiring.
- C. LEED Submittals:
1. Product Data for Credit IEQ 4.2: For paints and coatings, documentation including printed statement of VOC content.
  2. Laboratory Test Reports for Credit IEQ 4.2: For paints and coatings, documentation indicating that products comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Samples: For each luminaire and for each color and texture with standard factory-applied finish.
- E. Samples for Initial Selection: For each type of luminaire with custom factory-applied finishes.
1. Include Samples of luminaires and accessories involving color and finish selection.
- F. Samples for Verification: For each type of luminaire.
1. Include Samples of luminaires and accessories to verify finish selection.
- G. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

## 1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Lighting luminaires.
  2. Suspended ceiling components.
  3. Partitions and millwork that penetrate the ceiling or extend to within **12 inches (300 mm)** of the plane of the luminaires.
  4. Structural members to which equipment and or luminaires will be attached.
  5. Initial access modules for acoustical tile, including size and locations.
  6. Items penetrating finished ceiling, including the following:
    - a. Other luminaires.
    - b. Air outlets and inlets.
    - c. Speakers.
    - d. Sprinklers.

- e. Access panels.
- f. Ceiling-mounted projectors.
- g.
- 7. Moldings.
- B. Qualification Data: For testing laboratory providing photometric data for luminaires.
- C. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
  - 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
  - 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
- D. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- E. Product Certificates: For each type of luminaire.
- F. Product Test Reports: For each luminaire, for tests performed by manufacturer or a qualified testing agency holding NVLAP accreditation.
- G. Sample warranty.

## 1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.
  - 1. Provide a list of all lamp types LED Modules and LED Drivers used on Project; use ANSI and manufacturers' codes.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents citing lighting fixture types.
  - 1. Lamps: 2 for every 100 of each type and rating installed. Furnish at least one of each type.
  - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
  - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

## 1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications: Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

- C. Provide luminaires from a single manufacturer for each luminaire type.
- D. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- E. Mockups: For interior lighting luminaires in room or module mockups, complete with power and control connections.
  - 1. Obtain Architect's approval of luminaires in mockups before starting installations.
  - 2. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
  - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

### **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

### **1.10 WARRANTY**

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
  - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

### **2.2 LUMINAIRE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. Bulb shape complying with ANSI C79.1.
- F. Lamp base complying with ANSI C81.61 or IEC 60061-1, where employing universal base or mount.
- G. CRI of minimum 80. CCT of 3500 K.
- H. L70 rated lamp life of 50,000 hours.
- I. Lamps dimmable as indicated or 0.5 to 100 percent of maximum light output, via 0-10 VDC control signal or, where indicated, Digital Dimming Control Signal.
- J. Field Replaceable driver.
- K. Nominal Operating Voltage: Universal voltage 120 V ac or 277 V ac unless scheduled differently.
  - 1. Lens Thickness: At least 0.125 inch (3.175 mm) minimum unless otherwise indicated.
- L. Housings:
  - 1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
  - 2. Anodized or powder-coat finish.

### **2.3 LED LAMPS AND DRIVERS:**

- A. Minimum CRI Ra- 82 or as specified.
- B. Lumen output shall be Luminaire Lumens or Delivered Lumens. Source lumens shall not be used.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.
- D. LED Rated life L70 of 50,000 hours per (IES LM-80). Luminaire shall maintain LED operating temperature to achieve this rating per TM-21.
- E. Flicker: No visible or detectable flicker, operating on all dimmed intensities.
- F. Dimming drivers shall be compatible with the control method shown on the drawings. All dimmed drivers shall use 0-10vdc control unless specified differently. Minimum level as scheduled.
- G. Inrush current shall be reported and the lighting controls adjusted for inrush of LED product supplied.
- H. THD: THD shall not exceed 80%.
- I. Minimum driver efficiency shall be 83%.
- J. LED module shall be replaceable in the field using modules with digitally traceable matching modules.

- K. Luminaire shall be NRTL Listed at intended operating temperature.
- L. Photometry shall be measured or absolute photometry. Derived or calculated photometry shall not be provided for consideration.
- M. Approved Manufacturers- Drivers
  - 1. General Electric.
  - 2. Philips.
  - 3. Osram / Sylvania.
  - 4. Lutron
  - 5. EldoLED
  - 6. Thomas Research
- N. Approved Manufacturers- LEDs
  - 1. General Electric
  - 2. Philips
  - 3. Osram
  - 4. Cree
  - 5. Xicato
  - 6. Nichia
- O. Approved Manufacturers for Luminaires shall be as scheduled.

## 2.4 MATERIALS

- A. Metal Parts:
  - 1. Free of burrs and sharp corners and edges.
  - 2. Sheet metal components shall be steel unless otherwise indicated.
  - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Diffusers and Globes:
  - 1. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
  - 2. Glass: Annealed crystal glass unless otherwise indicated.
  - 3. Lens Thickness: At least **0.125 inch (3.175 mm)** minimum unless otherwise indicated.
- D. Housings:
  - 1. Hydroformed, cast or extruded-aluminum housing and heat sink suitable for the environment.
  - 2. Anodized or powder-coat finish.
- E. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps and line wattage. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
  - 1. Label shall include the following lamp characteristics:
    - a. "USE ONLY" and include specific lamp type.
    - b. Lamp diameter, shape, size, wattage, and coating.
    - c. CCT and CRI for all luminaires.

## 2.5 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

## 2.6 LUMINAIRE FIXTURE SUPPORT COMPONENTS

- A. Comply with requirements in Section 26 05 29 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: **1/2-inch (13-mm)** steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, **12 gauge (2.68 mm)**.
- D. Rod Hangers: **3/16-inch (5-mm)** minimum diameter, cadmium-plated, threaded steel rod.
- E. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

## 2.7 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. NRTL Compliance: Fabricate and label emergency lighting units, exit signs, and batteries to comply with UL 924.
- C. Comply with NFPA 70 and NFPA 101.
- D. Comply with NEMA LE 4 for recessed luminaires.
- E. Internal Type Emergency Power Unit: Self-contained, modular, battery-inverter unit, factory mounted within luminaire body and compatible with LED light source and driver, including dimming driver.
  - 1. Emergency Connection: Operate luminaire continuously at an output of 5 watts upon loss of normal power. Connect unswitched circuit to battery-inverter unit and switched circuit to luminaire ballast.
  - 2. Operation: Relay automatically turns driver/led module on when power-supply circuit voltage drops to 80 percent of nominal voltage or below. Lamp automatically disconnects from battery when voltage approaches deep-discharge level. When normal voltage is restored, relay disconnects lamps from battery, and battery is automatically recharged and floated on charger.
  - 3. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
    - a. Ambient Temperature: Less than **0 deg F** or exceeding **104 deg F** with an average value exceeding **95 deg** over a 24-hour period.
    - b. Ambient Storage Temperature: Not less than **minus 4 deg F** and not exceeding **140 deg F**
    - c. Humidity: More than 95 percent (condensing).

- d. Altitude: Exceeding 3300 feet
- 4. Battery: Sealed, maintenance-free, lead-acid type.
- 5. Charger: Fully automatic, solid-state, constant-current type with sealed power transfer relay.
- 6. Integral Self-Test: Factory-installed electronic device automatically initiates code-required test of unit emergency operation at required intervals. Test failure is annunciated by an integral audible alarm and a flashing red LED.

### **PART 3 - EXECUTION**

#### **3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before fixture installation. Proceed with installation only after unsatisfactory conditions have been corrected.

#### **3.2 TEMPORARY LIGHTING**

- A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

#### **3.3 INSTALLATION**

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
  - 1. Sized and rated for luminaire weight.
  - 2. Able to maintain luminaire position after cleaning and repair.
  - 3. Provide support for luminaire without causing deflection of ceiling or wall.
  - 4. Luminaire mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and vertical force of 400 percent of luminaire weight.
- D. Flush-Mounted Luminaire Support:
  - 1. Secured to outlet box.
  - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
  - 3. Trim ring flush with finished surface.
- E. Wall-Mounted Luminaire Support:
  - 1. Attached to structural members or approved backer plate in walls
  - 2. Do not attach luminaires directly to gypsum board.
- F. Ceiling-Mounted Luminaire Support:
  - 1. Ceiling mount with four 5/32-inch- (4-mm) diameter steel wire or aircraft cable supports.



2. Ceiling mount with hook mount.
- G. Suspended Luminaire Support:
1. Pendants and Rods: Where longer than **48 inches (1200 mm)**, brace to limit swinging.
  2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
  3. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
  4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- H. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
  2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
  3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- I. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

### **3.4 IDENTIFICATION**

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

### **3.5 FIELD QUALITY CONTROL**

- A. Perform the following tests and inspections:
1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
  2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

### **3.6 STARTUP SERVICE**

- A. Comply with requirements for startup specified in Section 26 09 43 "Relay-Based Lighting Controls."

### **3.7 ADJUSTING**

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.

1. During adjustment visits, inspect all luminaires. Replace luminaires that are defective.
2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
3. Adjust the aim of luminaires in the presence of the Architect.

**END OF SECTION**

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**SECTION 27000****GENERAL COMMON CONDITIONS FOR ALL  
COMMUNICATION SECTIONS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, and other documents as designated, apply to this Document.
- B. See Division 7 and section 27 01 00 Part 3 for additional requirements.

**1.2 RELATED SECTIONS**

- A. Specifications throughout all Divisions of the Project Manual are directly applicable to this section, and this section is directly applicable to them.
  - 1. All Division 27 Sections
  - 2. Requirements of the following Division 26 sections apply to this section
    - a. Basic electrical requirements
    - b. Basic electrical materials and methods
    - c. Grounding, earthing, and bonding
  - 3. Division 21 Fire Suppression
  - 4. Division 22 Plumbing
  - 5. Division 23 HVAC
  - 6. Division 28 Electronic Safety and Security

**1.3 SUMMARY**

- A. The work on many processes in this section are not part of the Division 27 contract. The respective trades shall include their portions, and administration topics that are applicable to all Division 27 Sections in their proposals.
- B. This document is based upon the 2018 Construction Specification Institute (CSI) Master Format numbers and titles for sections within Division 27: Communications.
- C. Where IT or Owner representation is stipulated in this Division, it shall be provided by the Data Center Operations Infrastructure Cabling team.

**1.4 SUBMITTALS**

- A. Product data shall be supplied for any parts/equipment that does not match the specified part number.
- B. Shop drawings
  - 1. Labeling schedules and layouts in owner designated electronic format
  - 2. Cabling administrative drawings

**1.5 CONDITIONS**

- A. Drawings and General provisions of the contract, including Uniform General Conditions, Supplementary General Conditions, architectural plans and specifications, requirements of Division 1, electrical, mechanical, plumbing, audio visual, security and telecommunications specifications and plans apply to the communications section, and shall be consider a part of this section. The contractor shall read all sections in their

- entirety and apply them as appropriate for work in this section.
- B. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div. 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.
- C. Conflicts:
1. Drawings and specifications are to be used in conjunction with one another and to supplement one another. In general, the drawings determine the nature and quality of the installation, materials, and tests. The quantities are derived from the drawings, details, listings, and manufacturer's directions.
    - a. Final order counts and distances are the contractor's responsibility.
  2. If there is an apparent conflict between the drawings and specifications, or between specification sections, the items with the greater quality or quantity shall be submitted, estimated, and installed.
  3. Clarification with the Owner and/or Owner's Representative about these items shall be made prior to the ordering and installation.
- D. Owner / Contractor
1. The Architect/Project Manager will submit appropriate scope of work information that will allow the contractor to appropriately plan and bid the project.
- E. Contractor
1. Furnish all labor, materials, tools, equipment and services for the installation described herein. Provide add/deduct unit pricing for all components as part of the bid response. Base fixed price add/deduct units on an average cable length of 175 linear feet.
  2. The Contractor shall procure and maintain for the duration of this agreement, insurance against claims.
  3. Use of Subcontractors: Successful bidder shall inform the Owner's contact and/or General Contractor in writing about the intention to use Subcontractors and the scope of work for which they are being hired. The Owner or Owner's designated contact must approve the chosen Subcontractors in writing prior to the Subcontractor's hiring and start of any work. The low voltage Subcontractor must be approved and certified. Refer to the listing in appendix 7.
  4. Use of Subcontractors: The Contractor's designated project manager will be recognized as the single point of contact. The Project manager shall oversee all work performed to ensure compliance with specifications as outlined in bid documents (which includes all specifications and drawings) to ensure a quality installation.

## 1.6 SCOPE OF WORK:

- A. This establishes a communications infrastructure to be used as signal pathways for voice, high-speed data transmission, and other low voltage services. Contractor shall:
1. Comply with all Master Specifications documents and the following requirements for a complete project installation.
  2. Provide a structured cabling system as described hereafter that includes, but is not limited to, supplying, installing, labeling and testing of fiber backbone, fiber and voice riser cable; data copper, fiber, and voice copper horizontal cabling, cable connectors, communications outlets and terminations, patch cables, and equipment racks/cabinets for networking hardware and patch panels.
  3. All requirements and specifications will be enforced. Cable pathways and runs to individual outlets are not shown in their entirety but shall be provided as if shown in their entirety.

4. Coordinate with electrical tradespersons to verify conduit routing does not cause cabling to exceed allowable link length.
5. Follow industry standard installation procedures, including BICSI Installation Standard and guidelines as well as specified manufacturers standard recommended procedures and installation practices for communications cable to assure that the mechanical and electrical transmission characteristics of this cable plant and equipment are maintained.
6. The Division 27 work shall be performed by an approved, certified installer.
7. The low voltage communications Subcontractor shall complete non-concealed work.

#### 1.7 REFERENCE STANDARDS:

- A. The latest published edition of a reference shall be applicable to this Project unless identified by a specific edition date.
- B. All reference amendments adopted prior to the effective date of the Contract shall be applicable to this Project.
- C. The publications listed below form a part of this specification. The publications are referred to in the text by basic designation only.
- D. Specific reference in specifications to codes, rules, regulations, standards, manufacturer's instructions, or requirements of regulatory agencies shall mean reference to the latest printed edition of each in effect at the date of contract.
- E. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed in **Appendix 04**.

#### 1.8 DEFINITIONS:

- A. Definitions and Abbreviations are listed in **Appendix 05**:

### PART 2 - PRODUCTS

#### 2.1 PRODUCTS AND WORK NOT included BY DIVISION 27

- A. Others shall separately purchase and/or provide certain equipment and miscellaneous items that will be installed during the installation process. Such items may not be indicated in the documents. Contractor shall coordinate with the Owner and his suppliers when considering:
  1. Provision and installation of phone systems, computer hardware, and related networking software and equipment.
  2. Provision and installation of multi-port routers, hubs in communications rooms.
    - a. TEC/TDR UPS's are owner provided.
  3. Communications grounding bus bars and grounding wires connecting to the main building electrode system by Division 26.
  4. Dedicated power panels, ground bus bars, circuits and utility outlets.
  5. Installation and finishing of fire-rated plywood backboards.
  6. Building mechanical ductwork, cooling/heating system, and environmental control sensors.
  7. Communication pathway devices such as, conduits, conduit sleeves, back boxes, and penetrations in walls and floors. Including, but not limited to concealed work, office spaces and open areas.
  8. Provision and installation of modular furniture and millwork.

### PART 3 - PENETRATIONS

3.1 THE WORK IN THIS SECTION IS IN DIVISION 7 CONTRACT; AND VERIFIED COMPLETE AT PROJECT TURNOVER.

- A. Wall Penetrations - Fire - Smoke – Sound
1. All fire, smoke, and sound wall penetrations must be correctly made to protect the safety of patients and employees. A facility is designed/architected and built with fire integrity that must not be lost as the building is modified over its lifetime.
  2. The items listed often penetrate 1 – and 2 – hour fire-resistance-rated (FRR) assemblies. General requirements for filling the space between the item in question and the wall are found in NFPC 101® Section 8.2.3.2.4.2. There is the option to either fill the space with appropriately rated fire-stop material or protect the space with an approved device designed to maintain the fire resistance of the wall.
  3. If a sleeve is used around the item that transverses the wall, the sleeve must be installed into the wall without any opening between the sleeve and the wall. The open space within the sleeve must then be filled with appropriately rated fire stop.
- B. All items listed in 1 through 2 must have penetrations in fire-resistance-rated assemblies filled to maintain the integrity of the fire barrier.
1. Conduits
    - a. When conduit passes through a wall that is either rated or must be fire-stopped due to lack of sprinklers in the compartment, it is essential to fill any gap around the conduit as described above.
  2. Cables/Wires
    - a. Sometimes cables or wires are passed through a penetration contained in a fire wall as a single installation. This often happens in a health care organization with communication cables. Even in these cases, the penetration must be patched appropriately.
  3. NOTE: Fire, smoke, and sound wall penetrations are also governed by local and state building codes.
  4. NOTE: This requirement applies to all departments, organizations, employees, and/or vendors who perform structured cable work in the facilities for:
    - a. Telephony and Computer networks, fire, smoke, and sound wall penetrations, alarm systems, security systems, HVAC Control or sensors, patient entertainment systems, announcing systems, nurse call, telemetry, RFID, etc.
  5. NOTE: While this document is written specifically for low voltage wiring, the JCAHO standards apply for any fire or smoke wall penetration. As you perform work in the facility, if you note any existing penetrations that are not up to standard, please notify the construction Project Manager immediately.
  6. While Facility Engineering has the overall responsibility, each department, organization, employee, and/or vendor has the responsibility to follow the process in obtaining a permit from facility engineering before work is started and to follow the guidelines to maintain the fire/smoke wall integrity.
- C. Process:
1. NOTE: This process applies to any person, group, and/or vendor who perform low voltage cable installations at any Intermountain facility or clinic.
    - a. Fire/Smoke Walls
      - 1) Any Vendor, department, and/or person needing to do any cable work that involves wall penetrations, adding to existing or new, are required to obtain a “Low Voltage Cable Work Permit” from Facility Engineer.
    - b. Above Ceiling Work
      - 1) Any vendor, department, and/or person needing to do any cable work above ceiling tiles, adding to existing or new, are required

- to obtain all required permits.
- c. Above Ceiling Permit to be obtained from Facilities Management
    - 1) The permit requires detail information as to what work is being done, where the work will be done. The permit will also state the current approved sealing compound for the facility and specific requirements for conduits etc.
    - 2) There may also be specific rules regarding how work may be conducted in certain areas of the hospital. NOTE: Different manufacture's sealing products can NOT be used in the same penetration. Therefore, if an additional cable is added to an existing penetration, and you don't have the same brand of caulk, you must remove all of the caulk and re-do the seal completely.
  - d. ICRA Permit to be obtain from Infectious Preventionist
  - e. Hot Work Permit to be obtain from Facilities Engineer
2. Quality of Work
- a. Facility Engineering Orientation

### 3.2 MEASUREMENT PROCEDURES:

- A. The Contractor shall
- 1. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.
  - 2. Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements and scale on shop drawings.
  - 3. Coordinate fabrication schedule with construction progress to avoid delaying the work.
  - 4. Where field measurements cannot be made without delaying the work, establish dimensions and coordinate with the General Contractor.
  - 5. When approved, proceed with fabricating units without field measurements.

### 3.3 CHANGES

- A. ALTERNATES:
- 1. If an alternate material is proposed that is equal to or exceeds specified requirements, Contractor shall provide manufacturers' specifications in writing for Owner approval prior to purchase and installation.
  - 2. Substitutions of material by the Contractor shall be in writing complete with written manufacturers' specifications. The material substituted shall not void, alter or change manufacturers' structured cabling system warranty.
  - 3. Contractor shall:
    - a. Provide a complete cabling infrastructure according to these written specifications and drawings. If the Owner changes the scope of work to be performed by the Contractor, it shall be in writing.
    - b. Promptly respond to these changes with a complete material list, including pricing, and labor in writing presented to the Owner for approval. Also include unit pricing.
    - c. Do not proceed with any additional scope of work without a signed approval by the Owner.
  - 4. Owner will not pay for additional work performed by the Contractor without signed approval of these changes. Contractor will submit a copy of signed change order upon billing.
  - 5. The Owner's Infrastructure Cable team will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect. No substitute shall be ordered, installed or utilized without the

Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

**B. SUBSTITUTION PROCEDURES**

1. Substitution may be considered when a product becomes unavailable through no fault of the Contractor.
2. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Include in each request for substitution:
  - a. Product identification, manufacturer's name and address.
  - b. Product Data: Description, performance and test data, reference standards, finishes and colors.
  - c. Samples: Finishes
  - d. Complete and accurate drawings indicating construction revisions required (if any) to accommodate substitutions.
  - e. Data relating to changes required in construction schedule.
  - f. Cost comparison between specified and proposed substitution.
3. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
4. The Owner will be the final judge of acceptability, with review by Owner's Representative and the distribution of the acceptance by the Architect.
5. No substitute shall be ordered, installed or utilized without the Architect's prior written verification of acceptance from the Owner's Infrastructure Cable team.

**PART 4 - EXECUTION**

**4.1 QUALITY ASSURANCE**

**A. Regulatory Requirements:**

1. Contractor shall supply all city, county, and state telecommunication cabling permits required by appropriate governing agency.
2. Prior to commencing work, the Contractor and staff shall secure all required Intermountain Healthcare permits including, but not limited to; facility sign in, ceiling work permits, hot work permits, and confined space permits.
3. Contractor shall be city, county, and state-licensed and/or bonded as required for communications/low voltage cabling systems work.

**B. Certifications:**

1. Contractor shall submit an up-to-date and valid certification verifying qualifications of the Contractor and installers to perform the work specified herein at time of bid submission.
2. Contractor shall have a complete working knowledge of low voltage cabling applications such as, but not limited to data, voice and video network systems.
3. Contracting firm shall have installed similar-sized systems in at least ten (10) other projects in the last five years prior to this bid and be regularly engaged in the business of installation of the types of systems specified in this document. Certification shall include, but not be limited to, items such as name and location of project contacts and numbers, total square footage, total number of cables/drops, types of media, etc.
4. Contractor shall provide certificates for the appropriate insurance coverage as defined in contract documents.
5. All installer personnel that will be assigned to this project shall be listed in a qualification document. 50% of the personnel working on the job site shall have a minimum of 3 years' experience in the installation of the types of systems, equipment, and cables specified in this document. Any personnel substitutions shall be noted in writing to Owner's Data Center Operations Infrastructure



- Cabling representative prior to commencement of work.
6. BICSI ITS Cabling Installation Program Installer Level 1 or 2 or Technician certifications may be substituted in lieu of the 3-year requirement. All cabling installers shall be trained and certified by the cable manufacturer for communication cabling installations and maintenance of said materials.
  7. Refer also to General Conditions.
- C. Administrative Requirements and Coordination:
1. The Contractor shall:
    - a. Ensure that all technicians performing work have obtain badge access 48 hours prior to scheduled start.
    - b. Provide a specified contact person (name and contact number) for coordination to attend project meetings with the communication consultant, the Owner and others.
    - c. Coordinate work of this section with Owner's system specifications, workstations, equipment suppliers, and installers.
    - d. Coordinate installation work with other crafts (examples include ceiling grid contractors, HVAC and sheet metal contractors, etc.) under the direction of the General Contractor to resolve procedures and installation placement for cable trays and cable bundle pathways. The goal of this coordination will be to establish priority pathways for critical data/voice network cable infrastructure, materials, associated hardware, as well as mitigate delays to the project and to allow service access for communications and HVAC components. Damage by Contractor to the craftwork of others will be remediated at the Contractor's expense in a timely manner.
    - e. Exchange information and agree on details of equipment arrangements and installation interfaces. Record agreements reached in meetings and distribute record to other participants, Owner and communication consultant.
    - f. Arrangement, layout, and locations of distribution frames, patch panels, and cross-connect blocks in equipment rooms and racks to accommodate and optimize arrangement and space requirements of any service provider equipment, telephone system, and LAN equipment as directed by Data Center Operations. Tasks shall be coordinated with the Owner's Data Center Operations team, and other trades' installation representatives.
    - g. Where installed, confirm exact locations and method of mounting outlets in modular furniture. Follow furniture manufacturers' written instructions for installing cable and devices in modular partitions. Obtain modular furniture and power pole locations from the General Contractor. Wiring locations noted in plans along walls for modular furniture are approximate and will have to be determined by Contractor at time of installation. Field condition adjustments for installation may have to be made and coordination efforts with the mechanical and electrical contractor for pathway must take place early in the project to comply with maximum 40% conduit fill factor requirements.
    - h. When requested by Owner or Owner's representative, furnish extra materials that match specified products and that are factory packaged with protective covering for storage and identified with labels describing contents. Unit pricing shall apply.
- D. Contract Administration:
1. Change orders shall be submitted to the Owner/Project Manager complete with price breakdown and description for approval before any work is done.
  2. Owner's Data Center Operations Representative will provide job field reports upon inspection of Contractor's installation, materials, supporting hardware,

- coordination with other trades and progress to schedule to the Owner's project manager.
3. Job Field Report outline:
    - a. General installation progress in relation to scheduled work made by the Contractor up to that date.
    - b. All deficiencies noted in the cable installation to be corrected by the Contractor.
- E. Pre-Installation Meetings - Contractor shall:
1. Attend and/or arrange a scheduled pre-installation conference prior to beginning any work of this section.
    - a. Agenda: This venue is to ask and clarify questions in writing related to work to be performed, scheduling, coordination, etc. with consultant and/or project manager/and Data Center Operations Infrastructure Cabling representative.
    - b. Attendance: Communications project manager/supervisor shall attend meetings arranged by General Contractor, Owner's Data Center Operations Infrastructure Cabling representatives, and other parties affected by work of this document.
    - c. All individuals who will be installers of communication cables and equipment in an on-site supervisory capacity shall be required to attend the pre-installation conference. Individuals who do not attend the conference will not be permitted to supervise the installation of, or install, terminate, or test communications cables on the project. This includes supervisors, project managers, and lead installers of this project.
- F. Request for Change (RFC)
1. A Request for Change shall be opened and approved by the Change Approval Board prior to any modifications, attachments, or other activities that may affect production systems.
    - a. Policy and details available through the Data Center Operations Infrastructure Cable Representative.
- G. Post-Installation Meetings:
1. Schedule Div. 27 Final Inspection
  2. At the time of substantial completion, or shortly thereafter, the low voltage Sub-Contractor shall call and arrange for a post-installation meeting to present and review all submittal documents to include, but not limited to as-built drawings, test reports, warranty documentation, etc. Attendees shall be Owner staff, Owner's Representative, General Contractor, and others that the General Contractor deems appropriate.
  3. At this meeting the Contractor shall present and explain all documentation, including test results, and ask for feedback on its completeness. Any discrepancies or deviations noted by and agreed to by participants shall be remedied by Contractor and resubmitted within one week of meeting.

#### 4.2 DELIVERY, STORAGE, AND HANDLING:

- A. Coordination with delivery companies, drivers, site address, and contact person(s) will be the responsibility of the Contractor.
- B. Contractor Shall:
1. Be responsible for prompt material deliveries to meet contracted completion date.
  2. Coordinate deliveries and submittals with the General Contractor to ensure a timely installation.
  3. No equipment materials shall be delivered to the job site more than three weeks prior to the commencement of its installation.
  4. Equipment shall be delivered in original packages with labels intact and identification clearly marked.

5. Materials shall not be damaged in any way and shall comply with manufacturer's operating specifications.
  6. Equipment and components shall be protected from the weather, humidity, temperature variations, dirt, dust, or other contaminants. Equipment damaged prior to system acceptance shall be replaced at no cost to the Owner.
  7. Material Contractor shall be responsible for all handling and control of equipment.
  8. Material Contractor is liable for any material loss due to delivery and storage problems.
- C. Owner/General Contractor shall supply a list of security requirements for Contractor to follow.

#### 4.3 PROJECT/SITE CONDITIONS

- A. For all environmental recommendations, refer to master Architectural section.
- B. For all security recommendations, refer to related Division 01.
- C. After completing system installation, including outlet fittings and devices, inspect exposed finish. Contractor will remove burrs, dirt, and construction debris. If applicable, the Contractor will repair damaged finishes, including chips, scratches, and abrasions.
- D. Contractor shall provide daily a clean work environment, free from trash/rubbish accumulated during and after cabling installation.
- E. Food and drink are not permitted in work areas. They shall be stored, prepared, and consumed only in designated break or cafeteria areas.
- F. Contractor shall keep all liquids (drinks, sodas, etc.) off finished floors, carpets, and tiles. If any liquid or other detriment (cuts, soils, stains, etc.) damages the above finishes, Contractor shall provide professional services to clean or repair scratched/soiled finishes, at Contractor's expense.

#### 4.4 CLEANING

- A. Work areas will be kept in a broom clean condition throughout the duration of the installation process.
- B. Remove all unnecessary tools and equipment, unused materials, packing materials, and debris from each area where work has been performed daily, unless designated for storage.
- C. The Contractor will damp clean all surfaces prior to final acceptance by Owner.

END OF SECTION

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**SECTION 270100****OPERATION AND MAINTENANCE OF  
COMMUNICATIONS SYSTEMS****PART 1 - GENERAL****1.1 INTRODUCTION**

- A. To make the approval of such a large topic possible, the structured cable topic has been broken into its subcomponents and each subcomponent was completed, reviewed, and approved in turn. The result is this comprehensive guideline that should provide adequate guidance on this topic.

**PART 2 - PRODUCT****2.1 KEY POINTS**

- A. Category 6A shielded foil over unshielded twisted pair (F/UTP) is the only approved standard for cabling.
  - 1. Specifically, Siemon category CAT6A F/UTP (foil over unshielded twisted pair) cable and associated patch panels, wall plates and jacks; for data centers, and all clinical and hospital campus'.
  - 2. Only Siemon certified contractors or certified Intermountain Healthcare cable technicians will install structured cable at Intermountain Healthcare facilities.

**2.2 IMPLEMENTATION**

- A. This guide is to be used for New Construction and Remodels. These standards will be implemented over time in existing cabling environments as rework is performed.
- B. If there is a current need to connect servers at 10GBaseT and the only option is copper, CAT6A F/UTP is required. New Server connections shall be a minimum OS1 Single Mode Fiber.
- C. Installations already in place are not required to remove or replace existing cabling CAT5e or newer. All new cabling shall follow the recommendation to use CAT6A F/UTP cabling.

**2.3 STANDARD PRODUCT**

- A. The Approved cable type for horizontal cabling is CAT 6A F/UTP.
  - 1. The Approved Standard Manufacturer for Intermountain Healthcare's horizontal cabling is:
    - a. **Siemon Company USA**  
101 Siemon Company Drive  
Watertown, CT 06795
  - 2. Approved Suppliers of Siemon cable, patch panels, jacks, and parts are listed in Appendix 06:

**PART 3 - EXECUTION****3.1 Horizontal Cabling**

- A. Horizontal Subsystem is the portion of the cabling system that extends from (and includes) the work area telecommunications outlet/connector to the Floor Distributor (FD)/Horizontal Cross-connect (HC) in the telecommunications room (TDR). It consists of the communications outlet/connector, the horizontal cable, optional consolidation point, and that portion of the cross-connect in the telecommunications room serving the horizontal cable. Each floor of a building should be served by its own Floor Distributor/Horizontal (FD/HC) Subsystem located in the telecommunications Room (TDR).
1. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
  2. Current Siemon Approved/Certified Cable Installers for Siemon Network are listed in Appendix 07.
- B. Reliability of the horizontal cabling system is critical to the operation of IS equipment throughout a facility. Installing the cable is extremely labor intensive and there are several learned skills used to correctly install the cable. Cable installers are certified, and installers must demonstrate the ability to install the cable correctly to be certified. If the cable is installed by a certified installer and is installed in accordance with the manufacturer's guidelines, the manufacturer will warranty the cable installation.
- C. The manufacturer also requires the cables to be individually labeled and 100% tested and certified. Cable testing and certification equipment is usually expensive and is not commonly available at the facility or by many telecom installers. Certified Installer companies are required by the manufacturer to be knowledgeable in the use of "Qualified" Field Testing equipment and provide test results for warranty registration.
1. Contractor is to verify with the manufacturer the current "Qualified" tester manufacturers and the current operating software.
  2. Contractors will provide test results in the operating software format (not PDF, text or Word) to Intermountain Healthcare upon completion.
- D. Much of the cable is installed in walls and in the ceiling and usually lasts the lifespan of the building. As with most technology, the lifespan of cable is its usability and applicability to its use on future computing technology.

END OF SECTION

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SECTION 270113

WARRANTY, PRODUCT AND SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

PART 2 - PRODUCTS

2.1 STANDARD WARRANTY

- A. Contractor shall provide a minimum one (1) year warranty on installation and workmanship PLUS an Extended Product Warranty and System Assurance Warranty for this wiring system and shall commit to make available local support for the product and system during the Warranty period.
- B. System Certification: Upon successful completion of the installation and subsequent inspection, the customer shall be provided with a Manufacture Warranty certificate.
- C. Either a permanent link or channel model configuration may be applied to the horizontal and/or backbone sub-systems of the structured cabling system. Applications assurance is only applied to a channel model configuration. All channels are to be qualified for linear transmission performance up to 500 MHz to ensure that high-frequency voltage phase and magnitude contributions do not prove cumulative or adversely affect channel performance.

2.2 EXTENDED WARRANTY

- A. The manufacturer of passive telecommunications equipment used in a manner not associated with the Systems Warranty must have a minimum five (5) year Component Warranty on all its product. The Products Warranty covers the components against defects in material or workmanship under normal and proper use.
  - 1. Special Project Warranty: A full end-to-end written warranty mutually executed by manufacturer and the principal Installer, agreeing to replace and install voice/data distribution system components that fail in materials or workmanship, or do not meet manufacturer's official published specifications and performance criteria within the special Project warranty period specified below. This shall cover applications assurance, cable, and connecting hardware including both labor and materials. This warranty shall be in addition to, and not a limitation of, other rights and remedies the Owner may have against the Contractor under the Contract Documents.
- B. A twenty (20) year warranty available for the Category 6A Z-MAX copper structured cabling system shall be provided for an end-to-end channel model installation which covers applications assurance, cable, connecting hardware and the labor cost for the repair or replacement thereof. The fiber warranty will be an XGLO twenty (20) year warranty, which is based on using laser optimized single mode fiber as minimum.
  - 1. Performance claims based on worst case testing and channel configurations.

2. Special Project Warranty Period: 20 years minimum, beginning on the date of Substantial Completion.
3. Siemon Certified Warranty Requirements:
  - a. Upon Completion of the project, Intermountain Healthcare must receive the Full Warranty Documentation from The Siemon Company before final retention funds are released to the general contractor, electrical contractor and structured cabling subcontractor if applicable.

### 2.3 MAINTENANCE

- A. Support Availability: The Contractor shall commit to make available local support for the product and system during the Warranty or Extended Warranty period.

END OF SECTION

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**SECTION 270119****FIELD TESTING AND REPORTING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specifications throughout all Divisions of the Project Manual are directly applicable to this Section, and this Section is directly applicable to them, including but not limited to the listing found in Section 27 00 00.

**1.2 SYSTEM DESCRIPTION**

- A. Owner reserves the right to be present during any or all testing.
- B. The objective of this project is to provide a complete communications cabling infrastructure system installation including, but not limited to: fiber backbone, riser system, horizontal data and voice cabling with associated terminations, mounting equipment, cable pathway and management systems, testing and other items/materials, as specified in drawings, these specifications, and contract documents.
- C. The Contractor's BICSI Registered Communications Distribution Designer (RCDD) supervisor shall review, approve and stamp all documents prior to submitting. The Contractor's RCDD shall warrant in writing that 100% of the installation meets the requirements specified herein upon completion of all work.
- D. Product Certificates shall be signed by manufacturers of cables, connectors, and terminal equipment certifying that products furnished comply with requirements.
- E. Contractor shall submit the required Field Test Reports in the format and media specified, upon completion of testing the installed system.
- F. Contractor shall deliver manufacturer's signed long-term Warranty of installed cabling system to include all components that comprise the complete cabling system. Delivery to be affected within two weeks of the time of final punch list review. Failure of any component to pass system component tests shall be promptly corrected, repaired or replaced to meet standards compliance.

**1.3 PREFERRED OWNER INSPECTION & TEST CHECKPOINTS**

- A. DCO & ICT Inspection Milestones & Responsibilities need to be coordinated into master project plan to allow the GC to make timely arrangements. All are per floor and/or phase.
  - 1. ICT & DCO = Framing, during and/or after boxes & conduits are in place; prior to sheetrock.
  - 2. ICT = When cable basket is starting to be installed.
  - 3. ICT = When cable basket is ready, but prior to starting to pull cable.
  - 4. ICT & DCO = When TDR's are ready for racks and ladders.
  - 5. DCO = When anchoring racks and laying out equipment.
  - 6. ICT & DCO = When TDR environmental requirements are ready, room is dust free, and securable.
    - a. The TEC and TDRs must be high on the build timeline and be completed early in the construction to accommodate the building systems to be tested and commissioned, such as BAS, Security, and Wireless Network.
  - 7. ICT = When trim and testing are in progress.
  - 8. OTHERS
    - a. Depending on project, the manufacturer will inspect 1 or 2 times.



- b. DCO or ICT = When problems or questions arise.

## PART 2 - PRODUCTS

### 2.1 SITE TESTS & INSPECTIONS

- A. Prior to pulling cable, the cabling contractor shall schedule an inspection of the pathways with a member of the Data Center Operations Infrastructure cabling team.
- B. Upon completion of the communications infrastructure systems, including all pathways and grounding, the Contractor shall test the system.
  - 1. Cables and termination modules shall be affixed, mounted or installed to the designed/specified permanent location prior to testing.
  - 2. Any removal and reinstallation of any component in a circuit, including faceplates, shall require retesting of that circuit and any other disturbed or affected circuits.
  - 3. Approved instruments, apparatus, services, and qualified personnel shall be utilized.
  - 4. If tests fail, Contractor shall correct as required to produce a legitimate passing test.
  - 5. Manipulation of tester parameters on a failing test in order to achieve a passing test is unacceptable.
- C. These specifications will be strictly enforced. The Contractor must verify that the requirements of the specifications are fully met through testing with an approved tester (rated for testing the cable type in use), and documentation as specified below. This includes confirmation of requirements by demonstration, testing and inspection. Demonstration shall be provided at final walk-through in soft copy.
- D. Notification of the likelihood of a cable exceeding standardized lengths must be made prior to installation of the cable. Without contractor's prior written notice and written approval by the Owner, testing that shows some or all pairs of cable not meeting specifications, shall be replaced at Contractor's expense (including respective connectors).
- E. Testing is still required for non-compliant cabling. The tests shall be for wire-mapping, opens, cable-pair shorts, and shorts-to-ground. The test results must be within acceptable tolerances and shall be submitted with the Owner's acceptance document.

### 2.2 CABLE TESTING PLAN

- A. The Contractor shall:
  - 1. Provide a complete and detailed test plan for approval of the cabling system specified herein, including a complete list of test equipment for copper and fiber optic components and accessories prior to beginning cable testing. The following minimal items shall be submitted for review:
    - a. All testing methods that clearly describes procedures and methods.
    - b. Product data for test equipment
    - c. Certifications and qualifications of all persons conducting the testing.
    - d. Calibration certificates indicating that equipment calibration meets National Institute of Standards and Technology (NIST) standards and has been calibrated at least once in the previous year of the testing date.
  - 2. Include validation, and testing. Owner will require that the telecommunications cabling system installed by the Contractor be fully certified to meet all necessary requirements to be compliant with referenced IEEE and TIA specifications and vendor's warranty.
  - 3. Will determine the source/cause of test failure readings and correct malfunctioning component and/or workmanship within each channel or permanent link and retest to demonstrate compliance until corrected failure produces a passing result.

## 2.3 CABLE TESTING REPORTS

- A. The Contractor shall submit cable test reports as follows:
  - 1. Submit certified test reports of Contractor-performed tests.
    - a. The tests shall clearly demonstrate that the media and its components fully comply with the requirements specified herein.
    - b. (1) set of electronic test reports shall be submitted and clearly identified with cable identification.

## PART 3 - EXECUTION

### 3.1 TEST EQUIPMENT

- A. All transmission testing of balanced twisted-pair cables shall be performed with an approved Level III balance twisted pair tester found on the Siemon Ally Website. The latest version of software shall be installed prior to performing testing. Refer to the Siemon Warranty Documents for proper testing requirements of associated cable and components.
- B. All balanced twisted-pair field testers shall be factory calibrated each calendar year by the field test equipment manufacturer as stipulated by the manuals provided with the field test unit. The calibration certificate shall be provided for review prior to the start of testing
- C. Auto test settings provided in the field tester for testing the installed cabling shall be set to the default parameters
- D. Test settings selected from options provided in the field testers shall be compatible with the installed cable under test.

### 3.2 TEST METHOD / CRITERIA

- A. Copper Testing
  - 1. Testing of all newly installed cable channels shall be performed prior to system cutover.
    - a. Visually inspect F/UTP and optical fiber cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments and inspect cabling connections for compliance with TIA/EIA-568-C.1.
    - b. Visually confirm Category 6A marking of outlets, cover plates, outlet/connectors, and patch panels.
    - c. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
    - d. Test F/UTP copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
    - e. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C, and those required by manufacturer to validate and start warranty.
  - 2. Copper Testing all 500 MHz category 6A field-testing shall be performed with an approved level 111e balanced twisted-pair field test device, that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex (Level IIe or IIIe balanced twisted pair field test device). Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
  - 3. All installed 500 MHz category 6A channels shall perform equal to or better than the minimum requirements as specified below:

- a. Category 3, balanced twisted-pair backbone cables, for the channel shall be 100 percent tested according to ANSI/TIA/EIA-568-C.1. Test parameters include wire map plus F/UTP (ScTP) shield continuity (when present), insertion loss, length and NEXT loss (pair-to-pair). NEXT testing shall be done in both directions.
- b. 500 MHZ Category 6A balanced twisted-pair horizontal and backbone cables, shall be 100 percent tested.
4. F/UTP Performance Tests
  - a. Wire map.
  - b. Length (physical vs. electrical, and length requirements)
  - c. Insertion loss
  - d. Near-end crosstalk (NEXT) loss
  - e. Power sum near-end crosstalk (PSNEXT) loss
  - f. Equal-level far-end crosstalk (ELFEXT)
  - g. Power sum equal-level far-end crosstalk (PSELFEXT)
  - h. Return loss
  - i. Propagation delay
  - j. Delay skew
  - k. F/UTP Shield continuity
5. Final Verification Tests: Perform verification tests for F/UTP systems after the complete communications cabling and workstation outlet/connectors are installed.
6. Document data for each measurement. Data for submittals shall be printed in a summary report.
7. End-to-end cabling will be considered defective if it does not pass tests and inspections.
8. Prepare and submit test and inspection reports.
- B. Horizontal Fiber Testing
  1. Fiber horizontal cables shall be 100% tested for insertion loss and length.
  2. Insertion loss shall be tested at 850 nm or 1300 nm for 50/125 $\mu$ m and 62.5/125 $\mu$ m multimode cabling in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
  3. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
  4. The horizontal link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.
- C. Backbone Fiber Testing
  1. Fiber backbone cables shall be 100% tested for insertion loss.
  2. Insertion loss shall be tested at both 850 nm and 1300 nm for 50/125 $\mu$ m and 62.5/125 $\mu$ m multimode cabling and both 1310 nm and 1550 nm for 8.5/125 $\mu$ m single mode cabling and in at least one direction using the Method B (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-14A.
  3. Insertion loss shall be tested at 1310 and 1550 for single-mode cabling in at least one direction using the Method A.1 (1-jumper) test procedure as specified in ANSI/TIA/EIA-526-7.
  4. Length shall be tested using an OTDR, optical length test measurement device or sequential cable measurement markings.
  5. The backbone link performance guarantees are based on an optical fiber calculation for the appropriate fiber solution. Optical fiber calculations for any fiber cable greater than 90m (295 ft.) shall be determined using the Siemon Fiber Loss Calculator found on the Siemon Ally Website.

### 3.3 DEMONSTRATION

- A. Include training for appropriate IT staff in numbering system and documentation system methods and record keeping. Proper fiber terminations and fiber jumper installations.

END OF SECTION

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**SECTION 270133****SHOP DRAWINGS, PRODUCT DATA, SAMPLES  
DESIGN RECORDS & EXISTING CONDITIONS****PART 1 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES****1.1 SUBMITTALS**

- A. The Contractor:
  - 1. Shall not perform any portion of the work requiring submittal and review of shop drawings, product data, or samples until Owner has approved the respective submittal. Such work shall be in accordance with approved submittals.
    - a. Shop drawings as required by the owner or as a minimum to include a minimum of two sets of a plan view and elevations of all work to be installed. The Contractor shall make any corrections required by the owner or the owner's representative or consultant team, file with him two corrected copies and furnish such other copies as may be needed. The consultant's approval of such drawings or schedules shall not relieve the Contractor from responsibility for deviations from drawings or specifications, unless he has in writing and called to the Architect's attention such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in shop drawings or schedules.
- B. The Contractor shall provide a copy of the Certified Test Data Sheet, available from the delivering distribution warehouse for either a full run or cut piece from the Master Reel of the fiber cable to be installed
  - 1. The Certified Test Data Sheet shall include the Master Reel number, cable description, a passing test result with details, test equipment description, date certified, and a certificate of compliance stamp, and shall be included in the O&M Manual as a component of the final deliverables submittal package.

**1.2 DRAWINGS**

- A. Shop Drawings
  - 1. The Contractor shall:
    - a. Submit catalogue cut sheets that include manufacturer, trade name, and complete model number for each product specified. Model number shall be handwritten, marked with an arrow or underlined to indicate exact selection.
    - b. Identify applicable specification section reference for each product performance for each component specified for approval prior to purchase and installation.
- B. Record Drawings
  - 1. Drawings for the cabling system infrastructure elements shall be maintained and kept on file by the Siemon Certified Installer (Company) for the entire term of the warranty. Drawings shall include:
    - a. Horizontal cable routing and terminations
    - b. Telecommunications outlets/connectors
    - c. Backbone cable routing and terminations
    - d. Telecommunication Spaces (TS)
- C. Samples

1. For workstation outlet connectors, jack assemblies, housing and faceplates for color selection and evaluation of technical specifications and requirements. Confirm with Architect, interior designer, and Owner representative for color before purchasing materials. Face plates shall match the electrical face plates in Color and material type.
  2. Upon request, provide samples for workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration
  3. Sample mock-up rooms may be required in some areas to ensure proper equipment placement and fit.
- D. Qualifications:
1. The Contractor shall provide the appropriate documentation to comply with the requirements set forth in Section 01 43 23 Qualifications, included with, and at the time of, bid submittal.

## PART 2 - SUSTAINABLE DESIGN RECORDS AND REPORTS

### 2.1 DRAWINGS

- A. Closeout Submittals (As-built Drawings):
1. Communications Design drawings are to be supplied to the Architect to prepare the master "As-Built" drawings.
  2. As-Built drawings shall be in a format that is compatible with the format used by the Architect and consultant. Dimensions and scale of the drawing sheets submitted shall match the size of the drawing used for the contract documents and shall include the cable numbers labeled in accordance with this document.
  3. Utilize normal recognized drafting procedures that match standards, Architect and consultant guidelines and methodology.
  4. The As-Built drawings shall incorporate all changes made to the building identified in, but not limited to, addendum, change notices, site instructions or deviations resulting from site conditions.
- B. Contractor shall:
1. Clearly identify any resubmitted drawing sheets, documents or cut sheets either by using a color to highlight or cloud around resubmitted information.
  2. Maintain drawing numbering or page/sheet scheme consistency as per previously issued drawings/documents.
  3. Provide dimensioned plan and elevation views of networking components, showing:
    - a. All communications data/voice outlet locations complete with outlet/cable labeling.
    - b. Cable routing paths of communications cables to identified infrastructure pathways.
    - c. All rack and cabinet locations and labeling thereof.
    - d. One-line diagram of equipment/device interconnecting data/voice cabling of the data and voice systems.
    - e. Standard or typical installation details of installations unique to Owner's requirements.
    - f. Graphic symbols and component identification on detail drawing shall conform to the latest ANSI/TIA 568-C, ANSI/TIA 569-B, ANSI/TIA 606-A and ANSI/NECA/BICSI 607-A conventions.
  4. Submit one soft (compatible with Microsoft software) and hard copy with project deliverables within three weeks subsequent to substantial completion.
  5. Hard copy of floor plans for record shall be plotted to a standard, saleable, identified drawing scale.

### 2.2 RECORDS AND REPORTS

- A. All records shall be created by the installation contractor and turned over at the completion of work.
  - 1. The format shall be computer based
    - a. Soft copies and hard copies shall be part of the As-built package.
    - b. The minimum requirements include:
      - 1) Cable records must contain the identifier, cable type, termination positions at both ends, splice information as well as any damaged pairs/conductors.
      - 2) Connecting hardware and connecting hardware position records must contain the identifier, type, damaged position numbers, and references to the cable identifier attached to it.
  - 2. Test documentation on all cable types shall be included as part of the As-built package.
- B. All Siemon Warranty Registration documents shall be included.
- C. All reports shall be generated from the computer-based program used to create the records above. These reports should include but not limited to:
  - 1. Cable Reports
  - 2. Cross-connect Reports
  - 3. Connecting Hardware Reports

### PART 3 - EXISTING CONDITIONS SITE SURVEY

#### 3.1 SITE SURVEY

- A. Prior to placing any cable pathways or cable, the contractor shall survey the site to determine job conditions will not impose any obstructions that would interfere with
- B. the safe and satisfactory placement of the cables. The arrangements to remove any obstructions with the Project Manager need to be determined at that time.

END OF SECTION

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**SECTION 270143****QUALIFICATIONS AND REQUIRED TRAINING  
FOR CONTRACTORS AND INSTALLERS****PART 1 - GENERAL INSTALLER QUALIFICATIONS****1.1 ENTITIES**

- A. Communications contractors
1. The Communications Contractor shall at a minimum possess the following qualifications:
    - a. Contractor shall be a Siemon Certified Contractor with valid up to date contract certification and in good standing with the Siemon Company.
    - b. Be in business a minimum of five (5) years.
    - c. Contractor shall demonstrate satisfaction of sound financial condition and can be adequately bonded and insured if the project deems necessary.
    - d. Possess those licenses/permits required to perform telecommunications installations in the specified jurisdiction.
    - e. Use personnel knowledgeable in local, state, province and national codes and regulations. All work shall comply with the latest revision of the codes or regulations. When conflict exists between local or national codes or regulations, the most stringent codes or regulations shall be followed.
  2. Contractor must possess current liability and workers compensation insurance certificates.
  3. Contractor must be registered with BICSI and have at least one RCDD on staff or ITS Cabling Installer Program Technician certification and Installer Level 1 & 2 for a minimum of 75 percent of staff.

**1.2 TRAINING**

- A. The Contractor shall be fully conversant and capable in the cabling of low voltage applications such as, but not limited to data, voice and imaging network systems. The Contractor shall at a minimum possess the following qualifications:
1. Personnel trained and certified in the design of the Siemon Cabling System®.
  2. Personnel trained and certified to install the Siemon Cabling System®.
  3. The Designer and Installer shall show proof of current certification of the Siemon Cabling System® via an updated certificate given after attending the Certified Installer training course or an on-line re-certification class given every two years.
  4. Provide references of the type of installation provided in this specification.
  5. Personnel trained and certified in the installation of copper cable and in the use of Level IIIe Copper Transmission Performance testers, fiber optic cabling, splicing, termination and testing techniques. Personnel must have experience using an optical light source and power meter plus an OTDR.
  6. Personnel trained in the installation of pathways and supports for housing horizontal and backbone cabling.
- B. Facilities Orientation

**END OF SECTION**



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**SECTION 270171****RESPONSIBILITY AND WORKMANSHIP  
OF CONTRACTOR****PART 1 - GENERAL****1.1 CONTRACTOR RESPONSIBILITY**

- A. Contractor shall be obligated to exercise the highest standard of care in performing its obligations as defined in a request for proposal. All work shall be done in a workman like fashion of the highest standards in the telecommunications industry.
- B. All equipment and materials are to be installed in a neat and secure manner, while cables are to be properly dressed in accordance with standards recommendation for a specific type of media (i.e. UTP vs. F/UTP @ 10 Gigabit)
- C. Workers must clean any debris and trash at the close of each job and workday.
- D. Contractor acknowledges that Intermountain Healthcare will rely on contractor's expertise, ability and knowledge of the system being proposed and shall be obligated to exercise the highest standard of care in performing contractual obligation as defined in the Scope of Work.
- E. Contractor must submit The Siemon warranty, Cable Records, As Built Drawings and Test Results at the completion of work. Note: Intermountain Healthcare reserves the right to withhold final payments until all registration documents are approved by the Siemon Company and received by Intermountain Healthcare.

**1.2 CONTRACTOR AND EMPLOYEE RESPONSIBILITY**

- A. Contractors, their employees, and installers will attend annually Intermountain Healthcare required Infection Control training.
- B. Contractors, their employees, and installers will complete Reprax registration.
- C. Contractors, their employees, and installers will attend Intermountain Healthcare required site and job specific orientation.
- D. Contractors, their employees, and installers will maintain Intermountain Healthcare required immunizations.
- E. Contractors, their employees, and installers will keep their Intermountain Healthcare required confidentiality agreements current.
- F. Contractors, their employees, and installers always agree to follow all Intermountain Healthcare Policies and procedures and wear the appropriate ID while on any of Intermountain properties.
- G. Contractor will determine with Owner the appropriate level of Environmental Containment precautions to utilize for each work location. Infection Control Risk Assessments and permits will be performed as required.
- H. Upon request, provide qualification data for all qualified layout technicians, installation supervisors, and field inspector
  - 1. Siemon issued qualification badges shall be readily available for this purpose.

**1.3 EXAMINATION**

- A. Field Measurements: Verify dimensions in areas of installation by field measurements before fabrication and indicate measurements on shop drawings. Coordinate fabrication schedule with construction progress to avoid delaying the work.
- B. Established Dimensions: Where field measurements cannot be made without delaying the work, establish dimensions and proceed with fabricating units without field

measurements. Coordinate supports, adjacent construction, and fixture locations to ensure actual dimensions correspond to established dimensions.

#### 1.4 PREPARATION

- A. Pre-installation inspection
  - 1. The Contractor shall visually inspect all cables, cable reels, and shipping cartons to detect possible cable damage incurred during shipping and transport. Visibly damaged goods are not acceptable and shall be replaced by the contractor at no additional cost to the Owner.

#### 1.5 MISCELLANEOUS CONTRACTOR RESPONSIBILITIES

- A. Contractor will maintain unobstructed egress in work areas.
- B. Contractor will keep an access for all Emergency Services.
- C. Contractor will maintain training for Personnel in alternate exits if needed.
- D. Contractor will maintain Temporary construction partitions, as required, that are smoke tight and built of non-combustible materials.
- E. Additional Fire Extinguishers may be required and will be properly maintained and inspected.
- F. Construction site will be maintained clean and orderly.
- G. Contractor will observe Intermountain Healthcare's Tobacco Use Policy. (All forms of tobacco use are strictly prohibited)
- H. All Electrical Extension cords will be grounded, and in good condition and, plugged into approved GFI Receptacles.
- I. Construction site will be restricted. (Approved personnel Only)
- J. Required Personal Protective Equipment (PPE) will be worn as required. (i.e. hard hats, safety glasses, safety shoes, fluorescent vest, in accordance with general contractor's safety policy)
- K. Tools will be unplugged, and power secured at the end of each working day.
- L. All employees and contractors will understand how to obtain MSDS sheets.
- M. Contractor will notify proper personnel of any fire system shut down. A 48-hour notification is required.
- N. Contractor will address all vibration concerns with Intermountain Healthcare and general contractor's staff.
- O. Contractor will address all Noise Issues with Intermountain Healthcare and general contractor's staff.
- P. Contractor will fill out a Hot Work permit and keep it on site daily as needed.
- Q. Contractor will fill out an Above Ceiling Work Permit and keep it on site daily as needed.
- R. Contractor will obtain a Confined Space Permit, when required, and keep it on site.
- S. Contractor shall notify Information Systems 72 hours in advance of any shutdown or known interruption of required environmental services. Follow up by notifying the Service Desk.
- T. Demolition of low voltage cabling shall be performed by the Low Voltage installation contractor.
  - 1. To prevent accidental removal of in-use circuits.
  - 2. To allow for re-use of circuits where practical.

END OF SECTION

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**SECTION 270500****COMMON WORK RESULTS  
FOR COMMUNICATIONS****PART 1 - PRODUCT****1.1 SUMMARY**

- A. This section covers general work results for all Communications Division detail subsections.
- B. Work of the following sections cover a complete installation of both permanent and channel links for a data and voice communications network utilizing copper and fiber transmission media.

**PART 2 - EXECUTION****2.1 SCOPE OF WORK**

- A. Includes, but is not limited to the following.
  - 1. The Contractor shall:
    - a. Provide and install fabric and/or either plenum, PE or PVC Innerduct, rated appropriately for the installation environment; in accordance with all applicable codes and ordinances.
    - b. Provide, install, terminate, test, label and document all fiber backbone, fiber and copper riser cable.
    - c. Provide, install, terminate, test, and document all fiber, copper voice, and data horizontal cable.
      - 1) CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
    - d. Provide and place all termination devices such as, but not limited to, modular patch panels, termination blocks, information outlets (jacks and plates), phone jacks, fiber distribution panels, bulkheads, connectors, and fiber fan out kits.
    - e. Provide in quantities specified interconnect components such as, but not limited to, copper patch cords, fiber patch cables and data station cables.
    - f. Provide and place horizontal and vertical cable support devices such as, but not limited to, rack and wall-mounted horizontal and vertical cable management, cable runway, communications cable runway, and all required mounting hardware, unless otherwise noted.
    - g. Provide and install all equipment mounting racks, cabinets and/or brackets.
    - h. Provide and install UL-approved fire stopping systems in all communication pass-thru, conduits, cable trays and ceiling, wall and floor penetrations in coordination with General Contractor.
    - i. Provide all appropriate consumable items required to complete the installation.
    - j. Grounding and bonding in TEC and TR rooms to grounding bus provided by Division 26.
    - k. Provide complete documentation and demonstration of work.
    - l. Completion of all punch list deficiencies within 10 working days.
    - m. Provide indexed and organized complete Test Results of all copper and fiber cable and their components.
    - n. Provide Submittals.

- o. Conduct a final document handover meeting with client, consultant, and PM to review, discuss and educate the Owner on the test results and As-Built Drawings.
- p. Provide a Manufacturer's Extended Product Warranty and System Assurance Warranty for this wiring system.

END OF SECTION

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**SECTION 270526****GROUNDING AND BONDING FOR  
COMMUNICATIONS SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. This work shall be provided by Division 26.
  - 1. Division 26 shall provide and install the communications system grounding bus bar.
  - 2. Systems other than the voice/data system shall be bonded by their respective installers or Division 26.
- B. Exception: Division 27 shall bond racks, ladders, and other conductive IT equipment and enclosures as required.
- C. Requirements of the following Division 26 Sections apply to this section:
  - 1. Basic Electrical Requirements
  - 2. Basic Electrical Materials and Methods
  - 3. Grounding and Bonding for Electrical Systems

**1.2 SUMMARY**

- A. This Section includes methods and materials for grounding and bonding Communications systems.
- B. All grounding / earthing and bonding shall be done to applicable codes and regulations. It is recommended that the requirements of IEC/TR 61000-5-2: 1.0, ANSI-J-STD-607-A, or both be observed throughout the entire cabling system.

**PART 2 - PRODUCTS****2.1 CONDUCTORS**

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
  - 1. Stranded conductors No. 6 AWG.

**2.2 CONNECTORS**

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Compression fitting – 2-hole strap.

**PART 3 - EXECUTION****3.1 QUALITY ASSURANCE**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

**3.2 APPLICATIONS**

- A. Conductors: Install stranded conductors for No. 6 AWG and larger, unless otherwise indicated.

### 3.3 INSTALLATION

- A. Grounding Conductors
  - 1. Route along shortest and straightest paths possible, unless otherwise indicated or required by Code.
  - 2. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
    - a. Jumper across all tray junctions use two-hole crimp lugs with a bolt, lock washer and nut to prevent loosening of ground connections over time.
    - b. Contractor to remove small area of powder coat or paint to create a metal to metal bonding connection.
    - c. Per current BICSI TDMM "Grounding, Bonding and Electrical Protection":
      - 1) Grounding and bonding connectors should be one of the following: Tin plated copper, copper or copper alloy
      - 2) Connections should be made using crimp connectors, or exothermic welding.
    - d. Per TIA/EIA 607-A the TBB (Telecommunications Bonding Backbone) connections "shall be made using irreversible compression-type connectors, exothermic welding or equivalent."

END OF SECTION

## SECTION 270528

## PATHWAYS FOR COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Main pathways for communications systems shall be the responsibility of the Division 27 low voltage contract.
  - 1. Includes, but is not limited to, hangars, supports, J-hooks and cable tray.
  - 2. Sections 270536, 270539, and 270543\_46, are supplemental clarifications that are additions to this section. The appropriate section(s) shall add for the material used.
- B. Conduits, pathways, and boxes which are embedded within building finishes for communications systems shall be the responsibility of the Division 26 electrical contractor
- C. Requirements of the following Division 26 sections apply to this section
  - 1. Basic electrical requirements
  - 2. Basic electrical materials and methods
  - 3. Grounding, earthing, and bonding for electrical systems

## 1.2 SUMMARY

- A. Contractor shall install work following specifications, drawings, manufacturer's instructions and approved submittal data.

## PART 2 - PRODUCTS

## 2.1 CABLE PATHWAYS

- A. Comply with TIA/EIA-569-B.
- B. Pathways shall be designed and installed to meet applicable local and national building and electrical codes or regulations.
  - 1. All materials shall be UL- and/or CSA and/or ETL-approved and labeled in accordance with NEC for all products where labeling service normally applies.
  - 2. NRTL labeled for support of Category 6A cabling, designed to prevent degradation of cable performance and pinch points that could damage cable
  - 3. Materials and equipment requiring UL 94, 149 or 1863 listing shall be so labeled. Modification of products that nullifies UL labels are not permitted.
  - 4. The installed systems shall not generate, nor be susceptible to any harmful electromagnetic emission, radiation, or induction that degrades, or obstructs any equipment.
- C. Pathways consist of conduit, basket tray/ladder rack, J-hooks, surface mounted raceway and power poles.
  - 1. Basket tray shall be utilized for distribution pathways
    - a. Provides proper support and load distribution along pathways.
    - b. Flexibility, scalability, and accessibility
    - c. Ladder rack shall be used in data rooms.
  - 2. Conduits may be utilized where cable tray is not viable, providing the cross-sectional area of the conduit is greater than the cross-sectional area of the cable tray.
  - 3. J-hooks are the minimum pathway device required for all low voltage contractors for use in ceiling distribution.
    - a. Refer to section 270529.

4. Note: Surface mounted raceway and power poles should be installed only when other pathway choices are not feasible.

## 2.2 EQUIPMENT

- A. Compatibility
  1. All material and equipment as provided should be the standard Commercial-Off-The-Shelf (COTS) products of a manufacturer engaged in the manufacturing of such products. All shall be typical commercial designs that comply with the requirements specified. All material and equipment shall be readily available through manufacturers and/or distributors.
    - a. All equipment shall be standard catalogued items of the manufacturer and shall be supplied complete with any optional items required for proper installation.
    - b. Coordinate the features of materials and equipment so they form an integrated system. Match components and interconnections for optimum future performance and backward compatibility
- B. Horizontal cables shall be installed in "clean, dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables
  1. Cable pathways shall be installed to provide protection from the elements (i.e. moisture) and other hazards.
  2. Cables and cable pathways shall be protected from detritus elements such as paints, adhesives, water and cleaners.
    - a. In case of contamination, cables shall be replaced at the General Contractors expense. Cleaning is not acceptable.
  3. Pathways shall not have exposed sharp edges that may come into contact with telecommunications cables.
- C. Pathways shall not be in elevator shafts.
- D. Grounding / Earthing and bonding of pathways shall comply with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-B, or both be observed throughout the entire cabling system.

## 2.3 SURFACE MOUNTING

- A. Surface Mount Cable Runs and Faceplate Boxes
  1. Surface mounting of cable pathway runs and/or boxes for outlets/faceplates are only authorized as a last resort and exception to running cables through the wall and above the ceiling.
  2. If surface mount cable runs are used:
    - a. Burrs will be removed from the inside of the plastic or metal surface mount pathway to prevent damage to cables pulled through the run.
    - b. Raceway manufacturer plastic bushings shall be installed at all outlet openings in raceway to prevent damage to cable.
    - c. "T", Splice, and corner pieces will be used to join runs. Runs will not be butted together without the appropriate joining pieces.

## PART 3 - EXECUTION

### 3.1 HORIZONTAL PARAMETERS

- A. Allowable Cable Bend Radius and Pull Tension:
  1. In general, communications cable cannot tolerate sharp bends or excessive pull tension during installation.
    - a. Bend radius for 4 pair UTP and F/UTP under no load (no pulling tension) shall not exceed four (4) times the outside diameter of the cable and



eight (8) times the outside diameter of the cable under load (110N/25lbf).  
Note: Cable bend radius and pulling tensions for cables other than 4 pair

cable increase with the diameter and type of cable refer to the manufacturer's recommendations for specific requirements.

2. After installation, exposed cable and other surfaces must be cleaned free of lubricant residue. Use only lubricants specifically designed for cable installation.
- B. Pull Strings:
1. Horizontal and Vertical Pathways
    - a. The pathway installer shall:
      - 1) Provide pull strings in all new conduits, including all conduits with cable installed as part of this contract.
      - 2) Provide pull strings in all new cable trays.
      - 3) Pull string shall have a rated average breaking strength of 200 pounds.
      - 4) During pulling sessions, pull strings must move freely to prevent cable jacket/cable damage.
      - 5) Free moving pull strings shall be provided in all locations where they are utilized as part of this contract.
- C. Conduit Fill:
1. Reference manufacturer's Design Installation Guidelines manual.
  2. Comply with requirements of NFPA 70 (NEC)
  3. The number of cables placed in a pathway shall not exceed manufacture specifications, nor, will the geometric shape of a cable be affected.
    - a. Conduit pathways shall have a maximum fill ratio of 40% to allow for proper pulling tension and lay of the CAT6A F/UTP cable. A minimum of a 1" diameter conduit is required for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.

### 3.2 INTRA-BUILDING CABLE ROUTING

- A. Pathways
1. The backbone subsystem shall include cable installed in a vertical manner between floor telecommunications rooms and the main or intermediate cross-connect in a multi-story building and cable installed horizontally between telecommunications rooms and the main or intermediate cross-connect in a long single-story building.
  2. Adequate riser sleeve/slot space shall be available with the ability to ingress the area later in all telecommunications rooms, such that no drilling of additional sleeves/slots is necessary. Proper fire stopping is required for all sleeves/slots per national and local codes. Install fire stop material designed specifically for the building construction conditions and to meet the existing fire stop material as directed by the building engineer.
  3. Backbone pathways shall be installed or selected such that the minimum bend radius of backbone cables is kept within manufacturer specifications both during and after installation.
  4. Where redundant paths are required, they shall be separated by a minimum of 24".
    - a. Separate innerducts and/or armored fiber are required for each leg of the redundant path.
    - b. Separate physical routing for each path shall be utilized where possible.
  5. Building backbone cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables. "Slab-on-Grade" building designs wherein pathways are installed underground on/in the poured concrete slabs that are in direct contact with the soil are considered wet locations and hence are not permitted.

END OF SECTION

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**SECTION 270529****HANGERS AND SUPPORTS FOR  
COMMUNICATION SYSTEMS****PART 1 - PRODUCTS****1.1 APPROVED PRODUCT**

- A. The J-hooks shall meet or exceed the below characteristics of construction and features
  - 1. Provide broad based support for cabling to aid in maintaining overall system performance.
  - 2. Be available in 50.8mm (2") and 101.6mm (4") options
  - 3. Come equipped with a cable retention clip
  - 4. Offers a full line of mounting accessories.

**1.2 APPROVED MANUFACTURERS**

- A. Ericson / Caddy
- B. B-Line
- C. Stiffy

**PART 2 - EXECUTION****2.1 J-HOOKS AND OTHER SUPPORTS SHALL BE INSTALLED SUCH THAT THEY:**

- A. Shall be supported with devices designed for this purpose and shall be installed independently of any other structural component. J-Hooks shall not use the suspended ceiling support wires or lighting fixture support wires.
- B. The number of cables placed into the J-hooks shall be limited to a number that will not cause a change to the geometric shape of the cables.
  - 1. Limit to a 40% fill in new construction.
- C. J-hooks shall not be spaced farther than 1.5 meters (5 ft.) apart, with a recommendation that they be spaced at 1 meter (3 ft.) apart. Note: Construction may require distances to exceed the maximum and are considered an exception requiring approval of project manager or building engineer.
- D. J-hooks or better must be installed without exception.

**2.2 UNACCEPTABLE INSTALLATIONS**

- A. Free flight of cables
- B. Resting or attaching of cables on pipes, conduits, HVAC duct work, fire sprinkler systems, basket tray, basket tray supports or on the ceiling tiles/grid.

**END OF SECTION**

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**SECTION 270533****CONDUITS AND BACK BOXES FOR  
COMMUNICATIONS SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Division 26 – Electrical work

**PART 2 - PRODUCTS****2.1 APPROVED PRODUCT**

- A. Conduits and Back boxes shall meet the construction requirements of the NEC for the type of structure and space in which they are installed and will be of the diameter and size to provide adequate fill, bend radius and connector space. Refer to section 270528.

**PART 3 - EXECUTION****3.1 CONDUIT SIZING**

- A. Conduit size shall be based on the type of cable installed and the required fill ratio and bend radius associated with the type of cable specified.
  - 1. Minimum conduit size to back box for CAT6A F/UTP shall be 1-inch EMT.
- B. Conduit and installation shall be provided by Division 26.
- C. All conduit stubs shall be installed with plastic bushings appropriate for the size of conduit used.
- D. Conduits that stub to accessible ceiling shall be installed in the direction to provide the shortest path to the TDR, complete with pull string.

**3.2 BACK BOX SIZING**

- A. New work back boxes for CAT6A F/UTP shall be a minimum of trade size 4-11/16" x 4-11/16" x 3" (depth) plus a 5/8" plaster ring to allow for proper bend radius and connector termination/installation. Side knockouts shall be avoided.
- B. Back boxes for rework shall meet the same specification as for new work.
  - 1. If existing back boxes or back boxes that are smaller due to construction restrictions, then devices such as extension rings, bezels or faceplates shall be used to modify the back box to insure proper bend radius and connector termination/installation.
    - a. Verification and approval of the size change must have DCO Infrastructure Cabling and engineering approval.

**3.3 BACK BOX COMPOSITION**

- A. All back boxes for IT systems shall be UL/CSA listed and approved for the purpose.

1. Non-metal back boxes shall not be used for any interior IT related device.

3.4 SPECIAL CONDITIONS – LEAD LINED WALLS FOR RADIATION CONTROL

- A. Refer to the complete IT Lead Lined Wall Procedure – Attachment Appendix 8

END OF SECTION

## SECTION 270536

CABLE TRAY FOR  
COMMUNICATIONS SYSTEMS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. This section shall be coordinated with Sections 270528, 270539, and 270543\_46

## 1.2 COORDINATION

- A. Prior to beginning installation, a kick-off meeting to properly coordinate the tray installation and expectations should be held. It should be arranged by the General Contractor, and at a minimum include representatives of the following trades: FP&D, Electrical (Div 26), Structured cable, Nurse Call, paging, building automation and control, plumbing, HVAC, fire sprinkler, framing, and others as applicable. The Data Center Operations Infrastructure Cabling Team will lead the meeting.
- B. The wire basket tray routing shall be approved by the low voltage CI cable contractor (Div. 27 sub-contractor), and the Data Center Operations.
- C. Where adequate space is available a Triple tier J-Hook pathway shall parallel the basket trays for other services
1. The triple tier J-Hooks shall be installed by the cable tray installer.
- D. Single J-Hooks as needed to extend beyond the triple tier, shall be installed by the trade that will be utilizing them.
- E. Cable tray shall be a high priority installation to allow adequate time for proper and complete cable installation prior to ceiling grid.

## PART 2 - PRODUCTS

## 2.1 APPROVED PRODUCT

- A. The Cable Tray shall meet or exceed the below characteristics of construction and features:
1. It shall be fully welded and available in a galvanized silver or powder coat black finish
  2. Have an optional construction using "elongated" shaped wires offering a more broad-based support for installed cables.
  3. Cable ladder shall be used in data rooms for horizontal management above the racks.
  4. Ladder shall match the manufacturer of the data racks or exact equal.
  5. Ladder shall be assembled with manufacturer approved parts and methods.
- B. APPROVED MANUFACTURES
1. WBT – Wire Basket Tray (preferred)
  2. Siemon RoutelT™ Wire Mesh Cable Tray, or equal basket type tray
  3. Cabofil per owner's approval

## 2.2 PART NUMBERS (SUBMITTAL REQUIRED)

- A. Cable Tray
1. Refer to plans for part numbers.

PART 3 - EXECUTION

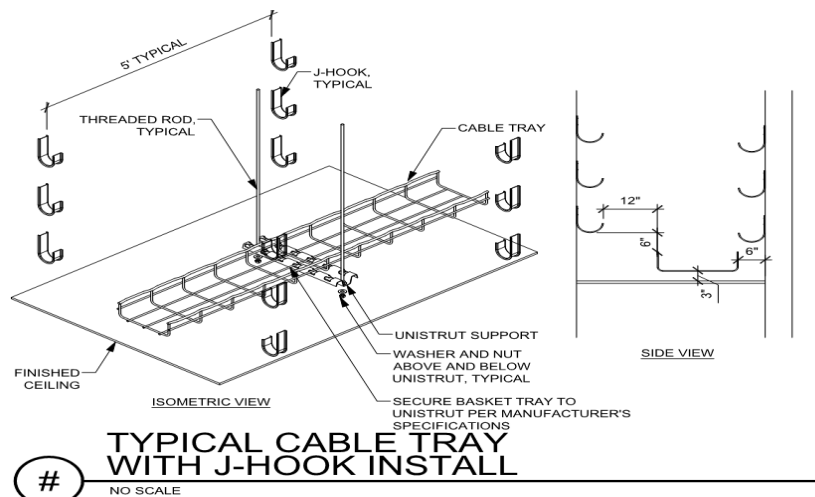
3.1 PATHWAY INSTALLATION

A. Supports

1. Installed per Manufacturer's Specifications and utilize components specific to the maintenance of proper access in and out of the cable tray using bend delimiters.
2. Distance between supports shall not exceed 5 feet
  - a. Less distance between supports required if per manufacturer's instructions.
  - b. Minimum of one support required within 24" on each side of any junction point.
3. Supports shall be of the trapeze design to provide maximum stability.
  - a. Each support shall attach to structure via its own hangers.
    - 1) All hanger supports shall be constructed of a rigid material such as all-thread.
    - 2) All hangers and supports shall be installed perpendicular and plumb to the tray. No angle supports shall be permitted unless augmented perpendicularly.
    - 3) Vibration and sway (seismic) damping required.
    - 4) Provide support across width of tray underneath, not via basket side wires.
    - 5) Building walls do not qualify as a support and shall not be used as a support.
4. Supports shall be of sufficient strength to support at least 200% of the expected load
5. Wall mounted angle brackets shall not be used as a load bearing support for cable tray.

B. Complete system access

1. Cable tray shall have a dedicated free clearance zone surrounding it.
  - a. 12" clear space shall be provided on the side where natural feed will occur.
  - b. 6" clear space shall be provided on the side opposite the feed access.
  - c. 8" clear space above the top of tray minimum – recommended 12".
  - d. 3" clear space below the tray.
2. Exception: other services may pass through the free clearance zone provided it is perpendicular to the tray direction and providing they do not exceed 6' in width or interfere with the access to pull wire in the tray.

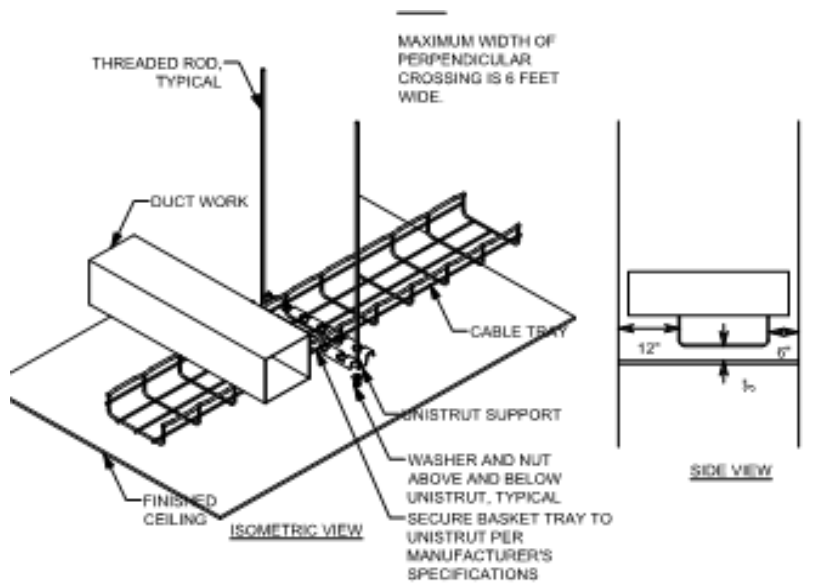


3.2 ROUTING OF BASKET TRAY

- A. Exact cable tray location shall be coordinated with other trades to ensure proper clearances and access. Prior to installation, final cable tray routing must be approved by the Owner's Data Center Operations/Infrastructure cabling team.
- B. Cable tray shall be installed in straight lines, either parallel or perpendicular to building lines
- C. Cable tray shall follow corridor paths
  - 1. Routing above rooms and other partitions shall be avoided
- D. Cable tray and flush penetrations shall be utilized over hard-lid areas as specified.
- E. Access panels shall be provided where needed to provide access to the cable tray on both sides of the wall in hard lid areas within 3' or less of the basket tray.

3.3 TRAY INTEGRITY

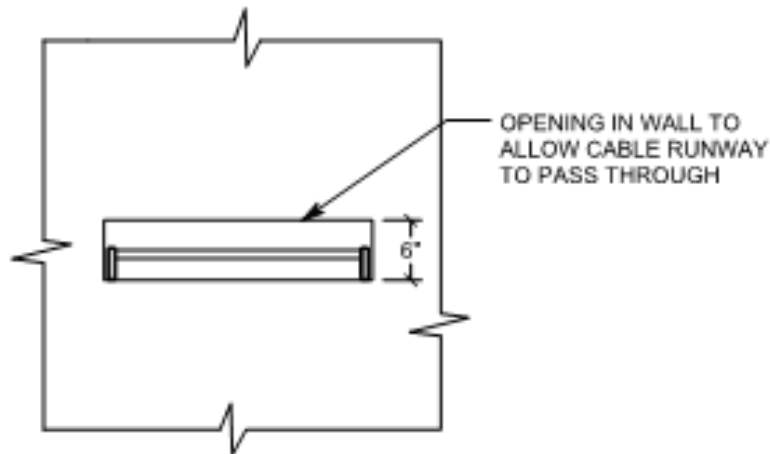
- A. Tray shall be installed as a complete, continuous system with no open spaces, cut outs, or missing segments. Bonding between sections shall be accomplished by the manufacturer's approved clamp or designated method.
- B. Tray shall be free from obstructions, other systems, trash or debris. Access to the tray shall be provided as outlined.
- C. There shall not to be any other trades infrastructure or equipment attached to or supported by the basket tray or basket tray support system.
- D. Tray must not be notched or cut-out to accommodate other trades. Repairs will not be accepted. Section replacement will be required at no cost to owner.
- E. As much tray material as possible shall be left uncut at turns, junctions, elevation changes, width changes, etc. Overlap shall be clamped to maximize strength and prevent pinch points.



**TYPICAL CABLE TRAY WITH PERPENDICULAR CROSSING**

PART 4 - #





## PART 5 - # CABLE RUNWAY THROUGH WALL DETAIL

### 5.1 WALL OR OTHER PENETRATIONS (SUBMITTAL REQUIRED)

- A. Fire and smoke rated assemblies
  - 1. Penetrations shall comply with all fire and smoke prevention methods per codes and as outlined elsewhere in this document, including Section 270528 and Division 7.
- B. Approved penetration methods
  - 1. Preferred barrier penetration method shall be to run the tray continuous through the barrier, with closure provided by Firestop pillows.
    - a. Framing shall be boxed around openings to permit proper pillow insertion. Coordinate with framing contractor.
  - 2. Sleeves or conduits
    - a. EZ-Path or alternate penetrations must provide 150% of the designed cross-sectional area of the basket.
    - b. Conduit permitted only with written pre-bid permission or engineering notation on the drawings.
    - c. Each penetration sleeve or conduit shall be bonded on both sides of the penetrated barrier using UL and AHJ approved methods.
  - 3. All penetrations shall be positioned in-line with the cable tray to facilitate ease of pulling conductors and provide a straight-line path.
    - a. The bottom of the penetration device shall be flush with the bottom of the cable tray
    - b. Side-to-side penetrations must be completely within the cable tray space or directly above whenever possible.
  - 4. Approved penetration devices shall be a minimum size of 4"
    - a. Total penetration space at each location shall be sized for 20% growth and be equal to or greater than the cross-sectional area of the basket tray.
    - b. Approved devices where smaller penetrations are permitted shall be a minimum size of 1".

5. Approved devices shall be approved by the local facility manager:
  - a. Fire rated STI EZ-Path
  - b. Hilti self-sealing device
  - c. Tray with enclosed wall and properly sized and installed pillows
  - d. Conduit sleeves
    - 1) Conduit sleeves should only be used as a last resort upon approval from owner's Data Center Operations Infrastructure Cabling representative.

## 5.2 UTILIZATION

- A. Capacity
  1. Trays and penetration devices shall be properly sized
    - a. Provide a maximum calculated fill ratio of 40% to an inside depth not to exceed 3 inches (75 mm)
    - b. Provide capacity to allow for at least 20% future growth
- B. Systems served
  1. Cable trays, J-hooks, and penetrations shall be dedicated to a single system. Mixing of other systems with voice and data shall not be permitted in tray or J-hook paths.
  2. Exception: Different systems may share cable tray providing the following conditions are met:
    - a. Less than 40% overall fill is maintained, plus 20% additional space for growth
    - b. There is a minimum 3" separation between systems
    - c. There is a grounded physical divider between systems
- C. Restricted content in trays
  1. The wire basket tray shall only contain cables for the voice and data communications systems.
    - a. If there is sufficient space in the tray, and with approval from both the data network sub-contractor and the Data Center Operations, certain other IP services may share tray space. (i.e. camera, telemetry, similar).
    - b. Service loops must not reduce tray capacity.
    - c. Nurse call cabling shall be run in the J-Hook path. All nurse call installations must provide their own path or utilize the triple J-Hook system.
- D. Triple J-Hook path assignments
  1. The Lower tier of the triple J-Hook path is designated for Card Access and building automation and controls
  2. The Middle tier of the triple J-Hook path may alternately be utilized for Nurse Call, or other EMI producing systems.
  3. The Top tier of the triple J-Hook path is designated for satellite, DAS, or similar systems.
  4. When a triple J-hook pathway is not installed or available each system provider shall install their own j-hook pathway and wall penetrations.
  5. Service loop and slack shall not interfere with other pathways.

END OF SECTION

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**SECTION 270543/46****UNDERGROUND DUCTS, UTILITY POLES,  
AND RACEWAYS FOR INTER-  
BUILDING/CAMPUS CABLE ROUTING****PART 1 - PRODUCTS****1.1 INTER-BUILDING/CAMPUS CABLE ROUTING**

- A. The backbone subsystem shall include cable installed between buildings via approved underground, tunnel, direct -buried, aerial or any combination of these from the Campus Distributor/Main Cross-connect (CD/MC/TEC) to Building Distributor/Intermediate Cross-connect (BD/IC/TDR) in a multi-building campus.
  - 1. 4" Conduit is required
  - 2. (3) 1 ¼" inner ducts shall be installed in all 4" conduits going building to building.
  - 3. Armored Fiber is required.
  - 4. Microduct/microfiber is optional.
- B. Backbone pathways shall be installed or selected such that the minimum bend radius and pulling tension of backbone cables is kept within cable manufacturer specifications both during and after installation.
- C. In an underground system, adequate underground conduit space shall be available and accessible at each building. The conduits shall not exceed a fill ratio of 40%.
  - 1. All underground systems shall be designed to prevent water runoff from entering the building. All underground systems must be cleared of any moisture prior to installation of any cable type. These systems must be sealed at both ends when not in use and after cable installation to prevent moisture and rodent infiltration.

**PART 2 - EXECUTION****2.1 INSTALLATION**

- A. The backbone cables shall be installed in a hierarchical star topology, emanating from the Campus Distributor/Main Cross-connect to each satellite building, Building Distributor/Intermediate Cross-connect or Floor Distributor/Horizontal Cross-connect located in a telecommunication room. All Inter-building/Campus cables shall be installed to the applicable codes and regulations.
- B. Where redundant paths are required, they shall be separated by a minimum of 24".
  - 1. Separate innerducts are required for each leg of the redundant path.
  - 2. Separate physical routing for each path shall be utilized where possible.
- C. Optical fiber shall be run for all Inter-building/Campus backbone segments, and as a recommendation, at least one balanced twisted-pair cable should be run for each Inter-building backbone segment.
  - 1. Fibers will be Fusion Spliced in the telecommunications rooms using LC Pigtails in wall mounted interconnect centers or rack mounted panels equipped with sufficient ports, slack storage space and splice trays if required to terminate and secure all fibers.
- D. ST connectors are no longer recommended in the TIA 568-C.3 standard but may be used in legacy installations.
- E. Over-voltage Circuit Protection shall be utilized for cabling which enters or exits a building shall comply with applicable codes and regulations.
- F. OSP (outside plant) cables shall transition to an ISP (inside plant) within 50 feet of changing environment, per national and local codes and regulations.

END OF SECTION

## SECTION 270553

IDENTIFICATION FOR LOW-VOLTAGE  
CABLES AND LABELING

## PART 1 - GENERAL

## 1.1 NOT USED

## PART 2 - PRODUCTS

## 2.1 LABELING

- A. Structured cabling shall be labeled in accordance with ANSI/TIA 606-B standards.
- B. A unique identifier shall be marked on each faceplate to identify it as connecting hardware.
- C. Each port in the faceplate shall be labeled with its identifier.
- D. A unique identifier shall be marked on each piece of connecting hardware to identify it as connecting hardware.
- E. Each port on the connecting hardware shall be labeled with its identifier.
- F. Cable Labeling
  - 1. Label System
    - a. Labels Identification (Labeling) System:
      - 1) Brady
      - 2) Dymo
      - 3) Hellerman-Tyton
      - 4) Panduit
      - 5) Acceptable alternate
        - a) Approval from Data Center Operations Infrastructure Cabling team member required prior to bid
  - 2. Cable Labels
    - a. Self-adhesive vinyl or vinyl-cloth wraparound tape markers, machine printed with alphanumeric cable designations. Plastic, self-adhesive labels are not acceptable.
    - b. Each end of the Horizontal cables shall be labeled with a mechanically generated label within 300mm (12 in) of the end of the cable jacket with the link identifier which shall be a unique configuration determined by owner. This also applies to the Backbone Cables.
  - 3. Flat-surface labels
    - a. Self-adhesive vinyl or vinyl-cloth labels, machine printed with alphanumeric cable designations
  - 4. Contractor shall:
    - a. Provide transparent plastic label holders, and 4 pair marked colored labels.
    - b. Install colored labels according to the type of field as per ANSI/TIA 606-B.1 color code designations.
- G. PALLETTE
  - 1. Use the owners color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Otherwise, use the ANSI/TIA 606-B designation strip color-code guidelines for voice, data, cross-connect, riser, and backbone fields. Color designations for F/UTP cable:
    - a. Intermountain Healthcare Standard Wiring Palettes for Horizontal Cabling

b.	Use	Color
	1) Data & IP Phones	Blue
	2) Analog Phone	Blue
	3) Security Card Readers	Grey/Yellow
	4) IP Security Cameras	Blue
	5) Fire Systems	Red
	6) TV Coax	Black
	7) Public Address/Telecom Patching in TEC only	White
	8) Clinical Engineering –	Orange
	a) Monitoring, Bed Systems	Orange
	b) Nurse Call (5e)	Orange
	c) Real time patient data	Orange
	9) Wireless	Yellow
	10) Foreseer (Belden 1422)	Red
H.	Outlet/Jack/Faceplate Icons/labeling will match the color of the cable attached to the back side of the outlet/jack.	

### PART 3 - EXECUTION

#### 3.1 GENERAL IDENTIFICATION

- A. Installer shall label all cable, regardless of length.
- B. Identify system components, wiring, and cabling complying with TIA/EIA-606-B.1. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- D. Using cable management system software specified in Part 2, develop Cabling Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable and label cable, jacks, connectors, and terminals to which it connects with same designation. At completion, cable and asset management software shall reflect as-built conditions.
- E. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- F. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications rooms, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-B.1. Furnish electronic record of all drawings, in software and format selected by Owner

#### 3.2 CONCEALED ENDS

- A. Jacks, connectors, terminations, and similar that are in concealed locations such as above grid ceilings, shall have additional labeling. The additional label shall be on the face of the grid in a visible location, immediately adjacent to the termination location.

#### 3.3 CABLE AND WIRE IDENTIFICATION

- A. Label each cable visibly within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.

- B. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
- C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
  - 1. Individually number wiring conductors connected to terminal strips and identify each cable or wiring group being extended from a panel or cabinet to a building mounted device shall be identified with name and number of particular devices as shown.
  - 2. Label each unit and field within distribution racks and frames.
- D. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-B.1.

END OF SECTION

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**SECTION 271100****EQUIPMENT ROOM FITTINGS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Requirements of the following Division 26 sections apply to this section
  - 1. Basic electrical requirements
  - 2. Basic electrical materials and methods
  - 3. Grounding, earthing, and bonding
- B. Standards
  - 1. Minimum equipment room specifications shall comply with the 2010 AIA Guidelines for Design and Construction of Healthcare Facilities.
  - 2. Minimum recommended room sizes are requirements, not suggestions.
  - 3. Enterprise IS Architecture (EISA) maintains several documents around standards. The primary standards list is the EISA Standards 2010 – Master List. Occasionally, there is a need to breakout specific standards for an area.

**1.2 SUMMARY**

- A. This Section specifically details the facilities design and operations standards to be utilized for Intermountain Health Care's Data Rooms (TEC) and data closets (TDR).

**1.3 COMMON REQUIREMENTS**

- A. Rack layout and mounting
  - 1. Standard room layouts are located on the plans.
- B. Rack and wall mounting locations
  - 1. Rack and wall space use is pre-designated at the design stage. Before mounting any equipment on a wall or in a rack, the location must be verified by the Div 27 sub-contractor and the Data Center Operations.

**1.4 DEFINITIONS**

- A. **Data Center** – Major computer/technology/network facilities providing a significant percentage of the data and application services for the enterprise.
- B. **Data Rooms – ((TEC) Technology Equipment Center)** – Purpose built buildings or rooms that provide communications point-of-presence along with some data and applications services for a local facility or region.
- C. **TSER (Telecommunications Service Entrance Room)** – Houses the point at which data and voice circuits and services enter the facility and outdoor cabling interfaces with the building infrastructure. Typically, the TSER will be located in the TEC.
- D. **Data Closets – ((TDR) Technology Distribution Room)** – Specific location within a facility that provides communication services for a specific area (floor, wing, office area) of that facility only. A secure, flexible, and easily managed location for the structured cabling systems, network electronics, clinical systems, nurse call systems, and other technology and communications equipment.

**PART 2 - TECHNOLOGY ROOM SPECIFIC REQUIREMENTS****2.1 TECHNOLOGY EQUIPMENT CENTER (TEC)**



- A. Each Hospital will have a dedicated TEC which will serve as the main communications point-of-presence along with data and application services for the local facility or region. Houses the core networking equipment, application servers and data storage devices that serve the buildings on the campus. The Telecommunications Service Entrance Room (TSER) will be in the same room.

## 2.2 TEC IN HOSPITALS

- A. Physical Construction
  1. The TEC should be in an area easily accessed for delivery of equipment and high traffic without disturbing patient care.
  2. The size of the TEC will be based on the number of cabinets required to support the campus, plus 30% growth.
  3. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  4. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  5. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  6. The TEC should not have a ceiling other than the deck.
  7. Static Dissipative Tile is required in the TEC.
  8. The door to the TEC shall be 8' tall and 4' wide to accommodate the cabinet height.
  9. The walls of the TEC should not have any windows installed.
- B. Layout
  1. Cabinets will be in a cold isle configuration.
  2. Containment will be installed, including removable ceiling panels and isle doors.
- C. Electrical
  1. The electrical distribution system will follow an A (BLUE) – B (RED) design.
  2. Each system A (BLUE) and B (RED) will be backed up by a dedicated UPS.
  3. Outlet type is L21-30
  4. All power is to be run in conduit.
  5. Lighting will be installed above each isle.
- D. Mechanical
  1. The mechanical system will be a precision cooling solution installed in an in row, N+1 configuration designed to maintain 72 degrees F at mid cabinet.
  2. The mechanical system will be redundant and concurrently maintainable including on the electrical supply.
  3. The system shall meet engineering specifications for the room at 110 degrees outside air at 4500 feet above sea level.
  4. Chilled water, DX (Air Cooled) and Glycol (30% polyethylene glycol to water) are all acceptable cooling strategies.
- E. Security
  1. Doors will be fitted with an auditable card reader.
- F. Fire System
  1. A pre-action dry pipe fire system will be installed
- G. Monitoring
  1. Eaton Forseeer system will be used to monitor all critical systems.
  2. Forseeer cables will be run to all UPSs, cooling units and TDRs.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.3 TEC in Clinics and Office Buildings

- A. Clinics and Offices will have a room which will serve as a TEC and TDR. This room will be sized to accommodate the multifunction of the space.

## 2.4 TEC/TDR in Clinics

- A. Physical Construction
  - 1. TDRs should be in a central location off the main corridor away from patient areas.
  - 2. TDRs should be stacked from floor to floor.
  - 3. TDR size will be at least 12' x 14'.
  - 4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  - 5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  - 6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  - 7. The TDR should not have a ceiling other than the deck.
  - 8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  - 9. 3' wide door is required.
  - 10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
  - 1. Racks in a single row with the front being the cold isle.
  - 2. The front of the racks should face the door.
- C. Electrical
  - 1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  - 2. System A(BLUE) will be backed up by a dedicated UPS.
  - 3. System B(RED) will be from a dedicated utility circuit.
  - 4. Outlet type is L6-30 and L5-20.
  - 5. All power is to be run in conduit.
  - 6. Lighting will be installed above each isle.
- D. Mechanical
  - 1. TDRs will have redundant cooling
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The Mechanical system will be designed to maintain 72 degrees F at mid rack.
    - e. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
  - 1. Doors will be fitted with an auditable card reader.
- F. Fire System
  - 1. TDRs will utilize the facility fire detection and suppression systems.
  - 2. Sprinkler heads should have a 200-degree fuse.
  - 3. Sprinklers should be protected from accidental activation.
- G. Monitoring
  - 1. TDRs will be monitored using Eaton/Foreseer.
  - 2. Run 3 foreseer cables to each TDR.
  - 3. One Cat6a F/UTP cable to each UPS.

## 2.5 TEC/TDR in Offices

- A. Physical Construction
  - 1. TDRs should be in a central location off a main corridor.
  - 2. TDRs should be stacked from floor to floor.
  - 3. TDR size will be at least 12' x 14'.

4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.
  8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
  2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  2. System A(BLUE) will be backed up by a dedicated UPS.
  3. System B(RED) will be from a dedicated utility circuit.
  4. Outlet type is L6-30 and L5-20.
  5. All power is to be run in conduit.
  6. Lighting will be installed above each row.
- D. Mechanical
1. TDRs will have redundant cooling system designed to maintain 72 degrees F at mid rack.
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
      - 1) The secondary system will be fed from the facility generator equipment electrical source if available.
    - c. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
  2. Doors will be fitted with an auditable card reader.
- E. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
  2. Sprinkler heads should have a 200-degree fuse.
  3. Sprinklers should be protected from accidental activation.
- F. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
  2. Run 3 foreseeer cables to each TDR.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.6 TECHNOLOGY DISTRIBUTION ROOM (TDR)

- A. There shall be a minimum of one TDR on each floor of the facility. TDR's shall be provided throughout the facility as necessary to meet the 292' (90-meter) maximum cables distance. The TDR is located on each floor within a facility to house equipment and cabling, providing communication and technology services for a specific area of that facility. Based on the different needs of different facilities, the TDR's will be broken down into three categories. Hospital, Clinic and Office spaces.

## 2.7 TDR IN HOSPITALS

- A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
  2. TDRs should be stacked from floor to floor.

3. TDR size will be at least 14' x 16'.
  4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.
  8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks will be in a cold isle configuration.
  2. Two rows with the cold isle in the middle.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  2. Each system A(BLUE) and B(RED) will be backed up by a dedicated UPS.
  3. Outlet type is L6-30 and L5-20.
  4. All power is to be run in conduit.
  5. Lighting will be installed above each row.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
  2. Sprinkler heads should have a 200-degree fuse.
  3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
  2. Run 3 foreseer cables to each TDR.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.8 TDR in Clinics

- A. Physical Construction
1. TDRs should be in a central location off a main corridor and away from patient areas.
  2. TDRs should be stacked from floor to floor.
  3. TDR size will be at least 10' x 12'.
  4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.

8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
  2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.
  2. System A(BLUE) will be backed up by a dedicated UPS.
  3. System B(RED) will be from a dedicated utility circuit.
  4. Outlet type is L6-30 and L5-20.
  5. All power is to be run in conduit.
  6. Lighting will be installed above each isle.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
  2. Sprinkler heads should have a 200-degree fuse.
  3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
  2. Run 3 foreseer cables to each TDR.
  3. One Cat 6a F/UTP cable to each UPS.

## 2.9 TDR in Offices

- A. Physical Construction
1. TDRs should be in a central location off a main corridor.
  2. TDRs should be stacked from floor to floor.
  3. TDR size will be at least 10' x 12'.
  4. Walls will be constructed from the floor to the deck and be completely sealed from surrounding spaces.
  5. A minimum 50% of open wall space will have ¾" fire rated plywood covering the walls.
  6. Fire rated plywood shall be painted with fire resistant paint, leaving the fire rating stamp un-painted.
  7. The TDR should not have a ceiling other than the deck.
  8. Flooring can be Static Dissipative Tile or Epoxy Paint.
  9. 3' wide door is required.
  10. When permissible, doors shall swing out of the room to provide maximum available space and rapid egress.
- B. Layout
1. Racks in a single row with the front being the cold isle.
  2. The front of the racks should face the door.
- C. Electrical
1. The electrical distribution system will follow an A (BLUE)-B (RED) design.

2. System A(BLUE) will be backed up by a dedicated UPS.
  3. System B(RED) will be from a dedicated utility circuit.
  4. Outlet type is L6-30 and L5-20.
  5. All power is to be run in conduit.
  6. Lighting will be installed above each isle.
- D. Mechanical
1. TDRs will have redundant cooling designed to maintain 72 degrees F at mid rack.
    - a. Primary cooling is from the facility cooling system via a dedicated source.
    - b. Secondary cooling is from a standalone split or ceiling mount source.
    - c. The secondary system will be fed from the facility generator equipment electrical source if available.
    - d. The coordination scheme between primary and secondary cooling systems can be accomplished by setting the primary system to 72 degrees F and the secondary system to 75 degrees F.
- E. Security
1. Doors will be fitted with an auditable card reader.
- F. Fire System
1. TDRs will utilize the facility fire detection and suppression systems.
  2. Sprinkler heads should have a 200-degree fuse.
  3. Sprinklers should be protected from accidental activation.
- G. Monitoring
1. TDRs will be monitored using Eaton/Foreseer.
  2. Run 3 foreseer cables to each TDR.
  3. One Cat 6a F/UTP cable to each UPS.

### PART 3 - EXECUTION

#### 3.1 COMMON REQUIRED CHARACTERISTICS FOR TDR, TEC, & TSER

- A. SECURITY - COMMON
1. Any visitor, vendor, or contractor requiring access to a Technology Room, who does not have appropriate approvals or clearances, must be escorted by a properly credentialed tech from the appropriate system.
  2. The main technology equipment shall be secured in a dedicated, locked Technology Room.
  3. Unused access jacks should be disconnected from the patch panels, and unused switch ports disabled.
  4. Technology Rooms shall be dedicated to the data and telecommunications functions.
  5. Access to the Technology Room shall be restricted to authorized service personnel and shall not be shared with building services that may interfere with the main networking interfaces, the networking equipment, the application servers, data storage devices, and telecommunications equipment systems.
  6. Technology Rooms shall not be used for building maintenance services, custodial services, or be used for general storage.
  7. Security cameras may be installed in each Technology Room upon owner's preference.
    - a. At entrances
    - b. At the end of each row of equipment racks
    - c. In electrical and mechanical rooms serving the Technology Room
    - d. Approved camera manufacturers: Axis and Bosch
  8. Access to a Technology Room shall be restricted and controlled by an auditable access control system. The access control system shall comply with the requirements of this document.
  9. All secure data areas must be secured by an auditable badge reader system.

- a. Refer to plans or quotes for detailed information
- b. Approved supplier: Intermountain Lock and Security Supply /  
3106 S Main St / Salt Lake City, UT 84115 / 801-486-0079
- c. Owner of security locks and badge readers:  
Intermountain Healthcare Data Center
- d. For programing on the Medeco XT Electronic Keys contact:  
Intermountain Healthcare Data Center

#### B. PHYSICAL ENVIRONMENT

1. The Technology Room shall be in a dry area not subject to flooding and should be as close as possible to the electrical service room in order to reduce the length of the bonding conductor to electrical grounding system.
2. The Technology Room shall be in an accessible, non-sterile area.
3. Access to the Technology Room shall be directly off a corridor and not through another space.
4. The Technology Room shall be located to avoid large ducts, beams, and other building elements that may interfere with proper cable routing and may limit future access.
5. Mechanical and electrical equipment or fixtures not directly and exclusively related to the support of the Technology Room shall not be installed in, pass through, or enter the Technology Room.
6. Technology rooms shall not be located on exterior walls.
7. Technology rooms shall not have windows or other exterior openings.

### 3.2 TECHNOLOGY DISTRIBUTION ROOM (TDR) / DATA CLOSET

#### A. ELECTRICAL ENVIRONMENT

1. Separation from sources of EMI shall be in accordance with ANSI/TIA/EIA-569-C and local codes.
2. Communication grounding/earthing and bonding shall be in accordance with applicable codes and regulations. It is recommended that the requirements of IEC/TR3 61000-5-2 - Ed. 1.0, ANSI-J-STD-607-C, or both be observed throughout the entire cabling system.
  - a. All racks, equipment frames, furniture, flooring, ductwork within the IT space shall be bonded to the Central Ground bar provided and installed by Division 26.
    - 1) No AC electrical equipment bonding will be done at the Central Ground Bar. AC electrical grounding and bonding will be done according to the NEC.
3. Some TDRs will require redundant power and data feeds. See plans and drawings.
4. Lighting in the TDRs should be a minimum of 500 lx (50-foot candles) at the lowest point of termination.
  - a. Light switch should be easily accessible when entering the room.
  - b. Lighting will be fed from the generator system or have fixtures with battery backup.
5. A minimum of two dedicated duplex or two dedicated simplex electrical outlets, each on a separate 120V 20A circuit, should be provided for equipment power. Additional convenience duplex outlets should be placed at 1.8 m (6 ft) intervals around the perimeter walls.
  - a. Only twist lock receptacles will be used for rack power points. Type L-6-30R for 208 volt and type Nema L-5-20R for 120 volt
6. All power is to originate from the facilities generator backup system with one system (A-B) originating from the critical system.
7. All circuits serving the TDR and the equipment within it shall be dedicated to serving the TDR.

8. TDRs shall be connected by a backbone of insulated, #6 (minimum) to 3/0 AWG stranded copper cable between all technology rooms. This cable shall be provided and installed by Division 26.
- B. MECHANICAL ENVIRONMENT
1. Reliable cooling shall be provided.
    - a. Based on criticality tiering structure individual rooms may require redundant, concurrently maintainable cooling systems.
    - b. Tier structure level shall be determined from the design guide.
  2. Heat load shall be calculated at 4KW per equipment rack
  3. Temperature and humidity in the TDR shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
- C. EQUIPMENT
1. Each TDR shall be connected to the TEC (Technology Equipment Center) to provide a building-wide network and communications system.
  2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

### 3.3 TECHNOLOGY EQUIPMENT CENTER (TEC) / DATA ROOM

- A. ELECTRICAL ENVIRONMENT
1. The TDR and TEC electrical environments shall match with the following exceptions:
  2. All circuits serving the TEC and the equipment within it shall be dedicated to serving the TEC.
- B. MECHANICAL ENVIRONMENT
1. TEC and TSER have the same mechanical environment.
  2. Reliable cooling shall be provided.
  3. Heat load shall be calculated at 4KW per equipment rack
  4. Temperature and humidity in the TEC shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative humidity.
- C. EQUIPMENT
1. Each TEC shall be connected to the TSER (Telecommunications Service Entrance Room) to provide an enterprise-wide network and communications system.
  2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

### 3.4 TELECOMMUNICATION SERVICE ENTRANCE ROOM (TSER) / D-MARC

- A. PURPOSE
1. The TSER (Telecommunications Service Entrance Room) equipment subsystem shall consist of shared (common) electronic communications equipment in the TEC or the TSER required to interface this equipment and distribution hardware to the transmission media of enterprise Wide Area Network (WAN) infrastructure.
  2. The TSER shall be equipped to contain telecommunications equipment, cable terminations, and associated cross-connects.
    - a. Note that the AIA/State guidelines specify that the minimum size for a TSER is 12' by 14'.
    - b. Doors shall swing out of the room to provide maximum available space and rapid egress.
      - 1) Exception: where prohibited by fire or safety code.
  3. The TSER shall be dedicated to the telecommunications function.
- B. MECHANICAL ENVIRONMENT
1. Reliable cooling and heating shall be provided.
  2. Temperature and humidity in the TSER shall be controlled to an operating range of 64 to 75 degrees F (18 to 24 degrees C) with 30 to 55 percent relative



- humidity.
- C. EQUIPMENT
1. The TSER (Telecommunications Service Entrance Room) shall be connected to the specified WAN equipment to provide connectivity to the enterprise-wide network and communications system.
  2. All racks, cabinets, sections of cable tray, and metal components of the technology system that do not carry electrical current shall be grounded.

END OF SECTION

## SECTION 271116

CABINETS, RACKS, FRAMES,  
AND ENCLOSURES

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Cabinets and racks specifications are in TIA569-C and in the ET pages of the plans.

## PART 2 - PRODUCTS

## 2.1 APPROVED PRODUCT

## A. OPEN RACKS

1. For rack-mounted installations in a telecommunications room the installer shall use a 19 inch by 3-inch-deep equipment rack.
  - a. Equipment Rack 19" X 8', 52 RU, Black – Chatsworth 55053-715
  - b. Equipment Rack 19" X 7', 45 RU, Black – Chatsworth 55053-703
  - c. Exception: Where other size cabinets are specified by design team at owner's direction

## B. WIRE MANAGERS

1. Part Numbers
  - a. Vertical Wire Manager, Double Sided, Black 10" wide x 8' tall – Chatsworth 40096-715
  - b. Vertical Wire Manager, Double Sided, Black 10" wide x 7' tall – Chatsworth 40096-703
  - c. Horizontal Wire Manager, 4U – Panduit PEHF4
2. Typical Standard Layout
  - a. Layout is 10" vertical manager, then 19" rack, then 10" vertical manager, then 19" rack, then 10" vertical manager.
  - b. Where more than 2 racks are called for, maintain the pattern of 10" vertical wire management on the ends, and 10" vertical management between racks.

## C. CABINETS

1. Standard Cabinet
  - a. 2-Sided Cabinet – Vertiv E4562121120001S
  - b. 1-Sided Cabinet – Vertiv E4562122120001S
2. Wall Mount Cabinet
  - a. Vertical Wall Mount Cabinet – Legrand VWMSD-4RU-42-B
  - b. Vertical Wall Mount Cabinet – Legrand VWMSD-8RU-42-B
  - c. Fixed Mounting Rail Kit – Legrand VWM-RR-4RU
  - d. Fixed Mounting Rail Kit – Legrand VWM-RR-8RU
  - e. Pivoting Mounting Rail Kit – Legrand VWM-PIV-4RU
  - f. Fan Kits with 115 VAC fans – Legrand VWMFK-115
  - g. Top Brush Grommet Kit – Legrand VWMBGK
  - h. Circular Knockout Grommet Kit – Legrand VWMGR-30

END OF SECTION

## SECTION 271119

TERMINATION BLOCKS AND  
PATCH PANELS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

- A. Requirements of the following Division 26 sections apply to this section
  - 1. Basic electrical requirements
  - 2. Basic electrical materials and methods
  - 3. Grounding, Earthing, and Bonding

## PART 2 - PRODUCTS

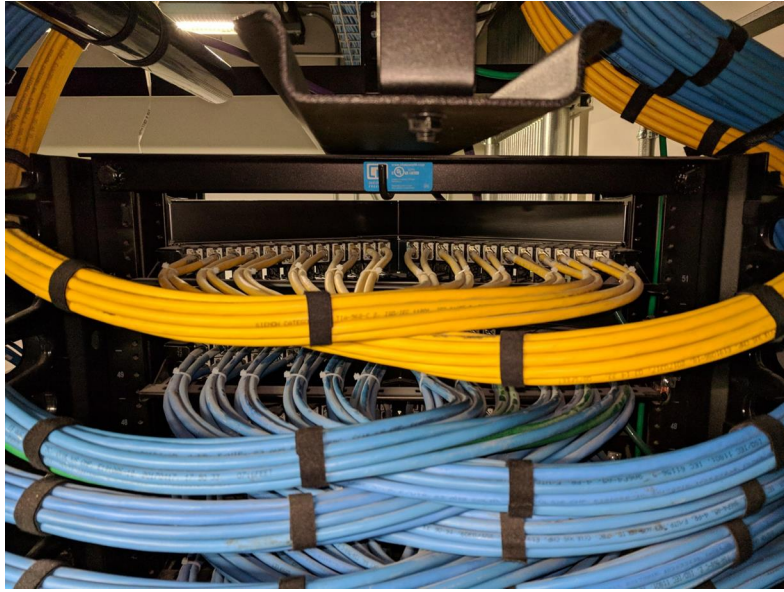
## 2.1 APPROVED PRODUCT

- A. PATCH PANELS – COPPER
  - 1. 48 Port CAT 6A Shielded, 1RU Angled Patch Panel with Outlets – Siemon Z6AS-PA-48A
  - 2. 48 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U48K
  - 3. 24 Port CAT 6A Shielded, 1RU Flat Patch Panel with Outlets – Siemon Z6AS-PNL-U24K
  - 4. 48 Port CAT 5e, 2RU Angled Patch Panel, 110 Style – Siemon HD5-48A
  - 5. 48 Port CAT 5e, 2RU Flat Patch Panel, 110 Style – Siemon HD5-48
  - 6. 24 Port CAT 5e, 1RU Angled Patch Panel, 110 Style – Siemon HD5-24A
  - 7. 24 Port CAT 5e, 1RU Flat Patch Panel, 110 Style – Siemon HD5-24
  - 8. 19" Angled Blank Filler Panel, 1U, Black – Siemon PNL-BLNKA-1
    - a. Provide blank fillers where appropriate.
  - 9. 19" Flat Blank Filler Panel, 1U, Black – Siemon PNL-BLNK-1
    - a. Provide blank fillers where appropriate.
- B. PATCH PANELS – FIBER
  - 1. Rack Mount Fiber Enclosure – Siemon RIC3-48E-01
  - 2. Wall Mount Fiber Enclosure – Siemon SWIC3G-AA-01
  - 3. Blank Adapter Plate, Black – Siemon RIC-F-BLANK-01
  - 4. 12F-LCUPC-SM-Loaded-Splice Cassette - Siemon – RSC12-LCUSMA-B1
- C. CABINET PATCH PANEL – FIBER
  - 1. Lightstack Surface Mount Module Enclosure – Siemon – LSE-01
  - 2. Lightstack Surface Mount Splice Enclosure – Siemon – LSS-01
  - 3. LightStack LC Adapter Plate – Siemon LS-LS12-01C-AQ

## PART 3 - EXECUTION

## 3.1 INSTALLATION

- A. For angled patch panels, the terminations shall cross in the back to the opposite path of the patch panel to maximize available cable bend radius.
- B. See illustration below in this section:



END OF SECTION

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**SECTION 271300****BACKBONE CABLING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawing and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 27 05 28 – Pathways for Communications Systems.

**1.2 DEFINITIONS**

- A. **INTRA-BUILDING CABLING**
  - 1. Cable that runs between telecommunications rooms (TRs) inside a building. Can be vertical or horizontal in physical orientation. It consists of the backbone transmission media between these locations and the associated connecting hardware terminating this media.
- B. **INTER-BUILDING / CAMPUS CABLING**
  - 1. Cable that runs between buildings in a campus environment. It is normally a first-level backbone cable beginning at the main cross-connect in the equipment room of the hub building and extending to the intermediate cross-connect in the equipment room of a satellite building. Campus Backbones require optical fiber cable to be installed to support high speed data applications.
  - 2. Customer owned outside plant (OSP) cabling.

**PART 2 - PRODUCTS****2.1 PERMITTED BACKBONE MEDIA**

- A. Cables allowed for use in the backbone include:
  - 1. CAT 6A F/UTP Riser, Blue, Data – Siemon 9A6R4-A5-06-R1A
  - 2. CAT 6A F/UTP Plenum, Blue, Data – Siemon 9A6P4-A5-06-R1A
  - 3. 50 Pair Category 3 Riser Cable Gray – General Cable 2133161 or equal
  - 4. Fiber Optic Cable, Single-mode, 24 Strand, Armored Indoor/Outdoor Cable, Black – Siemon 9BG8P024L-E201A
  - 5. Fiber Optic Cable, Single-mode, 24 Strand, Armored, Riser Cable, Yellow – Siemon 9BC8P024L-205A
  - 6. Fiber Optic cable, Multi-mode, OM4, 12 Strand, Armored, Riser Cable, Aqua – Siemon 9BC5P012G-T512A (Data Centers must be OM4 or better)
- B. The cable shall support voice, data and imaging applications. The bending radius and pulling strength requirements of all backbone cables shall be observed during handling and installation.
- C. Multi-pair twisted pair cable is intended to support analog voice applications and shall be tested for continuity only.
- D. In addition to meeting the applicable performance specifications, all copper and optical fiber cable shall be appropriate for the environment in which it is installed.

**2.2 MEDIA PRODUCTS**

- A. **COPPER**

1. The total channel length between the Campus Distributor/Main Cross-connect and to any floor Distributor/Horizontal Cross-connect shall not exceed the following length limits for copper cabling:
  - a. 2,000 m (6,560 ft) for balanced twisted pair for PBX/Class A (100 kHz) applications.
  - b. 200 m (656 ft) for balanced twisted pair for Class B ( $\leq 1$  MHz) applications.
  - c. 100 m (328 ft) for balanced twisted-pair categories 6, 6A & 7 (per Backbone segment when providing a two-level Backbone).
- B. MULTIMODE OPTICAL FIBER
  1. See Siemon website for supportable fiber distances
    - a. Laser qualified 50/125 $\mu$ m multimode fiber optical fiber cables shall be in compliance with the following standards ISO/IEC 11801:2002 OM3, ANSI/TIA-568-C.3, ANSI/TIA-568-C.1 and Telcordia GR-409-CORE as well as the guaranteed application distances, attenuation, bandwidth, and group index of refraction requirements.
    - b. Specifications:
      - 1) Shall support 10GBASE-SX for all horizontal workstations, risers and short length backbone (<300 m) locations.
      - 2) Constructed for overfilled launch (OFL) and restricted mode launch (RML) bandwidth to ensure compatibility with both LED and laser light sources.
      - 3) Have an Aqua Outer Jacket and be available in cable ratings including OFNR and OFNP.
- C. SINGLE MODE OPTICAL FIBER
  1. See Siemon website for supportable fiber distances
  2. Single-mode optical fiber cable shall be used for 1st and 2nd Level Backbone applications only.
  3. All fiber is to fusion spliced terminations.

### PART 3 - EXECUTION

#### 3.1 TOPOLOGY

- A. The Backbone cabling shall use a conventional hierarchal star topology.
  1. There shall be no more than two (2) levels of cross-connects between the campus distributor/main cross –connect (CD/MC) and any given floor distributor/horizontal cross-connect (FD/HC).
  2. From the FD/HC no more than one cross-connect shall be passed through to reach the CD/MC.
- B. Splicing of UTP, F/UTP and S/FTP copper cables is not permitted.

#### 3.2 TYPICAL TDR BACKBONE

- A. A typical TDR backbone for a hospital campus shall consist of:
  1. Redundant (2 ea.) 24 strand single-mode fiber each routed in a separate path.
  2. One 50 pair copper feed line.

END OF SECTION

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**SECTION 271500****HORIZONTAL CABLING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this section.
- B. Section 27 05 28 - Pathways for Communications Systems

**1.2 SUMMARY**

- A. This section includes requirements and guidelines for the installation of F/UTP, ScTP, and Fiber horizontal cabling.
  - 1. Horizontal cable and its connecting hardware provide the means of transporting signal between the telecommunications outlet/connector and the horizontal cross-connect located in the communications termination room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

**PART 2 - EXECUTION****2.1 HORIZONTAL CABLE**

- A. Quantity
  - 1. Two horizontal cables shall be routed to each work area. Cable connected to information outlets shall be CAT6A F/UTP, 4-pair, 100Ω balanced twisted-pair.
    - a. A work area is approximately 100 sq. ft. and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
    - b. Two (2) standard cables shall be run to each wireless access point location per current best practice.
    - c. One (1) standard horizontal cable may be run to the following locations:
      - 1) Each building control system enclosure as directed by the building controls vendor.
      - 2) Each IP Video Surveillance Camera at each of the designated locations.
      - 3) Each wall phone.
      - 4) Each wall monitor/display.
  - 2. For voice or data applications, 4-pair balanced twisted-pair or fiber optic cables shall be run using a star topology from the telecommunications room serving that floor to every individual information outlet. The customer prior to installation of the cabling shall approve all cable routes.
  - 3. Installation interfaces shall be T568B wiring standards.
- B. Maximum Length
  - 1. All horizontal cables, regardless of media type, shall not exceed 90 m (295 ft.) from the telecommunications outlets in the work area to the Floor Distributor/Horizontal Cross connect (FD/HC) located in the Telecommunication Room.
  - 2. Distributor/Horizontal Cross connect (FD/HC) located in the Telecommunication Room.
  - 3. The combined length of jumpers, patch cords inclusive of equipment cables in

- the Floor Distributor/Horizontal Cross-connect shall not exceed 5m (16 ft.).
4. The maximum length of Work Area equipment cables shall be 5m (16 ft.) If a MuTOA (Multiple User Telecommunication Outlet) environment exists, then the maximum equipment cable shall not exceed 22m (72 ft.) (Lake Park Facility)
  5. Terminate all conductors; no cable shall contain un-terminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
- C. Minimum Length
1. It is recommended that a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
  2. For installations with consolidation points, a minimum horizontal cable distance of 15m (49 ft.) shall be maintained between the telecommunications room and consolidation point, and 5m (16 ft.) between the consolidation point and the work area. This will provide adequate Insertion Loss/Attenuation for applications over 1 Gig.
- D. Splice Free
1. Each run of balanced twisted-pair cable between Floor Distributor/Horizontal Cross-connect in the telecommunication room and the information outlet at the Work Area shall not contain splices.
  2. Bridged taps and splices shall not be installed in the horizontal cabling
- E. Protection
1. Horizontal distribution cables shall not be run in under slab raceways that are damp or wet locations unless suitably rated for the environment.
    - a. Under slab conduits that are outside of the building are considered wet locations.
- F. Slack -Service Loop – Routing
1. In the work area, a minimum of 1m (3 ft) should be left for balanced twisted-pair cables and fiber cables.
  2. In telecommunications rooms a minimum of 3m (10 ft) of slack should be left for all cable types. This slack must be neatly managed on trays or other support types

## 2.2 SEPARATION

- A. Separation from EMI sources
1. Installation shall comply with BICSI TDMM and TIA/EIA-569-B for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
  2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and EMI Source shall be as follows:
    - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 5 inches.
    - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 12 inches.
    - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 24 inches.
  3. Separation between communications cables in grounded metallic raceways and unshielded power lines or EMI Source shall be as follows:
    - a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2-1/2 inches.
    - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 6 inches.
    - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 12 inches.
  4. Separation between communications cables in grounded metallic raceways and



power lines and EMI Source located in grounded metallic conduits or enclosures shall be as follows:

- a. EMI Source Rating Less Than 2 kVA: A minimum clearance of 2 inches.
  - b. EMI Source Rating between 2 and 5 kVA: A minimum clearance of 3 inches.
  - c. EMI Source Rating More Than 5 kVA: A minimum clearance of 6 inches.
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or 1 HP and Larger: A minimum clearance of 48 inches.
  6. Separation between Communications Cables and Fluorescent Fixtures: A minimum clearance of 5 inches
- B. Other Clearances
1. Horizontal pathways used for telecommunications cabling shall be dedicated for telecommunications use and not shared by other building services.
  2. In a false ceiling environment, a minimum of 75 mm (3 in) shall be observed between the cable supports and the false ceiling.

## 2.3 PATHWAY

- A. Cable Tie Wraps
1. Cable Tie Wraps are not permitted as a pathway device or support.
  2. Tie Wraps shall only be used to provide strain relief at termination points.
  3. Tie wraps shall not be over tightened to the point of deforming or crimping the cable sheath.
- B. Constraints
1. Horizontal cables shall be installed in "dry" locations that provide protection from moisture levels above the intended operating range of inside plant (ISP) cables.
    - a. If cabling is intentionally or unintentionally exposed to water or otherwise coated with or exposed to direct contact with solvents, paints, adhesives, sealants or other third-party materials, Siemon will not warranty the cabling product or if after the warranty has been issued, it would become void. Therefore, any cabling that has been exposed as listed above, must be removed and replaced.
  2. Horizontal pathways shall be installed or selected such that the minimum bend radius of horizontal cables is kept within manufacturer specifications both during and after installation.
  3. A minimum of a 1" diameter conduit is recommended for new construction. Existing conduits will require the reduction of the number of cables placed in the conduit to meet the required fill ratio.
    - a. The Contractor shall observe the bending radius and pulling strength requirements of the 4-pair balanced twisted-pair and fiber optic cable during handling and installation.
      - 1) 4-Pair UTP, F/UTP, S/FTP bend radius = 4 times outside diameter of cable under no-load conditions. 8 times the outside diameter under load (pulling 110 N/25 lbf.) conditions.
      - 2) Multi-pair or Hybrid cable bend radius = 10 times the outside diameter under all conditions.
      - 3) 2-Fiber and 4 Fiber cables bend radius = 25mm (1 in.) under no-load conditions. 50mm (2 in.) under load (pulling 222 N 50 lbf)
  4. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
  5. Cable that passes through non-Intermountain Healthcare spaces must be installed in conduit.
  6. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.

7. Do not install bruised, kinked, scored, deformed, abraded cable or otherwise damaged cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
  8. During Cold-Weather Installation, bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- C. Capacity
1. The number of horizontal cables placed in a cable support or pathway shall be limited to the number of cables that will not alter the geometric shape of the cables.
  2. Maximum pathway (cable tray/basket tray/wireway) capacity shall not exceed a calculated fill ratio of 50% to a maximum of 75 mm (3 in) inside depth.
  3. Maximum conduit pathway capacity shall not exceed a 40% fill. However, perimeter and furniture fill are limited to 60% fill for move and changes. A 40% fill ratio is the maximum fill for CAT6A F/UTP cables.
  4. All unused cables shall be removed
    - a. Or labeled at both ends designating future purpose and locations of each end.

END OF SECTION

## SECTION 271513

## COPPER CABLE

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 PALLETTE

- A. Color palette shall be in accordance with Section 27 05 53

## 1.3 SUMMARY

- A. This Section covers approved F/UTP cable types
- B. Systems shall be CAT6A F/UTP unless a written deviation has been approved.
- C. CAT6A UTP and CAT6A F/UTP shall not be mixed on the same campus.
- D. This cable shall be used for both voice and data applications and shall be plenum rated where required by code

## PART 2 - PRODUCT

## 2.1 APPROVED PRODUCT

- A. TYPE 6A F/UTP (foil over unshielded twisted pair) - Siemon
  - 1. CAT 6A F/UTP Riser, (CMR) – Siemon 9A6R4-A5-(XX)-R1A
  - 2. CAT 6A F/UTP Plenum, (CMP) – Siemon 9A6P4-A5-(XX)-R1A
    - a. (XX) = Color – 06, Blue – 05, Yellow – 09, Orange

END OF SECTION

## SECTION 271543

## FACEPLATES AND CONNECTORS

## PART 1 - GENERAL

## 1.1 RELATED DOCUMENTS

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

## 1.2 DEFINITION

- A. Work-Area Cabling
  - 1. The work area is comprised of work area outlet/connectors, faceplates, outlet boxes and equipment cords. It acts as the interface to the horizontal cabling from the horizontal cross-connect (HC) to telephone, network equipment, wireless access points (WAP) and OIP devices.

## PART 2 - PRODUCT

## 2.1 OUTLETS

- A. Category 6A Jack – Siemon Z6A-S(XX)
  - 1. Use (XX) to specify color.
  - 2. Universal design allows the same outlet to be mounted in a flat or angled orientation.
- B. Category 6A Z-Plug WO Latch Protector – Siemon ZP1-6AS-(00)S
- C. Voice Outlet, Single Gang Faceplate, White W/Wall Hung Phone W/6A Insert – Siemon MX-WP-Z6AS-SS

## 2.2 FACEPLATES/BOXES

- A. 10G Single Gang Faceplate, White, 4 Position – Siemon 10GMX-FP-04-02
- B. MAX Single Gang Faceplate, White – Siemon MX-FP-S-(XX)-02
  - 1. USE (XX) to specify the number of ports.
- C. MAX Single Gang Faceplate, Stainless Steel, 4 Position, with Label Holder – Siemon MX-FP-S-04-SS-L
  - 1. To be used in the Operation Rooms
- D. Surface Mount Box, White, 2 Position – Siemon MX-SMZ2-02
- E. Furniture Faceplate, Black – Siemon MX-UMA-01
- F. Conference Room Table Inserts should include and HDMI port.

## PART 3 - EXECUTION

## 3.1 WORK AREA TERMINATION

- A. All balanced twisted-pair cables wired to the telecommunications outlet/connector, shall have 4-pairs terminated in eight-position modular outlets in the work area. All pairs shall be terminated.
- B. Outlet/connector back boxes shall be a minimum 4-11/16 square box (4-11/16" x 4-11/16" x 3") with a minimum single gang 5/8" mud ring for new construction to accommodate the CAT6A connectors.

- C. Existing back boxes will require a faceplate stand-off and/or a faceplate that can accommodate a bezel to extend the CAT6A jack out to allow the installation of the CAT6A connectors.
- D. All outlets need to be installed in the angled position.

END OF SECTION

## SECTION 271619

## PATCH CABLES

## PART 1 - GENERAL

## 1.1 SUMMARY

- A. This section is issued as a guide for patch cable installations in the Data Center, wiring closets (TDR) and user areas where patch cables are required for connectivity to IP and TDM phones, and IP data connectivity needs for Intermountain Healthcare. All patch cables will support voice, data, and imaging applications within the Intermountain Healthcare Enterprise.

## PART 2 - PRODUCTS

## 2.1 APPROVED PRODUCT

- A. Patch Cable, CAT 6A Shielded - Siemon SP6A-S (XX)-(XX)  
1. Use 1<sup>st</sup> (xx) to specify length. Use 2<sup>nd</sup> (xx) for color.
- B. Patch Cable, CAT 5e, Orange – Siemon MC5-(XX)-0909  
1. Use (xx) to specify length. For use with NURSE CALL only.
- C. Patch Cable, CAT 5e, White – Siemon MC5-(XX)-0202  
1. Use (xx) to specify length.  
2. For use in the TEC for the Copper Backbone Patch only.
- D. Patch Cable, Fiber, Singlemode Duplex W/LC Connectors, Yellow – Siemon FJ2-LCULCUL-(xx)  
1. Use (xx) to specify length.
- E. Patch Cable, Fiber, Multimode Duplex W/LC Connectors, Aqua – Siemon FJ2-LCLC5V-(xx)AQ  
1. Use (xx) to specify length. For use in the Data Center.

## PART 3 - EXECUTION

## 3.1 PALLETTE

- A. Patch Cable Color Codes  
1. The Intermountain Healthcare Enterprise standard for patch cable color is in Section 27 05 53.  
2. The patch cable color shall match the feed cable color to identify the service provided.
- B. Contractor furnished  
1. All patch cables for the TEC, TDR's shall be included in the low voltage contract and will be required to match or exceed the existing level of the installed structured cabling system.  
2. All patch cables for the user areas shall be Owner furnished and will be required to match or exceed the existing level of the installed structured cabling system.  
3. All patch cables shall be Owner installed.  
4. The quantity of patch cables to be provided by the low voltage contractor shall be specified in the plans.  
a. 50% 5ft – 30% 7ft – 15% 10ft – 5% 15ft

END OF SECTION

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**SECTION 275113****OVERHEAD PAGING****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. The Primary Division 27 subcontractor shall be accountable to closely coordinate the Overhead Paging system with the General Contractor.
  - 1. Division 27 is accountable for including the cabling, equipment, and installation thereof in their work; based upon the project drawings.
- B. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- C. Requirements of the following Division 26 Sections apply to this Section:
  - 1. Basic Electrical Requirements.
  - 2. Basic Electrical Materials and Methods.

**1.2 SUMMARY**

- A. This Section includes the installation of an overhead paging system that shall be accessible through the telephone system. It includes requirements for paging system components including, but not limited to, the following:
  - 1. Speaker systems.
  - 2. Wiring
- B. This section requires that rough-in materials for this section be provided by the Division 26 installer for installation under Division 26. Rough-in materials include but are not limited to conduit, junction boxes, alternative raceway, and device enclosures. Cable for this section is to be provided by the Division 27 installer.

**PART 2 - PRODUCTS****2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following (for each type of product) as listed in the drawings and these specifications:
  - 1. BiAmp

**2.2 SYSTEM REQUIREMENTS**

- A. General: Provide complete and fully functional overhead paging systems using materials and equipment of types, sizes, ratings, and performances as indicated. Use materials and equipment that comply with referenced standards and manufacturers' standard design and construction in accordance with published product information. Coordinate the features of materials and equipment so they form an integrated system with components and interconnections matched for optimum performance of specified functions.

**2.3 EQUIPMENT AND MATERIALS**

- A. General: Provide all solid-state components fully rated for continuous duty at the ratings indicated or specified. Select equipment for normal operation on input power supplied at 105-130 V, 60 Hz.

- B. Loudspeakers shall be Drop-In Tile speakers. To be 24" x 24" tile speakers, provided by one of the following manufactures.
  - 1. Bogen CSD2X2/VR
  - 2. Quam System 12/70RS
- C. Transformer must be capable of providing 25V/70V.

### PART 3 - EXECUTION

#### 3.1 EXAMINATION

- A. Examine conditions, with the Installer present, for compliance with requirements and other conditions affecting the performance of the Overhead Paging System work.
- B. Do not proceed until unsatisfactory conditions have been corrected.
- C. Verify compliance of the following items before beginning sound equipment installation.
  - 1. No cables spliced except at standard barrier terminal blocks inside equipment cabinet.
  - 2. Cables marked at each end with permanent wire labels such as Brady or equal.
  - 3. Isolated ground run back to main electrical panel from paging equipment cabinet.
  - 4. Specified conduit, cables, speaker enclosures and equipment cabinets are properly installed.

#### 3.2 INSTALLATION

- A. General: Install system in accordance with NFPA 70 and other applicable codes. Install equipment in accordance with manufacturer's written instructions.
- B. Speakers:
  - 1. Confirm polarity of speaker before installation and wire to maintain uniform polarity.
  - 2. Mount transformers with screws securely to speaker brackets or enclosures.
  - 3. Neatly mount speaker grilles, panels, connector plates, etc., tight, plumb, and square unless indicated otherwise on drawings.
  - 4. Provide brackets, screws, adapters, springs, rack mounting kits, etc., recommended by manufacturer for correct assembly and installation of speaker assemblies and electronics components.
  - 5. Identification:
    - a. Legibly identify user operated system controls and system input/output jacks using engraved, permanently attached laminated plastic plates or imprinted Lexon labels. Label equipment and controls within equipment cabinet using similar labels or "Kroy" type labels.
- C. Repairs: Wherever walls, ceilings, floors, or other building finishes are cut for installation, the contractor shall be responsible to repair, restore, and refinish to original appearance.

#### 3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Services: Provide services of a factory authorized service representative to supervise the field assembly and connection of components and the pre-testing, testing, and adjustment of the system.
- B. Pre-testing: Upon completing installation of the system, align, adjust, and balance the system and perform a complete pretest. Determine the conformance of the system to the requirements of the Drawings and Specifications. Correct deficiencies observed. Replace malfunctioning or damaged items with new, and retest until materials satisfactory performance and conditions are achieved.



3.4 COMMISSIONING

- A. Occupancy Adjustments: When requested by the Architect or the Sound/Acoustical Consultant within one year of date of substantial completion, provide on-site assistance in adjusting sound levels, resetting matching transformer taps, and adjusting controls to suit actual occupied conditions. Provide two trips for this purpose.

3.5 CLEANING AND PROTECTION

- A. Prior to final acceptance, clean system components and protect from damage and deterioration.

END OF SECTION

**SECTION 27 52 23**  
**NURSE CALL/CODE BLUE SYSTEMS**

**PART 1 - GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Specification Section 27 00 00 "Intermountain Healthcare Structured Cabling Standards".

**1.2 SUMMARY**

- A. Section includes raceways, back boxes and cabling for a Hill-Rom Navicare Nurse Call (NNC) system.
- B. All active components and software to be provided, installed and programmed by Hill-Rom Vendor under contract with the owner.

**PART 2 - PRODUCTS**

**2.1 NURSE-CALL SYSTEM:**

- A. Rauland Responder

**2.2 CONDUCTORS AND CABLES**

- A. Data Cable and Hardware: Category 6, Orange, UTP and UTP hardware. Comply with requirements in Section 270000.
- B. Power Conductors and Cables: Copper, solid, No. 20 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."
- C. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

**PART 3 - EXECUTION****3.1 INSTALLATION**

- A. Wiring Method:
1. Install cables in raceways and J-Hooks except within consoles, cabinets, desks, and counters
    - a. Conceal raceway and cables except in unfinished spaces.
  2. Conduit and Boxes: Comply with requirements in Section 26 05 33 "Raceway and Boxes for Electrical Systems." Flexible metal conduit shall not be used.
    - a. Outlet boxes shall be no smaller than **2 inches (50 mm)** wide, **3 inches (75 mm)** high, and **2-1/2 inches (64 mm)** deep.
    - b. Coordinate each outlet box type with Hill-Rom.
- B. Install cables without damaging conductors, shield, or jacket.
- C. Do not bend cables, while handling or installing, to radii smaller than as recommended by manufacturer.
- D. Pull cables without exceeding cable manufacturer's recommended pulling tensions.
  1. Pull cables simultaneously if more than one is being installed in same raceway.
  2. Use pulling compound or lubricant if necessary. Use compounds that will not damage conductor or insulation.
  3. Use pulling means, including fish tape, cable, rope, and basket-weave wire or cable grips, that will not damage media or raceway.
- E. Install exposed raceways and cables parallel and perpendicular to surfaces or exposed structural members, and follow surface contours. Secure and support cables by straps, staples, or similar fittings designed and installed so as not to damage cables. Secure cable at intervals not exceeding **30 inches (760 mm)** and not more than **6 inches (150 mm)** from cabinets, boxes, or fittings.
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.
- G. Separation of Wires: Separate speaker/microphone, line-level, speaker-level, and power-wiring runs. Run in separate raceways or, if exposed or in same enclosure, provide **12-inch (300-mm)** minimum separation between conductors to speaker/microphones and adjacent parallel power and telephone wiring. Provide separation as recommended by equipment manufacturer for other conductors.
- H. Splices, Taps, and Terminations: Make splices, taps, and terminations on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures. Install terminal cabinets where there are splices, taps, or terminations for eight or more conductors.

- I. Impedance and Level Matching: Carefully match input and output impedances and signal levels at signal interfaces. Provide matching networks if required.
- J. Identification of Conductors and Cables: Comply with requirements in Section 271500 "Communications Horizontal Cabling" for cable administration, cable schedule, and cable and wire identification.
- K. Equipment Identification:
  - 1. Comply with requirements in Section 260553 "Identification for Electrical Systems" for equipment labels and signs and labeling installation requirements.
  - 2. Label stations, controls, and indications using approved consistent nomenclature.

### **3.2 EXISTING SYSTEMS**

- A. Examine existing systems for proper operation, compatibility with new equipment, and deficiencies. If discrepancies or impairments to successful connection and operation of interconnected equipment are found, report them and do not proceed with installation until directed. Schedule existing systems' examination so there is reasonable time to resolve problems without delaying construction.

### **3.3 GROUNDING**

- A. Ground cable shields and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other signal impairments.
- B. Signal Ground Terminal: Locate at main equipment cabinet. Isolate from power system and equipment grounding except at connection to main building ground bus.
- C. Grounding Provisions: Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

### **3.4 FIELD QUALITY CONTROL**

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
  - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

**END OF SECTION**



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**SECTION 275319****INTERNAL CELLULAR, PAGING  
AND ANTENNA SYSTEMS****PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Requirements of the following Division 26 Sections apply to this Section:
  - 1. Basic Electrical Requirements.
  - 2. Basic Electrical Materials and Methods.

**1.2 SUMMARY**

- A. The DAS system is provided and installed as an Owner-provided, Owner installed (OFOI) system by a 3<sup>rd</sup>-party vendor, contracted and managed by Intermountain CTIS/Telecom Team.
- B. A/E to coordinate DAS requirements with the Owner's vendor to incorporate necessary infrastructure on their drawings to support a fully functional DAS system.

**PART 2 - EXECUTION****2.1 INSTALLATION**

- A. DAS contractor is to install their equipment located in the TDRs in the assigned rack location as noted in the ET Rack Elevation Drawings.
- B. DAS contractor is to install any wall mounted equipment in the TDRs in the assigned location as noted in the ET TDR Room Elevation drawings.
- C. Specific power requirements will need to be provided in the design phase of the project by the CTIS/Telecom team.
- D. Cable installation will follow Division 27 installation specifications.

**END OF SECTION**

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## SECTION 276001

### APPENDIX 01 – DEVIATION REQUEST PROCESS

#### PART 1 - GENERAL

##### 1.1 DEFINITIONS

- A. Cable Plant Deviation
  - 1. A business need to not fully comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
- B. Cable Plant Deviation Request form.
  - 1. The document is available from the Facilities Planning team, the Data Center Ops team, or the Infrastructure Cabling team.
  - 2. Usage:
    - a. The deviation request form shall be used if there is a business need to not comply with the requirements of the “Division 27 – Communications and Structured Cabling Specification document”
    - b. The deviation request form should also be used to propose a change to that document. Always verify that you are using the current version of the Standard before requesting a modification.

#### PART 2 - PROCESS

##### 2.1 STANDARDS MODIFICATION

- A. Check the box and explain why the standard should be modified.

##### 2.2 ALTERNATE PRODUCT

- A. The deviation form must be completed, submitted through channels, and approved prior to any deviation from the specifications. This includes issuing change orders.

##### 2.3 AUTHORIZED SIGNATURES

- A. Both the Standards Holder and the DCO Manager signatures are required for a deviation to be valid.

##### 2.4 DEVIATION REVIEW PROCESS STEPS

- A. First be sure that there is an actual need. Then be certain that your manager, supervisor, or project manager agrees with the requested deviation. Be sure to state this or obtain their signature on the deviation form. By doing so you are confirming that your supervisor or project manager has approved.
- B. The requestor will then complete sections 1, 2, and 3 of the deviation form.
  - 1. The requestor should then digitally sign in the designated location at the end of Section 3. Do not write in the sections below 3.
- C. Forward the saved copy of this form to the Standards Holder via email.
  - 1. Email to: [melissa.lopez2@imail.org](mailto:melissa.lopez2@imail.org)
- D. The Standards Holder will then review and evaluate the request. The requestor should be prepared to provide plans, specifications, and competitive bids if requested. Any email threads or meeting discussions regarding the issue will be taken into consideration.

- E. The Standards Holder will then cast an Approve or Deny vote and forward the request to the DCO Manager for a decision.
- F. When the decision has been made by the Operations Manager, the Standards Holder will then notify the requestor by returning the completed and signed form via email.
- G. An approved deviation will have the final disposition button 'Approved' and be signed by at least 2 people. One will be from the Standards Holder, and the other the DCO Manager. Other signatures may be required for specific features and areas such as Safety, Security, Print, Medical group, etc.

### PART 3 - EXECUTION

#### 3.1 POST DECISION EXECUTION

- A. DENIED
  - 1. If the requester is not satisfied with the decision, they may file an appeal with the Data Center Operations manager (shawn.folkman@imail.org), who will then escalate the issue to the appropriate business leaders as needed. The decision from the appeal is final.
- B. APPROVED
  - 1. If a deviation is approved for contracted material, labor, or method; the facilities project manager will arrange for fulfillment or contract adjustment as needed via appropriate contract channels such as change orders.

END OF SECTION



SECTION 276002

APPENDIX 02 – DOCUMENT  
REFRESH PROCESS

PART 1 - GENERAL

1.1 NOT USED

PART 2 - PRODUCTS

2.1 APPROVED PRODUCT

- A. The purpose of this section is to help ensure a current standards document.
- B. The product delivered will be a current revision or version of the Cable Plant Standards Document.
- C. All changes must be approved by Enterprise Infrastructure Cabling team.

PART 3 - EXECUTION

3.1 REVIEWS AND UPDATES

A. Minor updates

- 1. Changes that do not significantly affect scope of work, or contract pricing will be made, and the Rev number will be updated. (i.e. updated part numbers, etc.)
- 2. Significant changes will be added to the Change Log for review and approval from the DCO/Infrastructure Cabling Team.
  - a. When approved, they will be submitted for approval; and then implemented in the new Version.

B. Major updates

- 1. The DCO/Infrastructure Cabling Team will review the entire document at least once every three years.
- 2. This review will coincide with the release of new versions of NFPA70 (National Electrical Code) (2017, 2020, etc. - to be completed by the end of each designated year).
- 3. The review will cover standards adjustments that may be deemed necessary and ensure compliance with applicable codes and standards.
- 4. Upon completion of the reviews and updates, the standards document will be submitted for approval.

END OF SECTION

## SECTION 276003

## APPENDIX 03 – DATA CENTER, TEC, TDR PART NUMBERS

ITEM	MANUFACTURER	PART NO.	DESCRIPTION
Blanking Panel	Upsite Hotlok	10031	Blanking Panel 1U
Blanking Panel	Upsite Hotlok	10033	Blanking Panel 2U
UPS	Eaton	9PX1500R	Eaton Powerware 9PX-1500V
UPS Network Card	Eaton	NETWORK-M	Card for 9PX-1500VA
PDU	Eaton	ePBZ79	Horizontal Mount ePDU 208vac
PDU	Eaton	ePBZ82	Horizontal Mount ePDU 120vac
PDU	Server Technology	C1S24VS-YCFA13C9	Vertical 30A PDU (Blue) for TEC
PDU	Server Technology	C1L24VS-YCFA13C9	Vertical 30A PDU (Red) for TEC
PDU	Server Technology	C2SG36TE-YCMFAM66/C	Vertical 30A PDU (Blue) for Data Centers
PDU	Server Technology	C2LG36TE-YCMFAM66/C	Vertical 30A PDU (Red) for Data Centers
PDU	Server Technology	C2SG36TE-DQME2M66/ZB	Vertical 60A PDU (Blue) for Data Centers
PDU	Server Technology	C2LG36TE-DQME2M66/ZR	Vertical 60A PDU (Red) for Data Centers
UPS	Eaton	K41512000000000	Eaton 9155-15kVA UPS
Modbus Card	Eaton	103005425-5591	Eaton Modbus Card X-Slot
Reverse Transfer UPS System	Eaton	9GPV15C0009E00R2	Eaton 93PM-150kW Reverse Transfer UPS System
CRAC Cooling Unit	Liebert	DE363G	
Vertical Wall Mount Cabinets	Legrand	VWMSD-4RU-42-B	42" 12" 4RU Fixed
Vertical Wall Mount Cabinets	Legrand	VWMSD-8RU-42-B	42" 18" 8RU Fixed
Rail Accessories	Legrand	VWM-RR-4RU	Fixed Mounting Rail Kit, 4RU
Rail Accessories	Legrand	VWM-RR-8RU	Fixed Mounting Rail Kit, 8RU
Rail Accessories	Legrand	VWM-PIV-4RU	Pivoting Mounting Rail Kit, 4RU
Fan Kit	Legrand	VWMFK-115	VWM Fan Kit w/115 VAC Fans (includes 2 fans and mounting hardware) (2 kits needed for 8RU cabinet)
VWM Top Brush Grommet Kit	Legrand	VWMBGK	VWM Top Brush Grommet Kit
Circular Knockout Grommet Kit	Legrand	VWMGR-30	Circular Knockout Grommet Kit
Vertical Wall-Mount Cabinets	Hubbell	IR221APG	Refrigerated cabinet 24"
Vertical Wall-Mount Cabinets	Hubbell	IR321APG	Refrigerated cabinet 36"
Vertical Wall-Mount Cabinets	Hubbell	IR421APG	Refrigerated cabinet 48"
Air Conditioners	Hubbell	IRAC1	Air conditioner for Hubbell refrigerated cabinets
Cylinder	Medeco	100500 G	1 ¼" Mortise Cylinder
Cylinder	Medeco	100400H G	Rim Cylinder, Horizontal Tailpiece
Cylinder	Medeco	EA-100108	Small Format Interchangeable Core (SFIC) Cylinder
Cylinder	Medeco	20200S1 G	Cylinder Package for Schlage

Cam Lock	Medeco	EN-150002-219	7/8" Cam Lock Assembly, Key Retaining
Cam Lock	Medeco	EN-150003-219	1 1/8" Cam Lock Assembly, Key Retaining
Cylinder for Legrand cabinet front door	Medeco	232301S 800 G	Modular Profile Cylinder – 30mm Half Profile - Assembled
Electronic Key	Medeco	94-0271	Medeco Slim Line Key (G2) & Charger Bundle
Programming Station for Small Locations	Medeco	EA-100109	Medeco XT Desktop USB Programming Station (not preferred)
Programming Station for Large Locations	Medeco	EA-100158	Medeco XT Wall USB Programming Station (preferred)
Wall Mount for Wall Programmer	Medeco	94-0294	Medeco XT Remote Wall Programmer Wall Mount Kit
Padlock for use with Electronic Cylinder	Master	6842D045KZ	Padlock
Red C20 C19 Dual Lock 12 gauge 6'	Stay Online	5914	Red C20 C19 Dual Lock 12 gauge 6'
Blue C20 C19 Dual Lock 12 gauge 6'	Stay Online	6766	Blue C20 C19 Dual Lock 12 gauge 6'
Red C14 Locking C15 Notched 14 gauge 6'	Stay Online	9144	Red C14 Locking C15 Notched 14 gauge 6'
Blue C14 Locking C15 Notched 14 gauge 6'	Stay Online	9138	Blue C14 Locking C15 Notched 14 gauge 6'
Red C14 C13 Dual Lock 18 gauge 6'	Stay Online	5656	Red C14 C13 Dual Lock 18 gauge 6'
Blue C14 C13 Dual Lock 18 gauge 6'	Stay Online	6694	Blue C14 C13 Dual Lock 18 gauge 6'

## SECTION 276004

## APPENDIX 04 – REFERENCE STANDARDS

## PART 1 - GENERAL

## 1.1 REFERENCE STANDARDS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. ANSI/TIA-568.0-D and addenda "Generic Telecommunications Cabling for Customer Premises
  2. ANSI/TIA-568.1-D and addenda "Commercial Building Telecommunications Cabling Standard
  3. ANSI/TIA-568.2-D and addenda "Balanced Twisted-Pair Telecommunications Cabling and Components
  4. ANSI/TIA-568.3-D and addenda "Optical Fiber Cabling Components Standard"
  5. ANSI/TIA-568.4-D and addenda "Broadband Coaxial Cabling and Components Standard"
  6. ANSI/TIA-569-D and addenda "Telecommunications Pathways and Spaces"
  7. ANSI/TIA-606-C and addenda "Administration Standard for Commercial Telecommunications Infrastructure"
  8. ANSI/TIA-607-D and addenda "Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises"
  9. ANSI/TIA-758-B "Customer-Owned Outside Plant Telecommunication Infrastructure Standard"
  10. IEEE 802.3at PoE Plus and Next Gen PoE CFI March 2013 and IEEE P802.3ba latest draft revision and amendments.
  11. "Media Access Control Parameters, Physical Layers and Management Parameters for 40 Gbp/s and 100 Gbp/s Operation".
  12. ANSI/TIA-526-7-A "Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant"
  13. ANSI/TIA/EIA-526-14-C "Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant"
  14. ANSI/TIA-942-B "Telecommunications Infrastructure Standard for Data Centers"
  15. ANSI/TIA – 1179-A "Healthcare Facility Telecommunications Infrastructure Standard"
  16. IEC/TR3 61000-5-2 - Ed. 1.0 and amendments "Electromagnetic compatibility (EMC) - Part 5: Installation and mitigation guidelines - Section 2: Earthing and cabling"
  17. ISO/IEC 11801-1 (2017) and amendments "Information technology - Generic cabling for customer premises – PART 1: General Requirements"
  18. EN 50173-1 and amendments "Information Technology - Generic cabling systems – PART 1 General Requirements"
  19. AIA Guidelines for Design and Construction of Hospital and Healthcare Facilities
  20. Construction Specification Institute Master Format
  21. BICSI: Comply with the most current editions of the following BICSI manuals:
    - a. BICSI - Telecommunications Distribution Methods Manual
    - b. BICSI – Installation Transport Systems Information Manual
    - c. BICSI – Network Design Reference Design Manual
    - d. BICSI – Outside Plant Design Reference Manual
    - e. BICSI – Wireless Design Reference Manual

- f. BICSI -Electronic Safety and Security Design Reference Manual
- g. Infocomm/BICSI – AV Design Reference Manual
- 22. Underwriters Laboratories (UL) Cable Certification and Follow-Up Program.
- 23. National Electrical Manufacturers Association (NEMA)
- 24. American Society for Testing Materials (ASTM)
- 25. National Electrical Code (NEC) NFPA70 2020
- 26. National Electrical Safety Code (NESC) 2017
- 27. Institute of Electrical and Electronic Engineers (IEEE)
- 28. UL Testing Bulletin
- 29. Building Industry Consulting Services International (BICSI) Information Transport Systems Methods Manual (ITSMM)
- 30. Local, county, state and federal regulations and codes in effect as of date of installation.
- 31. Equipment of foreign manufacture must meet U.S. codes and standards. It shall be indicated in the proposal the components that may be of foreign manufacture, if any, and the country of origin.

END OF SECTION

## SECTION 276005

## APPENDIX 05 – DEFINITIONS AND ABBREVIATIONS

## PART 1 - GENERAL

## 1.1 RELATED TERMS

- A. Codes and Standards (Most recent editions with addenda/TSB, etc.) All materials, installation and workmanship shall meet or exceed the applicable requirements and standards addressed within the references listed below:
1. Basket Cable Tray: A fabricated structure consisting of wire mesh bottom and side rails.
  2. BICSI: Building Industry Consulting Service International.
  3. CBC: Coupled Bonding Conductor
  4. CFCI: Customer Furnished Customer Installed
  5. Cable Run - A single cable to a single location
  6. Cable Drop - Two cables to a single location
  7. Cable Tri Drop - Three cables to a single location
  8. CT Coupler A type of wall connector made by the Siemon Company
  9. DCO: Data Center Operations
  10. Div. 1: Division 1 General and Performance Requirements
  11. Div. 23: Division 23 Heating, Ventilating, and Air Conditioning
  12. Div. 22: Division 22 Plumbing
  13. Div. 26: Division 26 Electrical
  14. Div. 27: Division 27 Communications and Audio Visual
  15. Div. 28: Division 28 Electronic Safety and Security
  16. E.E.: Electrical Engineer
  17. EMI: Electromagnetic Interference
  18. F/UTP: Foil over Unshielded Twisted Pair. Individual pairs are unshielded.
  19. GC: General Contractor
  20. GE: Ground Equalizer
  21. Horizontal Cabling: The cable and connecting hardware utilized to transport communications signals
  22. ICT: Infrastructure Cabling Team
  23. LAN: Local Area Network
  24. N/A: Not Applicable
  25. NIC: Not in Contract
  26. OFCI: Owner Furnished Contractor Installed
  27. OFOI: Owner Furnished Owner Installed
  28. OTDR: Optical Time Domain Reflectometer
  29. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
  30. RCDD: Registered Communications Distribution Designer
  31. RFI: Radio Frequency Interference
  32. TBA or TBD: To Be Determined
  33. TDR: Technology Distribution Room
  34. TEC: Technology Equipment Center
  35. TGB: Telecommunications Ground Bus Bar
  36. TMBC: Telecommunications Main Bonding Conductor
  37. TMGB: Telecommunications Main Grounding Bus Bar
  38. TSER: Telecommunications Service Entrance Room
  39. UTP: Unshielded Twisted Pair
  40. Work Area: approx. 100 sq. ft. equipped for workstation equipment

- 41. DCO = Data Center Operations – [Boe.Sausedo@imail.org](mailto:Boe.Sausedo@imail.org)
- 42. ICT = Information and Communications Technology – [Melissa.Lopez2@imail.org](mailto:Melissa.Lopez2@imail.org)

END OF SECTION





## SECTION 276007

APPENDIX 07 – SIEMON CERTIFIED  
INSTALLATION FIRMS

## PART 1 - GENERAL

## 1.1 RELATED TERMS

- A. NOTE: Cable installers have rigorous requirements to be certified for Siemon cables and products. Validation of certification is required prior to accepting a bid.
- B. The firms selected to bid must be pre-approved by the local facility IT manager. Installation firms desiring to do work for Intermountain Healthcare must be selected from the official CI list below.
- C. Current Siemon Approved/Certified Cable Installers for Siemon Network Cable. This list is up to date as of 2018-12-01.
1. **Orion Integration Group:** 8880 W. Barnes Street, Boise, ID 83709 / Phone 208 321 8000
  2. **ACS Systems:** 925 North Main St. Meridian, ID 83642 / Phone 208 331 8554
  3. **IES Commercial:** 1960 S. Milestone, Suite D, Salt Lake City, UT 84104
    - a. Jason King – Branch Manager // Phone 801 975 8182 / Fax 385 242 7366 / Mobile 801 381 1508 // [Jason.King@iescomm.com](mailto:Jason.King@iescomm.com) / [www.iescomm.com](http://www.iescomm.com)
    - b. Boyd Evans – Project Manager // Phone 801 975 8191 / Fax 385 242 7366 Mobile 801 381 1518 // [Boyd.Evans@iescomm.com](mailto:Boyd.Evans@iescomm.com) / [www.iescomm.com](http://www.iescomm.com)
  4. **Cache Valley Electric:** 1338 S. Gustin Rd., Salt Lake City, UT 84104
    - a. Travis Grant – Acct. Manager // Phone 801 908 4170 / Fax 801 908 7401 Mobile 801 870 7226 // [Travis.Grant@cve.com](mailto:Travis.Grant@cve.com) / [www.cve.com](http://www.cve.com)
    - b. Brad Readicker – Acct. Manager // Phone 801 908 2686 / Fax 801 908 7401 // [Brad.Readicker@cve.com](mailto:Brad.Readicker@cve.com) / [www.cve.com](http://www.cve.com)
  5. **Data Tech Professionals:** 1199 S 520 W, Payson, UT 84651
    - a. Jesse Pierce – President // Phone 801 960 2202 / Mobile 801 420 0463 [Jesse@datatechprofessionals.com](mailto:Jesse@datatechprofessionals.com) / [www.datatechprofessionals.com](http://www.datatechprofessionals.com)
  6. **Hunt Electric, Inc.:** 1863 W. Alexander St., Salt Lake City, UT 84119
    - a. Darrin Guevara – Division Manager // Phone 801 975 8844 [Darrin@hunteletric.com](mailto:Darrin@hunteletric.com) / [www.hunteletric.com](http://www.hunteletric.com)
  7. **NCNS Communications:** 419 West Universal Circle, Sandy, UT 84070
    - a. Jayson Nosack – Owner // Phone 801 361 4572 [Jnosack@ncns-co.com](mailto:Jnosack@ncns-co.com) / [www.ncns-co.com](http://www.ncns-co.com)
  8. **Data Plus:** 769 Middlegate Road, Henderson, NV 89118
    - a. Chris Tettamanti – Project Manager // Phone 702 795 3282 [Chris@dpcnv.com](mailto:Chris@dpcnv.com)
  9. **Bombard Electric:** 4380 West post Road, Las Vegas, NV 89118
    - a. Bob Reese – Project/Division Manager // Phone 702 263 3570 [Bob.reese@bombardelec.com](mailto:Bob.reese@bombardelec.com) / [www.bombardelectric.com](http://www.bombardelectric.com)
  10. **Rosendin Electric:** 7470 Dean Martin Dr. #112, Las Vegas, NV 89139
    - a. Cora Shadbolt – Assistant Project Mgr. // Phone 702 258 1443 [cshadbolt@rosendin.com](mailto:cshadbolt@rosendin.com)
    - b. Adrian Youngblood – Sr. Estimator // Phone 702 258 1455 [ayoungblood@rosendin.com](mailto:ayoungblood@rosendin.com)
    - c. Breck Hardesty – Sr. Project Mgr. // Phone 702 258 1428 [bhardesty@rosendin.com](mailto:bhardesty@rosendin.com) / [www.rosendin.com](http://www.rosendin.com)
  11. **Mojave Electric:** 3755 W. Hacienda Ave., Las Vegas, NV 89118 Phone 702 798 2970

12. **The Morse Group:** 3874 Silvestri Lane, Las Vegas, NV 89120  
Phone 702 257 4400

END OF SECTION

SECTION 276008

APPENDIX 08 – LEAD WALL PENETRATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Sections 13090 & 134900

1.2 RELATED TERMS

**Procedure Name:** New Port and Electrical Box Installation Lead Lined Walls

**Document Detail Information: (This section must be completed in full.)**

<b>Implements Policy:</b>	Click here to enter policy title		
<b>Content Owner</b>	Craig Allen, Safety Security Environment Health Director, Central Office Jeremy Hawk Medical Physicist Radiation Safety Coordinator	<b>Content Consultant(s):</b>	Jeremy Hawk, Radiation Safety Officer, Medical Physicist Imaging  John Ellis, Facilities Management Director, Central Office Steve Kelly, System Project Facility Design Manager, Planning Melissa Lopez, Cabling, IS
<b>Date of Final Draft:</b>	12/29/2015	<b>Who Reviewed Content?</b>	<Name, Title, Dept> <Name, Title, Dept> <Name, Title, Dept> <Committee Name>
<b>Keywords (must have at least 3):</b>	Searchable Keywords (e.g., PHI, EMTALA, Coding)		

1.3 PURPOSE

- A. Maintain radiation safety controls in lead lined walls during installation of new power and data outlets in existing lead lined walls.

1.4 SCOPE

- A. Intermountain Hospitals, Intermountain Clinics Medical Group

1.5 DEFINITIONS

- A. Lead lined Walls – Structured element designed to provide a barrier to block radiation penetration beyond the designated space.

- B. Maintenance Manager – The person responsible for plant maintenance operations or his/her delegate.
- C. Radiation Safety Coordinator – The person responsible for Radiation Safety or his/her Delegate. Medical Physicist.
- D. Worker – The person responsible for completing work with the lead lined wall. This includes Intermountain Employees as well as any outside supplier or contractor.

## 1.6 PROVISIONS

- A. The Radiation Safety Program is following Utah regulation R313-15-101, R313-28 and U.S. Nuclear Regulatory Commission Regulation 1- CFR Part 20-1101.

## 1.7 PROCEDURE

- A. Prior to any work within a lead lined wall, the Worker reports to the Radiation Safety Coordinator, Maintenance Manager and completed a review of planned work “ACWP” Identification of specific description related to the lead lined wall planned work.
  - 1. Intermountain workers, outside suppliers or contractors hired to work in any Intermountain facility must contact the Maintenance Manager and Radiation Safety Coordinator prior to beginning work to discuss the project and ensure that the planned work will not interfere with facility operations, maintenance, or other projects.
  - 2. Failure to scheduled and complete the planning meeting described above may results in the delay or rescheduling of work. Outside suppliers or contractors are responsible for any costs incurred because of their failure to schedule and complete this meeting.
- B. The Radiation Safety Coordinator, Maintenance Manager and the worker conduct a pre-work inspection of the areas in which work is to be performed. This inspection identified the following:
  - 1. Areas of special concern or sensitivity, including those noted or described on the facility Life Safety records and drawings, and Radiation Safety records and drawings.
  - 2. Appropriate areas or structures to use for support of any work, as applicable.
  - 3. Existing deficiencies in Barriers.
  - 4. The as act assemblies impacted by the work.
  - 5. The type of shielding material acceptable in the area.
    - a. Lead lined boxes
    - b. Lead lined wall “inside wall” installation, and OR
    - c. Lead shielding for wall installation of “outside wall” maintaining radiation safety barriers.
  - 6. The exact condition of the areas upon completion of work.
- C. Upon completion of the work and before closing the wall, the worker, Radiation Safety Coordinator and Maintenance Manager conduct a post-work inspection of the area in which the work was performed, this inspection verifies the following:
  - 1. No Tools, Supplies or debris are left within the walls.
  - 2. Lead lining is installed to maintain radiation safety protection according to regulatory requirements.
  - 3. All work affecting Radiation Safety Lead Barriers has been properly sealed.
  - 4. The overall condition of the area meets the expectation outline in the per-work inspection.
- E. The Maintenance Manager and Radiation Safety Coordinator signs and logs the completed “ACWP”

1.8 EXCEPTIONS

- A. None.

1.9 PRIMARY SOURCES

- A. List the regulatory references upon which the procedure is based (cite the code, the title, and the statute).

1.10 SECONDARY MATERIALS

- A. Radiation Safety Policy
- B. Above Ceiling Work Permit
- C. Lead lined wall requirements as defined by Radiation Safety Building Requirements



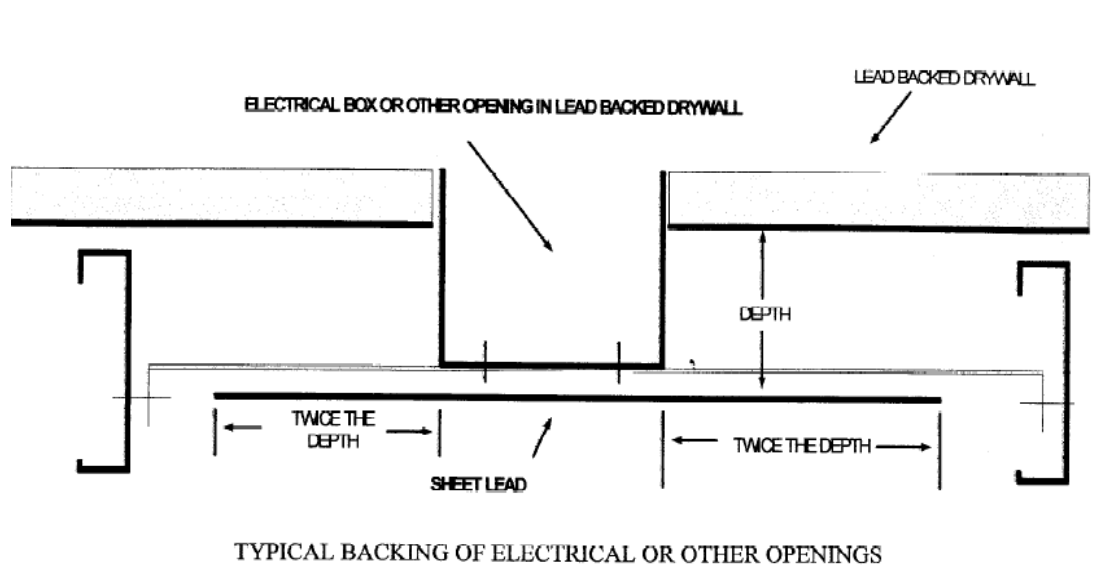
Option 1: worker to install new power utility wall box and add Lead Lining to wall behind box  
If worker can access posterior wall entry



Option 2: worker to install new power utility wall box – box is lead Lined by manufacturer



Option 3: worker to install new power utility wall box - no additional lead lining required if installation does not disrupt the existing shielding



END OF SECTION