

**McLeod Health
Seacoast Hospital 50-Bed Addition
Little River, SC**

**McLeod Health
Seacoast Hospital 50-Bed Addition
Little River, SC
Project Manual
Project No. 0370.45
December 24, 2020**

DesignStrategies
130 South Main Street
Greenville, SC 29601
864-527-6500

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INSTRUCTIONS TO BIDDERS

01 Project Description

Project Description: In general, the scope of work consists of upfitting approximately 26,000 SF with 37 patient rooms at the fourth floor of the Seacoast Hospital Bed Tower. Architecture, Interiors, Equipment, Mechanical, Plumbing, Fire Protection and Electrical are included in the scope of work.

The McLeod Health Seacoast (the Owner) requests that your proposal be in the form of a Fixed Price Lump Sum. All work to include all required license fees, sales taxes, contractor's profit and overhead.

The Owner will award the project to a Contractor whose bid is deemed, by the Owner and the Architect, to be fully responsive in accordance with the requirements of the Instructions to Bidders and Contract Documents.

Bidding Documents Access: Bidding Documents will be emailed in electronic format for Bidders reproduction as required.

Bonds: A Performance and Material Payment Bond of one hundred percent (100%) of the contract price will be required prior to the start of the Work and such bonds must be made with a bonding company licensed to do business in the State of South Carolina.

A Bid Bond / Guarantee of five percent (5%) of the Base Bid will be required prior to the start of the Work and such bond must be made with a bonding company licensed to do business in the State of South Carolina.

Project Schedule Overview

There will be a mandatory Pre-Bid Conference held on **January 05, 2021 at 3:00 PM** at the site. Location to be coordinated by the McLeod Project Representative.

Receipt of Bids will be at the office of the Architect at **3:00 PM on January 29, 2021**.

It is the intent of the Owner to issue to the selected contractor, within approximately two weeks of the date that bids are due for submission, a Notice of Intent to Award and Authorization to Proceed with procurement and mobilization activities.

For a detailed description of the documents upon which your bid should be based, refer to paragraph 05, Basis of Bid Documents.

02 Form of Agreement Between Owner and Contractor

It is the intent of the Owner to enter into an Agreement with the successful low bidder whose bid is deemed, by the Owner and the Architect, to be fully responsive to these Instructions to Bidders and the Contract Documents.

The Owner will utilize a modified AIA Construction Contract AIA A101-2017 and AIA A201-2017. By submitting a Bid, each bidder acknowledges the same.

03 Proposal Forms

- A. All bids shall be submitted only on form(s) provided by the Owner, except as specifically noted below in Paragraph 04, Proposal Format and Contents.
- B. No bidder shall modify, withdraw or cancel his/her bid, or any part thereof, for 120 (one hundred twenty) days following the Owner's receipt of bids.
- C. Fully fill in all blank spaces. All amounts must be in words as well as figures.
- D. Submit your proposal in a sealed envelope bearing the following:

Name of Entity Submitting Proposal
**McLeod Health Seacoast
Seacoast Hospital 50- Bed Additon
Little River, SC**

- E. Address the sealed envelope containing your proposal to the attention of:

DesignStrategies, LLC
130 South Main Street
Greenville, SC 29601
Attention: Benjamin T. Rook, FAIA

ATTENTION:

NOTE: All proposals must be mailed or delivered to be received at the receptionist's desk at the above location at or before the time and date of the bid as stated above. There will be no public opening and reading of the sealed bids.

- F. The Owner reserves the right to reject, without reason, any or all bid(s).

04 Proposal Format and Contents

Each bidder's Project Proposal shall include the following:

- A copy of the completed Bid Form; and
- Any Assumptions, Exceptions and / or Clarifications (if required)

05 Basis of Bid Documents

Proposals shall be based upon the following Drawings, Specifications and written documents as described below and any subsequent addenda and/or conference meeting minutes that may be issued prior to the date proposals are due.

A. Drawings

DOCUMENT ENUMERATION				
DOCUMENT			ISSUED/ REVISION # & DATE	
DRAWINGS				
General				
GI000	COVER SHEET		0	12-24-2020
GI002	GENERAL NOTES, LEGENDS, CODE REVIEW, AND INDEX OF DRAWINGS		0	12-24-2020
Architectural Drawings				
LS104-U	LEVEL 4 LIFE SAFETY PLAN		0	12-24-2020
AP104H-U	LEVEL 4 FLOOR PLAN – ZONE H		0	12-24-2020
AP104J-U	LEVEL 4 FLOOR PLAN – ZONE J		0	12-24-2020
AC104H-U	LEVEL 4 REFLECTED CEILING PLAN – ZONE H		0	12-24-2020
AC104J-U	LEVEL 4 REFLECTED CEILING PLAN – ZONE J		0	12-24-2020
AE410	ENLARGED NURSE STATION FLOOR PLAN AND RCP		0	12-24-2020
AE411	ENLARGED PATIENT ROOM FLOOR PLANS AND RCP		0	12-24-2020
AE412	ENLARGED TOILET ROOM PLANS & TOILET ACCESSORIES		0	12-24-2020
AE420	INTERIOR ELEVATIONS		0	12-24-2020
AE421	INTERIOR ELEVATIONS – LEVEL 4		0	12-24-2020
AE422	ENLARGED PATIENT ROOM ELEVATIONS AND DETAILS		0	12-24-2020
AE530	INTERIOR DETAILS		0	12-24-2020
AE532	INTERIOR DETAILS		0	12-24-2020
AE540	CEILING DETAILS		0	12-24-2020
AE601	DOOR & FRAME SCHEDULE AND HARDWARE NOTES		0	12-24-2020
AE602	DOOR & FRAME SCHEDULE AND HARDWARE NOTES		0	12-24-2020
AE610	PARTITION TYPES		0	12-24-2020
AE611	GYPSUM BOARD DETAILS		0	12-24-2020
AE612	GYPSUM BOARD DETAILS		0	12-24-2020
AE613	UL DESIGN WALLS		0	12-24-2020
AE614	SEISMIC DETAILS		0	12-24-2020

DOCUMENT ENUMERATION			
DOCUMENT		ISSUED/ REVISION # & DATE	
AE615	FIRESTOPPING DETAILS	0	12-24-2020
AE800	TYPICAL MILLWORK DETAILS	0	12-24-2020
AE801	CASEWORK ELEVATIONS	0	12-24-2020
AE810	SPECIAL MILLWORK SECTIONS	0	12-24-2020
AE811	SPECIAL MILLWORK ENLARGED PLANS ELEVATIONS, AND DETAILS	0	12-24-2020
AE812	SPECIAL MILLWORK ENLARGED PLANS ELEVATIONS, AND DETAILS	0	12-24-2020
AE814	INTERIOR DETAILS	0	12-24-2020
Interiors Drawings			
IN001-U	COLOR FINISH SCHEDULE	0	12-24-2020
IN002-U	ROOM FINISH SCHEDULE	0	12-24-2020
IF104H	LEVEL 4 FURNITURE FLOOR PLAN – ZONE H	0	12-24-2020
IF104J	LEVEL 4 FURNITURE FLOOR PLAN – ZONE J	0	12-24-2020
IN104H	LEVEL 4 FLOOR FINISH PLAN – ZONE H	0	12-24-2020
IN104J	LEVEL 4 FLOOR FINISH PLAN – ZONE J	0	12-24-2020
IW104H	LEVEL 4 WALL FINISH PLAN – ZONE H	0	12-24-2020
IW104J	LEVEL 4 WALL FINISH PLAN – ZONE J	0	12-24-2020
Equipment Drawings			
EQ104H	LEVEL 4 EQUIPMENT PLAN – ZONE H	0	12-24-2020
EQ104J	LEVEL 4 EQUIPMENT PLAN – ZONE J	0	12-24-2020
Mechanical Drawings			
M-001	LEGEND, ABBREVIATIONS, SYMBOLS AND GENERAL NOTES	0	12-24-2020
MH101H-U	LEVEL 1 MECHANICAL HVAC FLOOR PLAN – ZONE H	0	12-24-2020
MH104H-U	LEVEL 4 MECHANICAL HVAC FLOOR PLAN – ZONE H	0	12-24-2020
MH104J-U	LEVEL 4 MECHANICAL HVAC FLOOR PLAN – ZONE J	0	12-24-2020
MP104H-U	LEVEL 4 MECHANICAL PIPING FLOOR PLAN – ZONE H	0	12-24-2020
MP104J-U	LEVEL 4 MECHANICAL PIPING FLOOR PLAN – ZONE J	0	12-24-2020
M-500-U	MECHANICAL DETAILS	0	12-24-2020
M-501-U	MECHANICAL DETAILS	0	12-24-2020
M-600-U	MECHANICAL SCHEDULES	0	12-24-2020
Plumbing Drawings			
PL001-U	PLUMBING LEGEND, SCHEDULES, ABBREVIATIONS, SPECIFICATIONS, & NOTES	0	12-24-2020

DOCUMENT ENUMERATION			
DOCUMENT		ISSUED/ REVISION # & DATE	
PL103H-U LEVEL 3 PLUMBING FLOOR PLAN – ZONE H		0	12-24-2020
PL103J-U LEVEL 3 PLUMBING FLOOR PLAN – ZONE J		0	12-24-2020
PL104H-U LEVEL 4 PLUMBING FLOOR PLAN – ZONE H		0	12-24-2020
PL104J-U LEVEL 4 PLUMBING FLOOR PLAN – ZONE J		0	12-24-2020
PM104H-U LEVEL 4 MEDGAS FLOOR PLAN – ZONE H		0	12-24-2020
PM104J-U LEVEL 4 MEDGAS FLOOR PLAN – ZONE J		0	12-24-2020
PP104H-U PLUMBING WATER FLOOR PLAN- ZONE H		0	12-24-2020
PP104J-U PLUMBING WATER FLOOR PLAN- ZONE J		0	12-24-2020
P-500 PLUMBING DETAILS AND RISERS		0	12-24-2020
Fire Protection Drawings			
FX001-U FIRE PROTECTION LEGEND, SCHEDULES, AND NOTES		0	12-24-2020
FX104H-U LEVEL 4 FIRE PROTECTION FLOOR PLAN – ZONE H		0	12-24-2020
FX104J-U LEVEL 4 FIRE PROTECTON FLOOR PLAN – ZONE J		0	12-24-2020
Electrical Drawings			
E-001 ELECTRICAL NOTES, LEGEND AND SCHEDULES		0	12-24-2020
ED104H&J LEVEL 4 ELECTRICAL DEMO PLAN ZONE H & J		0	12-24-2020
EL104H-U LEVEL 4 LIGHTING PLAN – ZONE H		0	12-24-2020
EL104J-U LEVEL 4 LIGHTING PLAN – ZONE J		0	12-24-2020
EP104H-U LEVEL 4 POWER PLAN – ZONE H		0	12-24-2020
EP104J -U LEVEL 4 POWER PLAN – ZONE J		0	12-24-2020
EP105H&J LEVEL 5/ROOF PLAN ZONE H & J		0	12-24-2020
EP400 ENLARGED PLAN		0	12-24-2020
EP500 ELECTRICAL DETAILS		0	12-24-2020
EP602 PANEL SCHEDULES		0	12-24-2020
EP604 PANEL SCHEDULES		0	12-24-2020
EP605 PANEL SCHEDULES & SINGLE LINE DIAGRAMS		0	12-24-2020
EP700 ELECTRICAL FEEDER LEGEND AND DETAILS		0	12-24-2020
EP701 ELECTRICAL SINGLE LINE DIAGRAM		0	12-24-2020
EP702 ELECTRICAL SINGLE LINE DIAGRAM		0	12-24-2020
EY104H -U LEVEL 4 SYSTEMS PLAN – ZONE H		0	12-24-2020
EY104J -U LEVEL 4 SYSTEMS PLAN – ZONE J		0	12-24-2020
EY700 TELEPHONE ROOM RISER DIAGRAM AND DETAILS		0	12-24-2020
A. Specifications: Dated December 24, 2020.			
B. Instructions To Bidders dated December 24, 2020.			
C. Supplemental Instructions To Bidders dated December 24, 2020.			
D. Bid Form dated December 24, 2020			

DOCUMENT ENUMERATION		
DOCUMENT		ISSUED/ REVISION # & DATE
E.	McLeod Health Attachments: A, B, B-2, C, D, E, F	
END OF INSTRUCTIONS TO BIDDERS		

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

ADDRESS: DesignStrategies, LLC
130 South Main Street
Greenville, SC 29601

ATTENTION: Thomas Weir, AIA

PROJECT McLeod Health Seacoast
Seacoast Hospital 50-Bed Addition
Little River, SC

- 1. PROPOSED SCHEDULE** – The following schedule is presented for general information only and is subject to change at the Owner's discretion.

Contract Documents Available:		December 24, 2020
Mandatory Pre-Bid Conference:	3:00 PM	January 05, 2021
(Coordinated by the McLeod Project Representative at the project site)		
Bids Received:	1:00 PM	January 29, 2021

2. PROJECT TEAM

Owner: McLeod Health Seacoast
1145 East Day Street
Florence, SC 29506

Project Site: McLeod Health Seacoast
Little River, SC

Architect / Engineer: DesignStrategies, LLC
130 South Main Street
Greenville, SC 29601

3. PROJECT DESCRIPTION

Project Description: In general, the scope of work consists of upfitting approximately 26,000 SF with 37 patient rooms at the fourth floor of the Seacoast Hospital Bed Tower. Architecture, Interiors, Equipment, Mechanical, Plumbing, Fire Protection and Electrical are included in the scope of work.

The successful bidder will be required to hold pricing for 120 days.

4. QUESTIONS DURING THE BID PROCESS

Project questions resulting from the mandatory Pre-Bid Conference or from Contractor review of the documents shall be submitted to the Project Architect for response back to the General Contractors in the Addenda format. The Project Architect for this project is: Thomas Weir, AIA
E-mail: tweir@designstrategies.net

5. ATTACHMENTS:

Attachment A	Insurance Requirements
Attachment B	McLeod Code of Conduct and Compliance Program
Attachment B-2	McLeod Health's Policy on Business Practices
Attachment C	Construction and Renovation Policy 2019
Attachment D	Interim Lien Waiver Form
Attachment E	Final Lien Waiver Form
Attachment F	Change Order Request Cover Sheet

END OF SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

ATTACHMENT A

Insurance Requirements

Prior to the commencement of any Work, the Contractor shall obtain and maintain at its sole expense, including payment of any and all deductible amounts, self-insured retentions, or coinsurance penalties, the minimum types and limits of insurance set forth below, together with any other insurance required by applicable law, in each case, with reputable insurance companies that have an A.M. Best's rating of A-VII or better and that are authorized to do business in South Carolina. All insurance obtained and maintained by Contractor shall be designated as primary to and non-contributory with any and all insurance maintained by or otherwise afforded to Owner. Contractor shall and shall require its insurers to waive all rights of recovery from or subrogation against Owner and its affiliates and their respective insurers, employees, agents, and directors. Policies required under this Section A shall not prohibit any waiver of subrogation. Unless a different duration is stated herein, Contractor shall continue to maintain these required insurance policies for not less than three years following the expiration of the period for correction of Work

Contractor shall obtain and maintain:

(1). **Commercial General Liability Insurance** written on an occurrence form for liabilities arising out of or related to the Work, whether performed by Contractor or a subcontractor, with policy limits of not less than \$1,000,000 per occurrence, \$2,000,000 in the annual aggregate, and \$1,000,000 aggregate for products-completed operations hazard. The aggregate must be applicable on a per project basis and may not include diminishing limits or eroding limits terms. This policy shall include coverage for: bodily injury, sickness or disease, including occupational sickness or disease, and death of any person; damage to or destruction of tangible property, including loss of use of such property; personal and advertising liability or injury; injury or damage arising out of products and/or completed operations; and contractual liability. This insurance shall include standard severability of interests provisions and shall include coverage for Contractor's indemnity obligations set forth in the Contract Documents, including but not limited to Section 9.15 of this Agreement.

(2). **Automobile Liability Insurance** covering bodily injury and property damage for all owned, non-owned, and hired automobiles used by or on behalf of Contractor in the performance of Work, with policy limits of not less than \$1,000,000 per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance, and use of those motor vehicles along with any other statutorily required automobile coverage.

(3). **Workers' Compensation Insurance** in accordance with all applicable laws.

(4). **Employers' Liability Insurance** with policy limits not less than \$1,000,000.

(5). **Umbrella/Excess Liability Insurance** in addition to other insurance requirements with policy limits not less than \$10,000,000 per occurrence and \$10,000,000 annual aggregate.

(6). **Professional Liability Insurance** covering performance of the professional services, with policy limits of not less than \$1,000,000 per claim and \$1,000,000 in the aggregate, but only if Contractor or a subcontractor will furnish professional services as part of the Work.

(7). Pollution Liability Insurance with policy limits of not less than \$1,000,000 per claim and \$1,000,000 in the aggregate, but only if the Work involves the transport, dissemination, use, or release of pollutants.

Except for insurance required under (3) and (4), Owner and its affiliates shall be made additional insureds on a primary and non-contributing basis for liabilities arising from or related to Work performed by or on behalf of Contractor. Contractor shall require its subcontractors to maintain reasonable amounts of insurance, provided that, nothing contained herein shall relieve Contractor from its own insurance requirements or from otherwise being responsible and liable for any act or omission of its subcontractors.

Prior to the commencing of any Work, Contractor shall furnish to Owner certificates of insurance evidencing: insurance of the types and amounts set forth herein, including all required endorsements; and commercially reasonable deductibles acceptable to Owner. The certificates shall require the insurer to provide at least thirty (30) days' prior written notice to Owner of any cancellation or material change to the policy. If any policy is cancelled or materially changed, Contractor shall promptly replace such coverage. If Contractor does not cure any breach of the insurance requirements set forth herein within ten (10) business days of notice to it by Owner, Owner may independently secure such insurance and the cost thereof shall be borne by Contractor. Contractor agrees to reimburse the Owner for the cost of any such insurance plus a five percent (5%) administrative charge within ten (10) days after billing by Owner. Any sum remaining unpaid fifteen (15) days after billing by the Owner shall bear interest at the rate of twelve percent (12%) per annum until paid to Owner. Contractor shall furnish certificates of insurance upon Owner's written request. Contractor shall submit a certificate evidencing continuation of liability coverage, including coverage for completed operations, with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the period required to maintain insurance under this Attachment A.

Owner's receipt or acceptance of evidence of coverage that does not comply with these requirements, or Contractor's failure to provide evidence of coverage, shall not constitute a waiver or modification of the insurance requirements set forth herein. The minimum insurance requirements set forth herein shall not limit the liability assumed by Contractor elsewhere, including, and without limitation, Contractor's defense, hold harmless, and indemnity obligations.

Bond Requirements:

Prior to the commencement of any Work, Contractor shall obtain both a payment and performance bond. Each payment and performance bond shall be in the entire amount of the contract sum, from a surety acceptable to Owner and licensed to transact business in the State of South Carolina, and on a form acceptable to Owner. The premium for these bonds shall be paid by the Contractor. The bonds shall make reference to the Contract to which this Attachment A is attached. The performance bond shall be written as an "on demand" bond. Commencement of Work by Contractor without having provided performance and payment bonds as set forth herein shall not be considered a waiver or release by Owner of the requirement for bonds, and Contractor shall have proceeded with the Work at its own risk and shall not be entitled to payment hereunder until evidence of such bonds are delivered to Owner.

ATTACHMENT B

MCLEOD CODE OF CONDUCT AND COMPLIANCE PROGRAM

MCLEOD HEALTH'S POLICY ON BUSINESS PRACTICES **(commonly known as the "McLeod Health Code of Conduct")** **AND THE POLICY AND PROCEDURES REGARDING COMPLIANCE WITH THE** **ANTI-KICKBACK STATUTE AND THE STARK LAW**

With increasing governmental focus and attention on the relationships between hospitals, physicians, and other providers of healthcare services, McLeod Health believes that it is necessary to establish a set of rules and procedures that will ensure compliance with the Anti-Kickback Statute and/or the Stark Law, and will govern all applicable transactions and arrangements with affected third-parties, including referring physicians.

PURPOSE/BACKGROUND:

This policy and procedure is intended to establish a set of rules and guidelines that each McLeod Health entity must follow prior to entering into any transaction or arrangement with a third party in which the Anti-Kickback Statute and/or the Stark Law might apply, and to educate and inform each "Covered Person" (as that term is defined in the Corporate Integrity Agreement entered into on October 31, 2002) or other individual who is employed by or acting on behalf of McLeod Health of the importance of fully complying with these laws and the potential consequences of failing to do so.

POLICY:

It is the policy of McLeod Health and its affiliated entities to adhere to the various requirements referenced within 42 U.S.C. Section 1320a-7b(b) et seq. (the "Anti-Kickback Statute") and in the Ethics in Referrals Act, which is codified at 42 U.S.C. Section 1395nn (the "Stark Law"), as well as any regulations or guidance promulgated pursuant to these laws.

Applicability of the Anti-Kickback Statute

The Anti-Kickback Statute establishes criminal penalties with respect to any person who knowingly and willfully offers, pays, solicits, or receives any remuneration to induce or in return for:

- (i) referring an individual to a person for the furnishing, or arranging for the furnishing of, any item or service payable in whole or in part under a Federal health care program; or
- (ii) purchasing, leasing, ordering, or arranging for, or recommending purchasing, leasing, or ordering any good, facility, service, or item payable under a Federal health care program.

"Remuneration" is defined broadly to include the transfer of anything of value, in cash or in kind, directly or indirectly, overtly or covertly. Violation of the Anti-Kickback Statute constitutes a felony punishable by a maximum fine of \$25,000, the imprisonment of up to five (5) years, or both. Conviction will also lead to automatic exclusion from Medicare and Medicaid programs. Because the Anti-Kickback Statute is quite expansive and can be implicated in a variety of legitimate investment or business relationships between two (2) or more individuals or organizations, a number of regulatory "safe harbors" have been established to protect certain business arrangements. Each condition of the applicable safe harbor must be met in order to gain complete protection from possible prosecution. However, failure to meet all such requirements of a safe harbor does not mean the parties to an arrangement or transaction have necessarily committed a *per se* violation of the Anti-Kickback Statute. Rather, the "intent" of the parties will be assessed to determine if the Anti-Kickback Statute has been violated.

Consequently, it is essential that, prior to entering into any transaction or arrangement that involves a physician or other healthcare provider and that might potentially trigger the applicability of the Anti-Kickback Statute, a McLeod Health entity, or such "Covered Person" or other individual acting on behalf of a McLeod Health entity must follow the procedures outlined below to assure the Anti-Kickback Statute is not violated.

Applicability of the Stark Law

The Stark Law provides that, unless certain exceptions are met, a physician (or an immediate family member of such physician) who has a financial relationship" with a healthcare entity cannot:

- (i) make a referral to that entity for the furnishing of "designated health services" ("DHS") for which payment otherwise may be made under the Medicare and Medicaid programs; and
- (ii) the entity receiving the referral may not present or cause to be presented a claim to Medicare or Medicaid, or to any individual, third party payer, or other entity for the DHS furnished pursuant to a referral prohibited under the Stark Law.

A "physician" is defined under the Stark Law to include a doctor of medicine or osteopathy, a doctor of dental surgery or dental medicine, a doctor of podiatric medicine, a doctor of optometry, or a chiropractor. A "financial relationship" is defined under the Stark Law to include both an ownership or investment interest a physician may have in a healthcare entity, as well as any compensation arrangement the physician may have with the organization~ DHS is a statutorily defined term that covers a wide variety of health care services, equipment and supplies. The term "referral" is broadly defined under applicable regulations and can be "direct or indirect," meaning that a physician will be deemed to have made a referral if he or she caused, directed, or controlled referrals made by others. A "referral" does not include services personally performed by the referring physician.

There are a number of exceptions to the ownership/investment and compensation arrangement prohibitions under the Stark Law. If the Stark Law applies to a physician's financial relationship with a healthcare entity, the arrangement must qualify for a specific exception in order for the physician to be allowed to refer Medicare and Medicaid patients for DHS to the entity.

A violation of the Stark Law can lead to denial of payment for any DHS provided by the entity and a refund of all prior Medicare and Medicaid revenues collected by the entity through referrals from a physician with which the entity has a non-conforming financial relationship. Violators may also be excluded from Medicare and Medicaid, and subject to civil penalties of up to \$15,000 for each bill or claim presented or caused to be presented for a DHS that a person "knows or should have known" was not eligible for payment.

Consequently, it is imperative that the procedures outlined below be strictly adhered to if the Stark Law may be applicable to a proposed transaction or arrangement.

PROCEDURES:

1. Any McLeod Health Entity, or any "Covered Person" or other person who is employed by or acting on behalf of a McLeod Health Entity, shall immediately notify McLeod Health's Corporate Compliance Officer ("CCO") in writing of any transaction or arrangement that is not in compliance with the Anti-Kickback Statute and/or the Stark Law.

2. For all transactions or arrangements that are covered by the Anti-Kickback Statute and/or the Stark law, the McLeod Health Entity, or any "Covered Person" or other person who is employed by or acting on behalf of a McLeod Health Entity, shall set forth in writing the proposed transaction or arrangement in the form of a written agreement or contract. This agreement or contract shall include a provision that all contracting parties shall be required to comply with McLeod Health's Compliance Program and with the Anti-Kickback Statute and the Stark Law. This agreement or contract shall also comply with all applicable provisions of the Anti-Kickback Statute and the Stark Law, and if possible, fall within an Anti-Kickback Statute safe harbor and/or Stark Law exception.
3. Legal counsel shall review the written agreement or contract containing the material terms of the proposed transaction or arrangement to assess whether the arrangement triggers the applicability of the Anti-Kickback Statute and/or the Stark Law.
4. Following such review, legal counsel shall forward the written agreement or contract to the President and Chief Executive Officer of McLeod Health ("CEO"), setting forth any aspect of the proposed transaction or arrangement that may trigger the applicability of the Anti-Kickback Statute and/or the Stark Law.
5. If, following review by the CEO and legal counsel, it is determined that the proposed transaction or arrangement could violate the Anti-Kickback Statute and/or the Stark Law, the CEO or legal counsel will communicate such in writing to the relevant parties to the proposed transaction or arrangement. The parties will be required to renegotiate the terms of the agreement or contract until it is determined that the proposed arrangement will not violate the Anti-Kickback Statute and/or the Stark Law.
6. If it is determined that the proposed transaction or arrangement does not violate or implicate the Anti-Kickback Statute and/or the Stark Law, the contracting parties shall certify in writing that, through the proposed transaction or arrangement, they do not intend to generate referrals for services or supplies for which payment may be made under a Federal health care program and that the parties shall continue to comply with the Anti-Kickback Statute and Stark Law.
7. Once such an agreement or contract is executed, the CCO and Contract Manager will be provided with a copy of the agreement or contract. The CCO and Contract Manager shall then summarize the transaction or arrangement and notify the OIG, as required under the Corporate Integrity Agreement, and maintain a copy of the agreement or contract on file.
8. If a McLeod Health Entity, or a "Covered Person" or other person who is employed by or acting on behalf of a McLeod Health Entity, has any questions or concerns as to whether an actual or proposed contract or agreement is in compliance with the Anti-Kickback Statute and/or the Stark Law, the entity or person should immediately contact the CCO with any such questions or concerns.

ATTACHMENT B-2

RESPONDENT ACKNOWLEDGEMENT OF MCLEOD CODE OF CONDUCT AND COMPLIANCE PROGRAM

MCLEOD HEALTH'S POLICY ON BUSINESS PRACTICES

MCLEOD HEALTH COMPLIANCE PROGRAM:

Respondent acknowledges that McLeod Health participates in McLeod Health's Compliance Program ("Compliance Program") and that McLeod Health is bound by a number of compliance-related policies, including a conflict of interest policy ("Conflict of Interest Policy") for certain purposes, including, but not limited to, the purpose of ensuring that the provision of, and billing for, all health care services at and by McLeod Health are in full compliance with applicable Federal and state laws. Respondent acknowledges that it has received information relating to such Compliance Program, including the McLeod Health Code of Conduct and the Conflict of Interest Policy, as well as other compliance policies and Respondent shall fully adhere to and support the policies set forth therein. IF required, Respondent shall cause its affiliated physicians to participate in training and education sessions relating to the Compliance Program, to include training and education sessions related to Anti-Kickback Statute and Stark Law as requested by McLeod Health. Respondent agrees to, and at all times shall, comply with all laws, rules and regulations impacting Respondent and McLeod Health and, if required, to cause its affiliated physicians to attend training sessions related to the Anti-Kickback Statute (42 U.S.C. Section 1320a-7b(b)), the Stark Law (42 U.S.C. Section 1395m), and other relevant compliance requirements. Respondent certifies that it has received, and will fully comply with, McLeod Health's Policy on Business Practices (commonly known as the "McLeod Health Code of Conduct") and the Policy and Procedures Regarding Compliance With the Anti-Kickback Statute and Stark Law, which are attached hereunto and incorporated herein as Appendix B.

NAME OF FIRM _____

BY: _____
SIGNATURE OF AUTHORIZED OFFICIAL TITLE

ATTEST/WITNESS:

Notary:

Sworn to and subscribed before me this
_____ day of _____, 20__.

Notary Public Commission expires: _____

Construction and Renovation Policy

A Handbook for Contractors

(Applies to All McLeod Facilities and Campuses)

McLeod Health Construction Department
Florence, SC 29501

Mission Statement

The mission of the McLeod Health Facilities Team is to create an exceptional and inspirational healthcare environment, which ensures life safety and the delivery of safe, quality patient care for people living within South Carolina and eastern North Carolina.

Values

A set of common values that unites the McLeod Health Facilities Management Team are:

The Value of Caring

"We will provide a safe and secure environment. We will focus on the needs of patients, families and staff and uphold a spirit of willing and compassionate service to others."

The Value of Person

"We will foster superior team communications. We will embrace collaborative efforts, engender trust among partners, and cultivate a commitment to the well-being of others."

The Value of Quality

"We will dedicate ourselves to the development of aesthetically appealing facilities. We will dedicate ourselves to quality and will promote a superior healthcare experience."

The Value of Integrity

"We will work respectfully with all stakeholders. We will make a long-term commitment to ethical responsibility and will uphold standards for honesty and truth."

Mandatory requirements for construction, demolition, and renovation projects

The McLeod Health Facilities Management Team recognizes that a culture of collaboration, communication, and discipline, which promotes the application of continuous quality improvement principles, is essential. The McLeod Construction and Renovation Policy ("CRP") is intended to foster collaboration and communication, by aiding in the development and implementation of projects that will ensure life safety and minimize the impact of construction on patient care and business operations of McLeod Health facilities

McLeod Health is committed to providing safe, effective care to our patients at all times. During the time you are working within a McLeod Health facility, there are a number of issues you must address. You are required to work with appropriate members of our Infection Control and Engineering departments to assess the potential impact from risks that may be associated with your work on our ability to meet the needs of our patients and caregivers. The risks identified will be used to develop a plan designed to minimize disruption of our patient care services. We will make every effort to minimize disruption of the construction or installation process; however, in all cases, patient care and life safety considerations shall always be given the highest priority. McLeod Health will not permit any action, which might compromise patient care quality or safety.

Before beginning any work on a McLeod Health campus, each individual contractor, subcontractor, and vendor must receive the annual influenza vaccination for the applicable flu season, as the term flu season is generally defined and understood. Each individual contractor, subcontractor, and vendor shall stay current with and receive additional influenza vaccinations for every flu season which occurs during his or her performance of work at a McLeod Health campus. McLeod Health agrees to provide the annual influenza vaccination at no cost. If McLeod Health does not provide the vaccination, then proof of vaccination for the applicable flu season is required. McLeod Health campuses include, but are not limited to, any hospital, freestanding emergency department, urgent care center, clinic, physician office, diagnostic center, support building, or medical office building.

Construction demolition, renovation, and installation projects can disrupt utilities and life support systems, create excessive noise levels, cause vibration, and disperse dust and dirt particles, all of which may impact air quality, infection control needs, and emergency procedures during various phases of the project. These activities can directly impact patients and other persons occupying or located near a space under demolition, renovation, construction, or during installation projects. Dispersal of dust may occur when walls, ceilings, ventilation systems, or floor spaces are broken into or torn down, or when vibration occurs. This dust may contain disease causing organisms (pathogens), which can be detrimental or even deadly to patients with weak immune systems.

Governing Policy

The McLeod Construction and Renovation Policy and Handbook for Contractors is intended to provide clarification for work taking place within McLeod owned properties. Should questions or conflicts occur, the McLeod Administrative Policy Manual entitled LIFE SAFETY and INFECTION CONTROL MEASURES DURING PERIODS OF CONSTRUCTION AND OTHER IDENTIFIED DEFICIENCIES shall govern over this manual.

Policy

DNV GL ("DNV") accredits McLeod Health through a survey process. Surveys are unannounced and occur annually after the previous unannounced survey. During survey, DNV representatives ("Surveyors") conduct on-site performance evaluations by measuring actual care processes and by tracing patients through the care, treatment, and services they received. DNV surveyors also analyze key operational systems that directly impact the quality and safety of patient care to ensure that patient care is provided in a safe and secure environment. DNV standards are developed in consultation with health care experts, providers, and researchers, as well as measurement experts, purchasers, and consumers.

When planning demolition, construction, renovation, cable installation or maintenance work, the McLeod Project Manager ("MPM") along with representatives from McLeod's Engineering, Construction, and Infection Control departments will conduct a proactive preconstruction risk assessment to identify hazards that could potentially compromise life safety, patient care, or worker safety in occupied areas. The risk criteria developed from these assessments will address the impact demolition, renovation, maintenance or new construction activities have on life safety, fire safety, air quality, infection control, utility requirements, noise, vibration and emergency procedures. These assessments include an Infection Control Risk Assessment ("ICRA") and an Alternate Life Safety Measure ("ALSM"). These tools are used to identify the potential for the disturbance of dust that could cause respiratory irritation, infections, or expose anyone to hazards; to evaluate the noise and vibrations associated with construction activities; and to recognize the potential of the work to impact our ability to provide safe, effective patient care or perform normal business functions. These risk assessments will also be used to evaluate the potential for disruption of utility services and communication systems and will aid in determining the impact the work may have on fire and life safety. They will further be used to assess the impact on McLeod's security program and systems and to determine if there are unique problems requiring other special considerations during construction or installation.

As part of your work within a McLeod facility, you may be required to participate in the implementation and enforcement of Alternate Life Safety Measures, as well as any other plan intended to ensure life safety and negate disruption to patient care. Your participation may include training your staff and your subcontractors, supplying specialized equipment to create or maintain desired environmental conditions, monitoring staff behavior, and enforcing safe work practices. You are also required to cooperate when patient care considerations necessitate temporary disruption of construction activities

McLeod personnel will perform routine, periodic monitoring of your compliance with these plans, policies, and procedures. They will also repeat the risk assessment process as often as necessary to assure effective management of the issues and risks identified. It is important to recognize that the impact can vary from day to day, which will require flexibility on your part to meet the needs of our patients and staff.

McLeod's CRP applies to all buildings that support outpatient and in-patient clinical programs. Ongoing renovation and construction projects shall be monitored to ensure compliance with the latest ALSM and ICRA standards in accordance with Authorities Having Jurisdiction ("AHJ"). The Engineering, Construction, and Infection Control departments are responsible for enforcement of this policy. Issues identified during the ICRA and ALSM will be addressed in the planning stage of all projects. The checklists attached to this policy will be used to document compliance with this policy.

Procedure

An ICRA is a multidisciplinary process that focuses on reducing risk from infection throughout facility planning, design, and construction (including renovation) activities, which considers:

- The environment,
- Infectious agents,
- Human factors, and
- The impact of the proposed project.

(Source: American Institute of Architects. Guidelines for Design and Construction of Health Care Facilities, 2014. www.aia.org.)

Early in the planning process, project planners, designers, architects, and engineers will receive input from experts in infectious disease, infection control, patient care, epidemiology, facility design, engineering, construction, and safety, as circumstances dictate. McLeod's Safety and Quality Control Officer and Director of Infection Control will provide ongoing monitoring during area preparation; throughout demolition, renovation, or construction activities; clean up and preparation activities for return to service; and final project review phases. ICRAs focus on prevention, but also address monitoring, testing, and intervention when problems are identified.

For bid projects, a pre-bid conference will be scheduled by the MPM at which time, each applicable ALSM and/or ICRA item will be reviewed for understanding & concurrence by all parties, including representatives from outside contractors. Upon completion of plans, a pre-construction conference will be scheduled by the MPM and each applicable ALSM and or ICRA item listed in project documentation will be briefed.

When a project requires Class III or Class IV Infection control precautions or when an ALSM, the Contractor will complete the daily monitoring. When ALSM or ICRA measures are found deficient, the Contractor, at its expense, shall take steps to ensure immediate compliance or halt work until deficiencies are corrected.

Infection Control Risk Assessment (ICRA)

The ICRA Matrix is used to indicate the level ("Class") of infection controls and monitoring required for the project work to take place. If any question on the ALSM Risk Assessment is answered "YES", then ALSM may apply to the project. In addition to the ICRA and ALSM planning, all project planning shall include consideration for all finishes to be used for renovation and new construction. Fire retardant or resistant materials shall be selected to insure that all new product installations meet applicable NFPA code(s). Examples are products such as furnishings, draperies, interior decorations, waste containers and other materials. Once determinations are made, McLeod's Infection Control department shall issue the appropriate Infection Control Work Permit, based upon the type of project and population at risk.

The Contractor is responsible for following the appropriate precautions required by Infection Control Work Permit. The Contractor is required to maintain the precautions defined by the Infection Control Permit throughout the course of the project or until the permit is modified and a new permit is issued by McLeod's Infection Control department.

The MPM shall ensure that all ALSM and ICRA forms, along with applicable checklists, minutes, etc. are kept in the construction project file and in the appropriate Engineering files for inspection by all AHJs.

Unless directed otherwise in this document, the MPM is responsible for obtaining all in-house McLeod Health permits, including but not limited to "Above Ceiling Work Permits," "Hot Work Permits," and "Confined Space Permits". The contractor is responsible for posting copies of applicable work permits clearly at the jobsite in a location approved by the MPM. All permits must be obtained prior to commencing demolition, construction, renovation, installation, or other activities. No work may begin until all permits are issued in writing. Please note that an Infection Control permit is required for all projects and that the project may require other applicable permits even if it is not designated Class III or Class IV for infection control purposes.

McLeod Engineering and Infection Control departments reserve the right to add/revise infection control and/or life safety requirements to a project based upon existing conditions and risk levels on an individual basis. These departments are responsible to ensure compliance with their departmental policies.

Failure by the Contractor to comply with McLeod Health policies and procedures may result in shut down of the job by the Engineering Department or Infection Control Departments until the problem or deficiency is corrected. Should a project be shut down for noncompliance, there shall be no added costs due to the Contractor for delays or additional work required to comply.

Alternate Life Safety Assessment ("ALSA") and Alternate Life Safety Measures ("ALSM")

The purpose of Alternate Life Safety Measures (ALSM) is to ensure that adequate life safety protection is provided to the building occupants when:

- Life Safety Code deficiencies cannot be immediately corrected;
- Construction, alteration, or renovation activities temporarily impair a Life Safety Feature; or
- The fire alarm, detection, or suppression system is out of service or impaired for more than 4 hours in a 24-hour period.

ALSMs may also be used during the time between the identification of a Building Life Safety System impairment and the PFI (Plan for Improvement) completion.

DNV requires that hospitals develop and implement ALSMs for evaluating when and to what extent the hospital implements one or more of the following special measures to compensate for increased life safety risk:

- Inspecting exits in affected areas on a daily basis.
- Providing temporary but equivalent fire alarm and detection systems for use when a fire system is impaired.
- Providing additional fire-fighting equipment.
- Using temporary construction partitions that are smoke-tight, or made of noncombustible or limited combustible material that will not contribute to the development or spread of fire.
- Increasing surveillance of buildings, grounds, and equipment, giving special attention to construction areas and storage, excavation, and field offices.
- Enforcing storage, housekeeping, and debris-removal practices that reduce the building's flammable and combustible fire load to the lowest feasible level.
- Providing additional training to those who work in the hospital on the use of firefighting equipment.
- Conducting one additional fire drill per shift per quarter in areas where life safety is compromised.
- Inspecting and testing temporary systems monthly. Documenting the completion date of the tests.
- Conducting education to promote awareness of building deficiencies, construction hazards, and temporary measures implemented to maintain fire safety.
- Training those who work in the hospital to compensate for impaired structural or compartmental fire safety features.

Contractors and their subcontractors are responsible for complying with all ALSMs as deemed appropriate by McLeod Engineering and Infection Control departments. ALSM shall be applied as required by the appropriate risk assessment(s) for the determined duration (may vary) and may include but are not limited to the following:

1. Daily surveillance to ensure unobstructed exits
2. Daily surveillance to ensure emergency forces access
3. Daily surveillance to ensure that the appropriate type and quantities of fire suppression devices are on hand
4. Dust partitions are to be constructed smoke tight and of non-combustible or limited combustible materials (i.e. drywall, fire resistant plywood, or metal partitions)
5. Requiring storage and housekeeping practices which require the prompt removal of accumulations of combustible/flammable debris and supplies
6. Compliance with required permits for Hot Work, Above Ceiling and/or Confined Space.
7. Monthly testing of temporary fire alarm, detection and suppression systems (for projects of more than 1 month duration)
8. Fire exit drills conducted twice quarterly (for projects of more than 1 month duration)
9. Any other appropriate measures as determined appropriate by McLeod Engineering and Infection Control departments.

Contractor Responsibilities for Infection Control Precautions: General and by Precaution Class

General Cleaning and Dust Control Requirements for all Classes of Projects - Infection Control Classes I, II, III, & IV

1. All nonessential equipment must be removed from the area prior to the beginning of major internal construction to avoid contamination of clean/sterile patient care surfaces, supplies and equipment.
2. Use appropriate barriers to contain dust and debris inside of work site. For projects taking place in a single room with minimal dust, closing the door to the room is appropriate. Other projects will require additional means of dust containment (e.g., portable vinyl enclosure units, taped stationary full-height polyethylene sheet barriers, sheetrock walls with inclusion of full-height polyethylene or sheetrock barriers above ceilings).
3. Temporary construction barriers and closures above ceilings shall be dust tight.
4. Activities generating large amounts of dust will require the strongest barriers and a means for negative airflow with HEPA filtration to assist with containment. The bigger the project and the higher the amount of dust generated, the more stringent the controls and barriers must be to contain dust and debris within the worksite.
5. For most small scope projects, wet sanding of drywall will be required.
6. Maintain manpower and equipment, including wet mops, buckets, and clean damp rags for cleaning fine dust from floors and other existing surfaces in or adjacent to occupied areas exposed to dust.
7. Clean as the project progresses. Clean up any dust or debris before it is tracked outside of construction area. Clean at the end of each workday before leaving work site. Any debris or dust tracked outside of the construction area must be cleaned up immediately.

Infection Control Precautions by Class

Class I Contractor Responsibilities for Infection Control Precautions

1. Obtain Infection Control and other applicable permits from McLeod Health Infection Control and McLeod Engineering department and all other governing bodies before demolition or construction begins.
2. Execute work by methods to minimize raising dust from construction operations (close doors or use other means of containment when indicated).
3. Immediately replace any ceiling tile displaced **for visual inspection**.
4. Minimize dust and dirt. Clean area when done and/or when dust or dirt builds up.
5. Vacuum with HEPA-filtered vacuum and/or damp mop when work is complete.
6. Direct all questions about work to the Engineering Department.

Class II Contractor Responsibilities for Infection Control Precautions

1. Obtain Infection Control and other applicable permits from McLeod Health Infection Control and McLeod Engineering department and all other governing bodies before demolition or construction begins.
2. In addition to the items contained in Class I:
3. Provide active means to prevent air-borne dust from dispersing into atmosphere by closing doors, using portable containment units, or enclosing area with plastic sheeting or equivalent. When openings are made into existing ceilings, use portable containment devices or provide polystyrene enclosure around ladder sealing off opening, fitted tight to ceiling and floor. Provide thorough cleaning of existing surfaces that become exposed to dust.
4. Seal unused doors with **duct** tape and post appropriate signs to prevent entry by others not engaged in the project.
5. Water mist work surfaces to control dust-generating activities that will cause dust or dirt to be airborne, such as cutting or sanding.
6. In consultation with McLeod's Director of Engineering or his/her designee, block off and seal air vents as indicated. If exhaust must be maintained, use "clean air machine," or powered HEPA filters in exhaust path, or exhaust directly to outside.
7. Use tacky mats and carpet squares/dust mats at project entrances and exits to minimize dust dispersal.
8. Control spread of dust and debris by using covered carts or containers to remove debris through internal hospital paths. Cover must be dust tight and secured to container, not just laid on top.
9. Damp mop areas during and after construction activities to control and remove dust.
10. Use HEPA filters on vacuums used in area for cleanup.
11. As work progresses, wipe down all horizontal surfaces with disinfectant approved by McLeod Environmental Services.
12. Replace all ceiling tiles or re-close ceiling.
13. At conclusion of the job, wipe down all horizontal surfaces with disinfectant approved by McLeod Environmental Services.
14. Damp mop or extract floor with disinfectant approved by McLeod Environmental Services.
15. If appropriate, vacuum all areas with HEPA-filtered vacuum.
16. Clean HVAC system before closure is removed and operate system for 24 hours prior to final cleaning of job site.
17. Maintain all barriers/enclosures as practical until post-job cleaning is complete.
18. Use HEPA-filtered vacuum during removal of barriers as practical.
19. Direct questions about work to the Engineering Department

Class III Contractor Responsibilities for Infection Control Precautions

1. Submit ICRA to the Department of Epidemiology and obtain Infection Control and other applicable permits from McLeod Health Infection Control and McLeod Engineering department and all other governing bodies before demolition or construction begins.
2. In addition to the items contained in Class I and Class II:
3. In consultation with McLeod's Engineering department, put controls or barriers into place to prevent spread of particles through HVAC system and contamination of duct system in the area where work is being performed.
4. Complete all critical barriers or use portable containment unit before demolition or construction begins. Throughout the work process, use appropriate barriers to control dust for type of work.
5. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
6. Seal holes, pipes, conduits, and punctures appropriately.
7. Place adhesive mat at entrance outside work area and carpet piece inside work area. Adhesive mats or carpet pieces at barricade entrances and in the anteroom shall be kept clean and changed daily, or more often as necessary, to prevent accumulation of dust.
8. Place carpet piece inside construction area at exit for workers to wipe off shoes before leaving work area.
9. Any ceiling access panels opened for investigation beyond sealed areas shall be replaced immediately when unattended.
10. Wet mop frequently during construction activities to keep dust at a minimum.
11. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work areas.
12. Contain construction waste before transport in tightly covered containers carts, or tightly closed impervious bags. Containers must be wiped down with water before leaving the area.
13. Use only designated route through facility and designated elevator for transporting construction materials to and debris to and from the work site.
14. Clean work site thoroughly before removing construction barriers.
15. Remove isolation controls or barriers from HVAC system after work is completed.

Class III Contractor Responsibilities for Infection Control Precautions at Job Completion

1. Maintain barriers in place as much as practical until final cleaning is complete, and site inspected by Infection Control.
2. Replace all ceiling tiles or re-close ceiling.
3. At conclusion of the job, wipe down all horizontal surfaces with disinfectant approved by McLeod Environmental Services.
4. Damp mop or extract floor with disinfectant approved by McLeod Environmental Services.
5. Removal of all barrier materials (including those of HVAC system) is to be accompanied by vacuuming using HEPA-filtered vacuum cleaner.
6. Remove HVAC barriers and clean HVAC system as closure is being removed. Operate HVAC system for 24 hours prior to final cleaning of job site and removal of barriers (to the extent practical, based on the system).
7. Use HEPA-filtered vacuum during removal of barriers as practical.
8. Site must be thoroughly cleaned by damp-wiping all horizontal surfaces with McLeod Health disinfectant approved by McLeod Environmental Services.
9. Once barriers are removed, the area is to be thoroughly cleaned by McLeod Environmental Services.
10. Direct questions about work to the McLeod Engineering department.

Class IV Contractor Responsibilities for Infection Control Precautions

1. Submit ICRA to the Department of Epidemiology and obtain Infection Control and other applicable permits from McLeod Infection Control and McLeod Engineering department and all other governing bodies before demolition or construction begins.
2. In addition to the items contained in Class I and Class II:
3. In consultation with McLeod's Engineering Department, put controls or barriers into place to prevent spread of particles through HVAC system in area where work is being done and to prevent contamination of duct system.
4. Complete all critical barriers or use portable containment unit before demolition or construction begins. Throughout work process, use appropriate barriers to manage dust for type of work.
5. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units.
6. Seal holes, pipes, conduits, and punctures appropriately.
7. Construct anteroom and require all personnel to exit through this room so they can be vacuumed using an HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site.
8. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area.
9. Use tacky mats and carpet squares/dust mats at project entrances and exits to minimize dust dispersal. Adhesive mats or carpet pieces at barricade entrances and in the anteroom shall be kept clean and changed daily, or more often as necessary, to prevent accumulation of dust.
10. Place carpet piece inside construction area at exit for workers to wipe off shoes before leaving work area.
11. Any ceiling access panels opened for investigation beyond sealed areas shall be replaced immediately when unattended.
12. Vacuum work area with HEPA filtered vacuums.
13. Wet mop area with disinfectant approved by McLeod Environmental Services.
14. Contain construction waste before transport in tightly covered containers carts, or tightly closed impervious bags.
Containers must be wiped down with water before leaving the area.
15. Cover transport receptacles or carts with impervious covers; Tape covers.
16. Use only designated route through facility and designated elevator for transporting construction materials to and debris to and from the work site.

17. Do not remove barriers from work area until project is completed and thoroughly cleaned, and area is inspected by McLeod Infection Control and Engineering departments.

Class IV Contractor Responsibilities for Infection Control Precautions at Job Completion

1. Maintain barriers in place as much as practical until final cleaning is complete, and site inspected by Infection Control.
2. Replace all ceiling tiles or re-close ceiling
3. At conclusion of the job, wipe down all horizontal surfaces with disinfectant approved by McLeod Environmental Services.
4. Damp mop or extract floor with disinfectant approved by McLeod Environmental Services.
5. Remove barriers/controls used to prevent spread of particles through HVAC system in areas where work was performed. Removal of all barrier materials (including those of HVAC system) is to be accompanied by vacuuming using HEPA-filtered vacuum cleaner.
6. Remove HVAC barriers and clean HVAC system as closure is being removed. Operate HVAC system for 24 hours prior to final cleaning of job site and removal of barriers (to the extent practical, based on the system).
7. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
8. Use HEPA-filtered vacuum during removal of barriers as practical.
9. Site must be thoroughly cleaned by damp-wiping all horizontal surfaces with disinfectant approved by McLeod Environmental Services
10. Once barriers are removed, the area is to be thoroughly cleaned by McLeod Environmental Services.
11. Direct questions about work to the McLeod Engineering department.

Security and Contractor Check-in

Contractor employees must wear a McLeod Health issued identification badge ("ID badge"). Please note that a vendor or contractor issued ID badge is not acceptable for identification purposes. The McLeod Health issued ID badge must be worn at all times when the Contractor's employee is present on any McLeod property. The McLeod ID badge is verification that the Contractor's employee is authorized to work within a McLeod Health facility.

To qualify to receive a McLeod issued ID badge each contractor employee must first satisfactorily complete McLeod Health Construction Orientation, and achieve a minimum score of 70 out of a possible 100 points on the McLeod Contractors exam and execute all required documents.

Failure to follow the ID policy may result in financial penalties (up to \$50 per badge) or denial of work privileges on McLeod facilities. When penalties are imposed for non-compliance with this policy, the contractor agrees to pay these in full or grants full authority to have these deducted from the contract amount. The Contractor agrees that it may not recoup penalties as any part of its contract.

Confidentiality

At McLeod Health Hospitals, the privacy of patients is valued and protected by Federal law. Although contractor employees will never have reason to use private health information, they may come into contact with documents or computer screens, or overhear conversations that contain private information. This information is protected and private and must not be discussed or shared under penalty of law.

Workplace Violence Prevention

McLeod Health hospitals are workplaces where violence, threat of violence, intimidation, harassment or coercion are forbidden and not tolerated. Contractor employees are responsible for adhering to these guidelines and for reporting disruptive or violent behavior to a nursing supervisor, the MPM or McLeod Health Security.

Emergency Preparedness

McLeod Health requires that all employees (hospital and contractor) are familiar with the basic requirements of the Emergency Plans before they begin work.

Emergency Response

In the event that emergency procedures are announced (see "Page Codes"), check immediately with your supervisor or the nearest hospital staff member to ask what is expected in this situation. If you are asked to leave the area, you must do so immediately in a quiet, orderly fashion.

Reporting an Emergency

To report an emergency in the McLeod Health Hospitals, use the following numbers:

- All McLeod Health campuses from any McLeod extension, dial "777-2020"
- For emergencies outside main buildings, dial "911"

As a part of orientation on each project, contractors and their employees are required to familiarize themselves with and to know where the fire pull boxes and fire extinguishers are located in and around their work area(s).

You are responsible to know the evacuation route for the work area and for the departments located in the proximity of your work area, in the event of a fire. Should a fire occur, McLeod patient care facilities are constructed to "defend in place." Patients and staff are moved horizontally first in the main corridors beyond the double fire doors. If the situation dictates, they may then be evacuated vertically down the stairwell. Instructions for evacuation are given by the Incident Commander, Administrator on Call, or Nursing Supervisor, depending upon the conditions.

It is imperative that each member of your team understands their responsibility if a fire occurs. To report a fire, call the emergency number appropriate for the campus which is applicable from any McLeod telephone extension and report a Code Red, be certain to give the specific location of the fire, then pull the fire alarm.

When deemed appropriate by the McLeod Construction team, McLeod's Telecommunications department may install a Red Emergency Telephone in the immediate area of construction or in the project job trailer. When picked up, a Red Emergency Phone will immediately connect to the McLeod Operator, without being forced into a call queue. These phones are intended to be used to report Emergencies only and do not have access to outside lines and are not capable to dial out of the hospital or for long-distance calls.

Electrical Emergency Contact

Florence/Darlington/Cheraw

Duke Energy Progress

Eric Gardner

Office: 843-661-4209 Cell: 843-687-8261

Customer Critical Hotline: 800-419-6356

Dillon

Duke Energy Progress

Eric Gardner

Office: 843-661-4209 Cell: 843-687-8261

Customer Critical Hotline: 800-419-6356

Loris/Seacoast

Santee Cooper

Phillip Greenway

Cell: 843-340-0202

Customer Critical Hotline: 888-769-7688

Clarendon

Duke Energy Progress

Dennis Turner

Office: 803-954-2510 Cell: 803-983-9277

Customer Critical Hotline: 800-419-6356

Natural Gas Emergency Contact

In case of natural gas emergencies, notification of system problems, or other natural gas concerns, please call:

Florence/Darlington/Dillon/Loris

Seacoast/Cheraw/Clarendon

SCE&G Gas Control

Charles Newton

Office: 803-217-6570 Cell: 803-206-6422

Outage Line: 800-815-0083

Downed/Sparking Lines: 888-333-4465

Curtailment Emergency Number: 866-624-7289

For follow-up information on curtailments, operation problems or contractual information, please contact your SCE&G account manager or call the SCE&G large customer group at: 800-455-0234.

Page Codes

McLeod Health Hospitals use a system of "Page Codes" to notify employees, vendors, and contractor employees of emergency situations. These codes will be given verbally over the public address system. Codes, which may be of importance to you, are:

FACILITY ALERT CODES ALL CAMPUSES

Decontamination

Decontamination Team Report

Evacuation

Prepare to Exit the Building

Fire Alarm Activation

Hazardous Material Release

Stay Clear of Area

Mass Casualty

ER Physician start notification procedures for additional staffing, if necessary

Utility Interruption procedures

Power outage – ensure critical equipment is plugged into RED receptacles – start downtime

Weather Event

Hurricane, Tornado, Severe Thunderstorm, High Winds, Hail – Take Cover and Seek Shelter

SECURITY ALERT CODES ALL CAMPUSES

Person With Weapon

Stay clear of the area; exit, if possible

Building Threat

Check area for items out of place

Civil Disturbance

Avoid the area

Controlled Access

Not allowed in the area

Missing Person

Security Assistance

Security report to ...

For example, if there is a fire, there will be a page over the public address system stating: "Fire Alarm Evacuation". In the event this alert is called, you should Rescue, Alarm, Contain, and Extinguish (see the section in this manual for "RACE") and using the appropriate fire extinguisher, you should "Pull, Aim, Squeeze, and Sweep (see the section in this manual for "PASS") to extinguish the fire.

Fire Extinguisher Type Use

Portable fire extinguishers can be used to extinguish most fires occurring in the hospital. Types of portable fire extinguishers and their intended uses are:

▪ Water	Class A fires: ordinary combustibles (mattress, blankets, paper).
▪ Carbon Dioxide	Class B fires: flammable liquids, electrical
▪ Dry Chemical	Class A, B & C fires: all fires
▪ MRI non-metallic	Class A, B & C; all fires

A fire extinguisher should not be used if a patient's clothes are on fire. In this case, the patient should be wrapped in a blanket or sheet.

Fire Alarm Systems

The fire alarm system is composed of three (3) components:

- Manual pull station alarms.
- Automatic smoke detectors.
- Automatic sprinkler heads.

The alarm system is activated if any of the above components are engaged. Chimes will ring and lights will flash when the alarm is initiated. The alarm system is addressable which allows McLeod Security to identify the exact location/zone in which the alarm was activated.

If you are trapped:

- Close all doors to corridors.
- Plug any leaks of smoke with a wet blanket.
- Lie on the floor with a wet towel over your nose and mouth.
- Stay calm until help arrives.
- Attempt to use internal communication system (radio, telephone, and intercom) to notify others of your situation.

Fire Drills

When the facility is under ALSM, the Director of Engineering will insure that any additional fire drills needed are conducted.

Fire Watch Safety

A Fire Watch is a method used to monitor an area for excessive combustible or flammable material build-up and for early detection of fires and potential ignition sources. When a Fire Watch is mandated, a McLeod staff person (security, contractor, engineering) will be specifically assigned to provide a fire watch by observing ongoing hot work or perform a periodic visual check of the work site, floor, or entire building during periods where a Life Safety Feature is impaired. The contractor is responsible for notifying the MPM when any of the following occur:

- When working in an area where you are unsure if the fire detecting system is activated;
- When sparks or hot particles will be dropped on a flammable substance (insulation, etc.); or
- When a fire detection or sprinkler system must be inactivated (48-hour advance written notification to the MPM is required);

The Contractor is responsible for supplying fire protection equipment (fire blanket) if sparks or hot particles will be dropped on a flammable substance (insulation, etc.); and for having the proper fire extinguisher(s) present on the work site. NOTE: A CO₂ extinguisher will not put out an insulation fire.

If you do start a fire or smoke condition, try to put the fire out by using standard "RACE" and "PASS" procedures.

All McLeod Health campuses, McLeod Hospice, McLeod Family Medicine, will notify the Emergency Operator by dialing call 777-2020 and providing your exact location and details, even if you put the fire out.

Outpatient Wound Care, McLeod Home Health, Outpatient Surgery Center, McLeod Pediatric Rehabilitation, McLeod Outpatient Rehabilitation and Sports Medicine, and McLeod Health & Fitness will call 911 and provide your exact location and details, even if you put the fire out.

The MPM is required to notify McLeod Security and the McLeod Switchboard of the project location and to post the location on the project worksite information board with appropriate contact and phone numbers to call in the event of a fire or other emergency.

RACE = Rescue • Alarm • Confine • Extinguish

This easy to remember acronym is our procedure in the case of a fire. Every staff member is trained to recognize and respond appropriately in the case of a fire using the acronym "R•A•C•E."

R = RESCUE: Remove everyone from the area. If a fire occurred in a patient room the staff should immediately remove the patient from the area.

A = ALARM: The Fire Alarm Pull Station shall be activated. Fire Alarm Pull Stations are located throughout the buildings, several on each floor. By activating the Fire Alarm, a fire action plan is set into motion and Initiate the emergency response. In addition, certain systems that could increase fire spread are automatically shut down.

C = CONTAIN: Once the room or area has been cleared of patients the door shall be closed, thus confining the fire, which enables the fire response team the time needed to arrive.

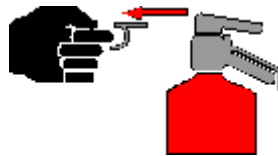
E = EXTINGUISH: When practical, use an extinguisher to put out the fire using the "P.A.S.S." system.

Additionally, McLeod personnel are trained to remember the acronym "PASS," which is the easiest way to remember how to use a portable fire extinguisher is to use the acronym

PASS = PULL • AIM • SQUEEZE • SWEEP

The acronym P.A.S.S. stands for "Pull" - "Aim" - "Squeeze" - "Sweep"

P = PULL: Pull the safety pin



A = AIM: Aim the extinguisher nozzle at the base of the flames



S = SQUEEZE: Squeeze the trigger while holding the extinguisher upright

S = SWEEP: Sweep the extinguisher from side to side, covering all areas of the fire with extinguishing agent still needs to respond to verify it's out as well as accomplish a report



REMEMBER: All fires must be reported.

No Tobacco Policy

All McLeod properties are smoke and tobacco free by the direction of the McLeod Board of Trustees. There is no tobacco use (chewing, smoking or vaping) in any McLeod building, parking areas or grounds. Contractors are responsible to ensure that their employees and their subcontractors working on McLeod property adhere to our Tobacco Free Policy.

Appearance and Attire

As representatives of McLeod Health, it is important that all employees and contractors present a professional appearance and maintain proper personal hygiene. In setting standards for personal appearance, three goals are identified:

Professional Appearance - Appearance that instills confidence in the people we serve and expresses concern and respect for patients and their families.

Personal Hygiene - The right of patients to be cared for and served by staff who maintain high standards of personal hygiene and the related right of coworkers to expect a non-offensive work environment.

Personal Safety - Reduction of injury risks where clothing, hair length or jewelry can be a contributing factor or where uniforms, certain types of clothing or personal protective equipment must be worn for infection control purposes.

General dress is dependent on the occupation, task or department where the work is to be performed. Employees and contractors are expected to avoid extremes of any kind in style and type of clothing. Attire that allows unnecessary exposure is regarded as inappropriate. Clothing must be clean and neat. Clothing must not be sheer, revealing or form fitting. Necklines and hemlines should conform to good taste. Personal cleanliness is expected. Hair must be kept clean and neat. Shoes are to be clean and in good repair, and must be of a safe style. Hosiery or socks must be worn and should be clean and free from holes or runs. Personnel must be free of tobacco odor. Tattoos should be covered. Inappropriate gum chewing is prohibited in any job involving contact with patients and the public. Shirts must have sleeves and shall not have logos or printing on them except for company or hospital identification

McLeod Health reserves the right to make final judgment on what is or is not appropriate dress on any of our campuses.

Noise or vibration

The contractor will provide no less than 48-hour advance notification of the onset of noise- or vibration-generating activities to occupants of areas of the facility above, below, and adjacent to the work site. The Contractor must coordinate work through the MPM who will coordinate activities, which generate noise or vibration for times when intermittently occupied areas of the facility above, below and adjacent to the work site are not occupied. McLeod Health reserves the right to suspend work if noise levels are deemed excessive.

Utilities Management

When a shutdown of utilities is required, it must first be approved by the McLeod Engineering Department. An approved Action Plan to coordinate all work is required in advance of any shutdown.

Utility outages will be planned and require that the Contractor provide the MPM with written notice, with copy to the McLeod Director of Engineering, of not less than fourteen (14) working days or other timeframe deemed appropriate by the McLeod Director of Engineering. The Contractor and the MPM will work through the McLeod Health Engineering Department to ensure that utilities in occupied areas of McLeod Health are interrupted as little as possible and for as short a time as possible.

Upon receiving a utility shutdown request, the MPM shall conduct an ALSM assessment in conjunction with the McLeod Engineering Department to ascertain what impact the shutdown will have upon affected occupants so that appropriate interim life safety measures and other interventions can be made to accommodate essential utility needs, while utilities are interrupted. The MPM must carefully assess the impact of any utility shutdown on operation of life support systems, medical gas, and vacuum. All utility shutdowns must be approved and administered by the McLeod Engineering Department.

Above Ceiling Work Permit and Above Ceiling Work Policy

Installation, repair, and inspection activities performed above the ceiling level in McLeod Health facilities shall comply with the requirements of the McLeod Health Above Ceiling Work Policy. Associated with this policy is an Above Ceiling Certification Training process, which is required for all contractors and McLeod Health staff in order to be approved to perform Above Ceiling Work in any McLeod Health facility. Only certified contractor personnel and staff may initiate/apply for Above Ceiling Work Permits or perform Above Ceiling Work.

Activities, which require above ceiling work, shall be performed in compliance with all applicable building codes, life safety standards and related McLeod policies, including but not limited to those identified in this Construction and Renovation Policy. Specific attention is required to Infection Control interventions during above ceiling work activity in patient care areas and other infection control risk group areas.

Installation and certain inspection and repair activities require an Above Ceiling Work Permit posted at the work location or in the possession of at least one of the McLeod certified above ceiling installers on the project.

The McLeod Health **Above Ceiling Work Permit** certification process consists of the following:

- Applicant Registration
- Infection Control requirements in patient care and infection control risk group areas
- Firestop Fundamentals
- Above Ceiling Work Policy
- Approval and assignment of Certification Number

Upon successful completion of the referenced training, the applicant will be issued a McLeod Health Certificate of Completion, a copy of which will be kept on file in the McLeod Health Engineering office. The applicant will be issued a McLeod Health Above Ceiling Work Policy Certification, which must be carried on the recipient's person while performing above ceiling work on McLeod Health facilities.

Note: This certification is required for all personnel installing new systems and services as well as for personnel performing routine visual inspections or conducting investigative and repair related activity.

OSHA General Duty Clause

Hazardous conditions or practices not covered in an OSHA standard may be covered under Section 5(a)(1) of the Occupational Safety and Health Act of 1970 which states: "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

General Inspections and Training

Contractors shall designate a competent site-safety coordinator for each job site. The contractor's site-safety coordinator shall be identified to the MPM in the event that safety concerns regarding the worksite arise.

Contractors shall initiate and maintain an inspection program to provide for frequent and regular self-inspections of the job site, materials, and equipment.

Contractors shall instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his or her work environment and to control or eliminate any hazards or other exposure to illnesses or injury.

The use of any machinery, tools, material, or equipment which is not in compliance with any applicable requirements of South Carolina Department of Labor, Licensing and Regulation, OSHA standards, or other AHJ is prohibited.

Medical Services and First Aid

Each contractor must ensure that they have a person trained to render first aid is to be available at the worksite. Should medical treatment of a Contractor's employees be necessary, such treatment is the responsibility of the contractor. Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use.

Hand and Power Tools

Electric power operated tools shall either be approved double-insulated, or be properly grounded, and used with ground fault circuit interrupters when used in damp or wet areas. When operating electrical equipment in or near oxygen-enriched areas, such as operating rooms special precautions may be required. Such work must be approved in advance by the Engineering Department.

Ladder Safety

Ladders must be inspected daily to ensure safety of components. Ladders that are deemed unsafe must be taken out of service. Supervisors and foremen are responsible to communicate with employees, which ladders are serviceable and which are not and may not be used. When not in use even temporarily, portable ladders must be taken down and laid flat.

Personal Protective Equipment

In designated workplace areas, contractor employees must wear hard hats, leather work shoes (hard sole, non-slip) and eye protection.

Electrical Safety

Always use grounded or double insulated power tools. Never defeat the ground of a power tool by using an adapter to plug a three-prong grounded plug into a two-prong non-grounded outlet. Frayed or damaged electric cords must be discarded and never used. Keep cords away from pedestrian traffic areas.

Housekeeping Chemical Use

Contractor employees are expected to maintain an orderly and safe jobsite. Daily cleanup of the jobsite is required. Keep floors and walkways clear by cleaning up spilled liquids, and keeping cords and other obstacles out of the way of pedestrian traffic. All cleaning materials and chemicals must be approved prior to use by the McLeod Health Environmental Services department. Improperly maintained jobsites shall be cleaned at the Contractors expense at the direction of the Director of Engineering or his/her designated appointee.

Safety Data Sheets (SDS) requirements

SDS are required for materials that are hazardous. As defined by OSHA Standard 1910.1200 (the OSHA HazCom Standard), a hazardous chemical is one which is a physical hazard or a health hazard. The Contractor is required to maintain SDS documentation according to AHJ requirements.

Health Hazard

The term "health hazard" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes.

Physical Hazard

The term "physical hazard" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

The following sources establish chemicals as being hazardous:

29 CFR part 1910, subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA) or, "Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment," American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition).

Hazard vs. Risk - A hazard is an inherent (built-in) property of a material. Risk is the extent to which that material can cause harm. One can reduce or remove risks associated with a hazardous material, but one cannot remove the underlying hazard itself (unless the hazardous material is completely removed). For example, gasoline is hazardous, but it does not have a significant risk when proper use and storage precautions have been taken.

No hazardous materials may be brought into a McLeod Health facility without prior written approval of the McLeod Engineering Department.

Prior to use, Contractors with a need to utilize hazardous materials or materials which may cause strong odors in the work process must:

Furnish SDS sheets for all materials to the MPM;

1. Have received prior written approval from the Directors of Engineering and Infection Control for use of any hazardous material;
2. Have copies of Safety Data Sheets (SDS) available at the job site at all times;
3. Ensure that all personnel present in the work area know and understand the hazards of all chemicals to which they will be exposed;
4. Ensure that all personnel present in the work area know how to protect themselves from any hazardous chemical being used in the work area; and
5. Establish and maintain an effective hazard communication program, which complies with OSHA standard 29 CFR 1926.59.

HAZCOM Program

When required, a contractor's HAZCOM program must provide:

1. A written hazard communication program,
2. An inventory of chemicals,
3. Safety data sheets (SDS) for all chemicals at the site,
4. Labeling of all containers and other warnings,
5. Employee training, and
6. Any additional requirements of AHJ.

Asbestos Containing Materials

Upon discovery of materials in the work area that may contain asbestos (Presumed Asbestos Containing Material, PACM) the Contractor must immediately contact the MPM. The MPM will then contact the Director of Engineering for testing. Upon discovery of PACM the contractor shall not disturb the areas containing the PACM.

Lead Awareness

Before operations on any paint that may contain lead, the contractor shall contact the MPM to arrange for testing and further direction.

Fluorescent light bulbs & PCB containing ballasts disposal

Personnel removing fluorescent light bulbs are responsible for examining the bulb to determine if the bulb should be recycled due to mercury vapor & lead content and making sure the bulbs are moved to a central collection point. (Green end caps or green writing on the bulb indicates the bulb is environmentally friendly and can be disposed of with other construction wastes.)

Personnel removing fluorescent ballasts are responsible for examining the ballast to determine if it contains PCBs (Polychlorinated Biphenyls), removing any PCB containing ballasts from the fixture, placing each ballast into proper containers, labeling the container to indicate that it contains PCBs and making sure the containers are moved to a central collection point.

Hazardous Work

Chemical fume hoods and related duct work require written request from the contractor to the MPM to initiate the hazardous work approval from the Engineering Department at least fourteen (14) calendar days before moving or repairing hoods or related ductwork.

Biological Safety Cabinets (BSCs)

The contractor will contact the MPM in writing to request approval for hazardous work from the Engineering Department at least **fourteen (14)** calendar days, **or other timeframe deemed appropriate by the McLeod Director of Engineering**, before moving or repairing cabinets or related ductwork.

Cold/Warm Room and related equipment

The contractor will contact the MPM in writing to request approval for hazardous work from the Engineering Department at least **fourteen (14)** calendar days, **or other timeframe deemed appropriate by the McLeod Director of Engineering**, before moving or repairing Cold/Warm Room or related equipment. Room users may require additional time to ensure removal of all items.

Rooftop Work

The contractor will contact the MPM in writing to initiate the hazardous work approval from the Engineering Department at least **fourteen (14)** calendar days, **or other timeframe deemed appropriate by the McLeod Director of Engineering**, before accessing the roofs.

Environmental Monitoring

The contractor is responsible for complying with the Environment of Care safety and health requirements during project activities as defined by classification of construction-type project, level of infection control precautions, and by other safety measures required to protect occupants in and/or near the project.

McLeod Engineering Department and Infection Control Department will perform field inspection and testing. When appropriate the McLeod Engineering Department and Infection Control Department will confirm negative airflow whenever barricades are erected or modified. McLeod Engineering Department and Infection Control Department personnel will also routinely monitor air quality throughout the project.

Medical Gas

Before any work involving the planned or possible interruption of medical gas services, Engineering Department approval is required. Contact the Engineering Department and the MPM in writing for this work. Personnel who work on medical gas systems must have appropriate medical gas certifications, which have been reviewed and approved by the Engineering department prior to working on these systems.

Electrical Hazards

It is very important that each contractor establish and maintain an effective electrical safety-related work practices program. References for such a program include OSHA standards 29 CFR 1910.331 to 1910.333 — Electrical Safety-Related Work practices and CFR 1926 Subpart K Electrical. Contractors are responsible to train all employees who face a risk of electric shock from working on, near, or with electrical circuits which are not reduced to a safe level by electrical insulation.

Lockout/Tagout

The lockout/tagout standard (the control of hazardous energy standard) in 29 CFR 1926.417 and 1910.147 will be followed by all contractors on all job sites. The OSHA lockout/tagout procedure requires at a minimum:

- Use of locks and/or tags on energy isolating devices.
- Special lockout/tagout procedures for jobs requiring multiple lockout/tagout devices.
- Contractors must provide their own lockout/tagout equipment.
- All contractor employees, (authorized, affected, and other employees), must be trained by the contractor (or another acceptable training source) concerning lockout/tagout procedures.
- An annual inspection shall be conducted by an authorized employee of the contractor to evaluate the implementation and efficacy of lockout/tagout procedures.
- Locks and/or tags must not be removed by anyone other than the employee applying them except under a special, approved permit.
- Testing or positioning of machines or equipment will be performed only under special procedures per OSHA 29 CFR 1910.147(f).

Contractors shall follow McLeod Health's defined lockout/tagout program when performing work at McLeod Health facilities. A written form will be required for lockout/tagout procedures for machinery on equipment which require more than one energy isolating device to be locked and/or tagged. Lockout/tagout procedures must be coordinated through the Engineering Department.

Confined Space Entry Program

Confined spaces present serious potential hazards to employees entering them including oxygen deficiency, toxic materials, flammable materials, and hazardous energy. Each contractor must adhere to McLeod Health's Confined Space Entry Procedures, which ensure compliance with OSHA standard 29 CFR 1926.21(b)(6) and 1910.146, as applicable. The contractor is responsible to provide all equipment required for safe entry, including special rescue equipment, when working in confined spaces. A McLeod permit, issued by the Engineering Department, is required prior to entry into confined spaces.

Fall Protection

Reasonable fall protection shall be provided to protect personnel from accidental falls associated with floors, platforms, scaffolds, guardrails, physical barriers, and elevated work locations. Standard guardrails must be provided by the Contractor for work locations six (6) feet or more above the adjacent level and fall protection generally provided over ten (10) feet per OSHA standard 29 CFR 1926.500. All employees working at unguarded locations above six (6) feet in construction (10 feet on scaffolds) must be protected by properly wearing approved fall protection equipment including safety harnesses and life lines as specified by supervision. All

employees required to wear approved fall protection devices must be properly trained concerning the need for and purpose of the protection. Contractor staff must be instructed in the proper use of the equipment and shall demonstrate that they know, understand, and can use the fall protection devices properly. The Contractor is responsible to provide all fall protection equipment and training, and the Contractor is responsible to ensure that fall protection devices are used properly by its employees.

Safety

Facilities, Equipment, Tools & Vehicles

All workplace facilities equipment, tools and vehicles must be properly designed and maintained to ensure safe operation. All workplace facilities, equipment, and activities must comply with applicable governmental regulations. Proper stairs, ladders, platforms, and guardrails must be provided to ensure employee safety and compliance with OSHA regulations. All equipment tools and vehicles used must be used in accordance with manufacturers operating instructions.

Education & Training

All managers, supervisors, and employees must be properly trained to recognize, evaluate, and control workplace safety and health hazards. No contractor shall allow their staff to perform a job until they have first been trained to perform the job safely. Specific training must be provided concerning the safety rules and procedures pertaining to the work being performed. McLeod Health Construction utilizes frequent refresher training such as tool box safety talks as a part of the safety training program.

Accidents

All accidents, incidents, injuries, and illnesses must be reported to MPM immediately to ensure proper investigation and employee protection. Injuries and illnesses requiring an "Employers' first Report of Accident" must also be reported to the MPM by forwarding an additional copy of the report to the McLeod Real Estate and Construction Department.

First Aid Kits

Contractors must provide adequately stocked first aid kits on their job sites for use by their employees.

Interacting with Patients and Hospital Staff

The staff of McLeod Health is always careful to ensure the comfort and welfare of patients, visitors, and coworkers. Even if only temporarily, contractor employees may be viewed by patients and visitors as a part of the hospital work force and may even be perceived as hospital employees by patients or visitors. All contacts with patients, visitors and staff should demonstrate respect for the individual. Any action or words that suggest bias or prejudice are inappropriate. Everyone is responsible for adhering to these guidelines and must report inappropriate actions to a McLeod supervisor or the MPM.

Appropriate Behavior

McLeod Health promotes a healthy work environment. Appropriate behavior by everyone is expected. Reports of inappropriate behavior will be investigated and possible disciplinary action will be taken.

Whistling, inappropriate language, and any other gesture that is perceived to be offensive to McLeod Health employees and guests will not be tolerated.

Entering Patient Rooms

Non-healthcare contract workers may enter patient rooms only after making arrangements with the MPM and the McLeod Nursing Department Director with responsibility for patient care in the area. The MPM is responsible to coordinate all work within a clinical care area with the nursing director and nursing staff as applicable.

Workplace Setup

All work areas must be marked off with cones, tape, barriers, or other traffic diverters. Hallways may never be blocked without first making arrangements with the MPM or the Engineering department. Tools and materials must be safely secured or packaged when unattended. Items must not be left in a way that could injure an employee, patient, or visitor.

Tools and materials must also be safeguarded against vandalism or theft.

Slip/trip hazards must be addressed or barricaded in such a manner to as to mitigate risk to hospital staff and patients.

Signage

McLeod Health maintains signage in the hospital buildings to assist patients, visitors, and staff with way-finding. Construction or renovation contractors are expected at all times to ensure that proper signage remains posted as facilities are modified or new construction is added.

Construction Project Signage

McLeod Health has approved sign packages for use in all construction areas. These may be obtained through the MPM. The McLeod Health Interiors Architect is responsible for ensuring the placement and coordination of all project signage. Hand written signs must not be used. Do not tape signs to doors or walls. For questions or to obtain additional project signage, please contact McLeod's Interiors Architect.

Construction Area Inspections

It is the responsibility of Safety and Quality Control Officer to inspect construction areas routinely. These checks will include but will not be limited to:

- Entrance and exits free from obstruction;
- Check that all fire notification is in working order or that a fire watch is in practice;
- Exits and passageway inside construction are free from obstruction;
- No smoking policy is obeyed (check for cigarette butts);
- Dust partition in place where necessary, no open holes, accessibility to construction area restricted;
- Machinery turned off when unattended;
- Check for water leaks;
- Check for proper storage of chemicals or other hazardous materials; and
- Check for odors of smoke, fumes or other fire hazards.

If an unsafe condition is detected, notify the McLeod Project Manager (MPM) and the Safety and Quality Control Officer immediately. Upon receiving such notification, these individuals must act immediately and in accordance with the severity of the situation.

Contaminants Safety Rule

As Contractors may be working in areas where contaminants may be located, all universal precautions must be strictly adhered to.

Post-accident Testing

During the course of the workday, a contractor employee may be subject to drug and/or alcohol testing, if he/she has:

- Been injured on the job,
- Caused injury to another person,
- A Blood Borne Pathogen incident;
- A safety incident involving damage to property or equipment, or
- Been involved in a “near accident” during the course of the workday

During the course of the workday, a contractor employee who has work related injuries/incidents, which require treatment by a Provider/Physician (Nurse Practitioner, Physicians Assistant, Medical Doctor, Doctor of Osteopath, Chiropractor) will REQUIRE a drug and alcohol test, with the exception of respiratory exposures (influenza, pertussis, tuberculosis, etc.).

Universal Precautions

When deemed appropriate by the Infection Control department, barrier protection should be used to prevent skin and mucous membrane contamination with blood, body fluids containing visible blood, or other body fluids (cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluids, semen, and vaginal secretions). Barrier protection should be used with ALL tissues. The type of barrier protection used should be appropriate for the type of procedures being performed and the type of exposure anticipated. Examples of barrier protection include disposable lab coats, gloves, and eye and face protection. Gloves are to be worn when there is potential for hand or skin contact with blood, other potentially infectious material, or items and surfaces contaminated with these materials. Face protection (face shield) should be worn during procedures that are likely to generate droplets of blood or body fluid to prevent exposure to mucous membranes of the mouth, nose, and eyes. Protective body clothing, such as disposable laboratory coats (Tyvek), is appropriate when there is a potential for splashing of blood or body fluids. Wash hands or other skin surfaces thoroughly and immediately if contaminated with blood, body fluids containing visible blood, or other body fluids to which universal precautions apply. Wash hands immediately after gloves are removed. Avoid accidental injuries that can be caused by needles, scalpel blades, laboratory instruments, etc. when performing procedures, cleaning instruments, handling sharp instruments, and disposing of used needles, pipettes, etc. Used needles, disposable syringes, scalpel blades, pipettes, and other sharp items are to be placed in puncture resistant containers marked with a biohazard symbol for disposal.

Dust and Dirt

Patient and public areas must be protected from dust, dirt, and other construction-related contamination. The use of dust barriers may be required in some situations. Construction activities causing disturbance of existing dust, or creating new dust, must be conducted in tight enclosures cutting off any flow of dust particles into adjacent occupied areas. Before any construction begins, all on site workers must be briefed to ensure full compliance with the dust control measures in the construction documents.

Traffic Control

When a project includes motorized and pedestrian traffic control, the MPM, Contractor, and Director of Engineering will consult with the Director of McLeod Security to determine the safest routes and procedure to facilitate this traffic. Whistles and other devices used to control traffic may be used only with the consent of McLeod Security, and for the purpose of traffic control only. If you must get the attention of someone crossing the street, please do so as respectfully as possible.

Designated Entrance and Exit Routes

The MPM shall consult with the Director of McLeod Security and other appropriate McLeod personnel to define entrance and exit routes for contractors that provide the least amount of interference with patient care initiatives. These routes must be able to accommodate the safe transport of construction equipment and debris. Contract workers will be required to use only these routes while on the worksite.

When access to patient entrances, roadways, parking areas, or critical care areas is impeded, the Contractor must provide fourteen (14) days advance written notice to the MPM prior to beginning any work. MPM must coordinate all such work with McLeod Real Estate and Construction, McLeod Security and McLeod Engineering. If access for critical or emergency vehicles, such as ambulances, fire trucks, or other rescue vehicles is obstructed, applicable agencies and providers must be notified by the MPM of alternate routes.

Basic Safety & Other Rules

All employees, contractors and subcontractors are expected to comply with the following basic safety rules:

- Vehicles must observe the posted speed limit. Unless otherwise posted, there is a campus wide speed limit of 15 mph.
- Do not pass other vehicles on campus unless the other vehicle is parked in a designated parking area and out of the lane of travel.
- Obey all posted warnings.
- Smoking and the use of any tobacco product is prohibited in all buildings and on all grounds, public walks, and landscaped areas of all McLeod campuses.
- Fighting or horseplay is prohibited.
- Firearms are prohibited.
- Contractors must remain in designated areas at all times and use approved travel routes into and out of site.
- Work areas must be maintained in an orderly manner that does not block exits or traffic through the work area.
- Always be aware that dust, debris, water or equipment can fall through the floor to the space below your work area.
- No radios of any type are allowed in any building while under construction.
- Treat our patients and staff respectfully.
- Whenever a wall is being removed, you must make certain that the areas below to the ground floor are protected.
- All chase-ways do not end on the ground floor. Some may end in the middle of a previously renovated area.
- Do not use red bagged trash containers.
- No debris or materials may be carried onto an elevator with a patient.
- Trash must be removed daily utilizing approved covered containers and routes
- Only use designated bathroom facilities and vacuum clothing if dust covered prior to leaving work areas.
- You must control access to work areas at all times (a small child won't know it is a construction area). This will require appropriate signs, barriers, barricades, etc.
- Standard McLeod construction signage will be supplied by McLeod's Interiors Architect. Handwritten signs are forbidden
- Use of elevators - Patients First: You must get off an elevator, if a patient in a bed or wheelchair needs to get on and there isn't enough room.
- There should always be a clear passage through construction areas, move equipment to the side.
- Fire extinguishers must be available. You are responsible for knowing where they are located.

Enforcement

For breach of the Environment of Care Requirements for Construction, Demolition, Renovation, and Installation Projects, McLeod Health will stop the work of the Project and the Contractor shall pay for all associated costs incurred by McLeod Health as well as for correction for the work. As applicable, the appropriate McLeod department or departmental personnel will record the following:

- Record and document each violation with photographs.
- Extract Contractor or Department information from the work log.
- Maintain a record of all infection control violations.
- Violations of infection control policies may affect status as a responsible Contractor for bidding future work.
- If you are using something that gives off a foul odor, notify the Engineering Department before use. (The ventilation may need to be shut-off). Do not leave open containers in work areas. Also do not leave paintbrushes in thinner or anything open that will give off an odor.
- Construction barriers are there for a reason--do not damage or remove sections or perform work outside of these barriers without authorization
- Do not remove or compromise the negative air pressure within a construction area.
- All penetrations into a fire, smoke or corridor wall penetrations must be sealed with a fire resistant sealer.

Action Plans

Developing an Action Plan

Depending upon the anticipated impact of work being performed, you may be asked to prepare an Action Plan specific for the planned activity. Action plans go hand in hand with decision making. They involve the concrete activities and things that must happen to bring decisions to life, and often knowing how to implement the decision is as important as the decision itself.

It is important to place first things first. Long before developing an action plan, one should:

1. Understand the problem/issue you're faced with and trying to resolve;
2. Develop goals and solutions to the problem;
3. Evaluate these possible goals and solutions; and
4. Decide upon goals and solutions -- or, make a decision.

This four step process describes the decision making process as a whole. The final step involves implementing your decision, or bringing it to life.

Think through and identify the actual steps necessary to take to achieve selected goals and solutions.

When is an Action Plan Required?

Although most day-to-day decisions don't need action plans, the more complex or important the decision, the more an action plan becomes a useful tool. At the other end of the decision making spectrum, there are some decisions that absolutely require a carefully developed action plan: fully identifying all electrical circuit components and completely labeling all electrical panels in the hospital; repairing all steam leaks and replacing faulty valves; repairing aged AHUs, on-going service requirements for equipment, as examples.

Separate Action from the Decision

Remember, the action plan follows the decision; it's the process that brings the decision into reality, but it's not the decision making itself. Your action plan will help you to determine the steps you must take to fully label the circuits in an electrical panel, but the decision to label the panel came first. The plan follows the decision.

Action Steps

A clear plan provides a way to think through, map out a solution, and identify the things that have to happen to make the dream a reality. An action plan is built on at least three things:

1. Understanding the problem/issue. This is more than simply knowing you have a decision you want to implement, a problem you want to solve, or

a need you want to meet. It means having a sense of the causes of the problem or the nature of the issue.

2. A goal. What do you actually want to accomplish? How will you know you've fixed the problem or met the need?

3. Action steps. What will you actually do to address the situation? Steps might include listing expenses, what supplies have to be ordered, what lead

times would be needed for special items, evaluating sources of labor and equipment (inside and outside the organization). A second set of steps in

this same scenario will involve how you implement your work, what hospital services might be impacted, what is the effect on patient care, etc.

The basic idea is that there are clear things you have to do to get your plan off the drawing board and into reality.

When thinking about putting the steps into action, it's important to also consider resources available to draw upon in order to complete the plan, what resources are realistically available, what obstacles must be overcome, and what alternatives are available as fall backs, if necessary.

Good action plans meet the "SMART" criteria, that is:

1. Specific
2. Measurable
3. Actionable & Acceptable
4. Realistic & Relevant
5. Timeframe

Penalties and Fines for Non-Compliance

McLeod Health places the highest priority on Life Safety.

Contractors are required at all times to utilize and follow code compliant means and methods in their work. Violations of any code can have potentially egregious and life-threatening consequences. Violations of code requirements or falsification of any inspections, reports, etc., particularly those regarding the means and methods for handling, cutting, and installing medical gas systems are not tolerated.

Companies whose employees violate code requirements will be fined \$1000 for each instance of a first occurrence. Individuals who violate code requirement knowingly or unknowingly will have their work privileges permanently revoked at all McLeod facilities. The supervisors of individuals who violate code requirements are also subject to having their work privileges revoked at all McLeod facilities.

Contractors or service providers whose employees violate code requirements on a second offense will be fined \$2500 per occurrence and will have their work privileges at McLeod facilities revoked until such time as: (a) all fines have been collected by McLeod in full, and (b) the company's project manager, project superintendent, project supervisors, all lead personnel and all employees who will work on a McLeod facility have successfully attended a Life Safety education class conducted by McLeod Health at the contractor's expense. Successful attendance of individuals is solely at the discretion of McLeod Health and is not subject to dispute or challenge. Companies which perform inspections of medical gas systems or whose representatives or employees inspect or verify work on medical gas systems and whose employees witness improper means and methods and who fail to (a) stop work immediately, and (b) report the names of violators and their companies will be dismissed immediately and will be subject to a fine of \$2500. Individuals who falsify reports or inspections shall have their work privileges permanently revoked at all McLeod facilities. Companies whose employee's falsification reports or inspections will be subject to a \$5000 fine and immediate termination of their contract without recourse and forfeit of bond.

Prior to payment of any balance due or claimed McLeod may choose at its sole discretion to deduct any fine from the fees, invoices, billings, or claims such companies may make. Fines may not be offset or recovered by contractors, service providers or their companies.

Contractors whose employees commit three offenses will be subject to additional fines and may have their privileges to perform work on all McLeod premises permanently revoked.

References regarding installation of medical gas systems - **NFPA 99C, Chapter 5**

McLeod Health Green Book

Introduction and Purpose

McLeod Health has been, and continues to be, committed to conducting its business in full compliance with all federal, state and local laws. McLeod Health has also long been committed to preventing and detecting non-compliance with these laws. The mission of the Corporate Compliance Program is to aid in the detection, prevention and remedying of compliance issues. The intent is to educate employees about the program and to guarantee full access to all mechanisms to safely report and remedy non-compliance issues.

Creating and reinforcing a corporate culture that embraces compliance is a top priority for the McLeod Health organization's Board of Trustees. Our values of quality, caring, the person, and integrity are the very foundation of all that we do at the McLeod Health organization for our patients and for each other. These values are held dear by our employee population and are introduced to all new employees who join the McLeod Health organization family upon employment.

Code of Conduct

The Board of Directors of McLeod Health considers it desirable to publish this Code of Conduct in order to assist officers and employees in avoiding both the fact and appearance of improper corporate activities and to assure that all applicable laws are obeyed. This publication is to be distributed to all new employees at the commencement of their tenure with the McLeod Health organization. Finally, it will be every employee's responsibility to read and understand this pamphlet on personal integrity and to continue to conduct his or her day to day activity with the highest degree of personal integrity.

All members of McLeod Health and its subsidiary organizations including members of the Medical Staff and Board of Trustees are expected to conduct their work-related activities in accordance with the highest personal and ethical standards. Individually, each member is accountable for conducting McLeod Health activities with integrity, operating in compliance with all McLeod Health policies and applicable laws, and avoiding situations where personal interests are, or appear to be in conflict with the interests of McLeod Health. All members of the McLeod Health family are expected to comply with all Federal Healthcare program requirements for all programs in which McLeod Health participates. A copy of the McLeod Health Compliance Manual shall be available in each department of McLeod Health. The following provides a summary of certain standards of conduct, which are included in various McLeod Health policies, publications, and guidelines.

Conflict of Interest

The term "conflict of interest" refers to situations in which financial or other personal considerations may compromise, or have the appearance of compromising, professional judgment. Such conflicts may affect the collection, analysis, and interpretation of data, as well as the hiring of staff, procurement of materials, issues related to public relations and misuse of the McLeod name.

The mere appearance of a conflict of interest may be as serious and potentially damaging as a known conflict of interest, and should be evaluated and managed with the same degree of consideration. Each staff member shall give prompt notification to his or her supervisor of any situation that may involve a conflict of interest. Annually, Administration and the Board of Trustees shall review the McLeod Health conflict of interest policy and each person shall disclose any duality or conflict of interest in accordance with the policy.

Confidential Information

All McLeod Health staff have an obligation to conduct themselves in accordance with the principle of keeping all information concerning patients confidential. Staff members also should refrain from revealing any personal or confidential information concerning other staff or business operations. Any carelessness or thoughtlessness in this respect leading to the release of such information is not only wrong ethically but may result in legal action against the individual and McLeod Health.

Professional Relationships

McLeod Health does not seek to gain any advantage through the improper use of business courtesies or other inducement. Good judgment and moderation must be exercised to avoid misinterpretation and adverse effects on the reputation of McLeod Health. Offering, giving, soliciting or receiving any form of compensation is prohibited.

Commissions, rebates, discounts, and allowances are customary business inducements, but careful attention is needed to avoid illegal or unethical payments. Such payments must be reasonable in value, competitively justified, properly documented, and made to the business entity to which the original agreement or invoice was made or issued. They will not be made to individual officers, employees or agents of such entity, or to a related business entity. No such commissions, rebates, discounts, or allowances will be given/received in order to induce referrals of patients to McLeod Health.

Tips, Gratuities, and Gifts

McLeod Health takes pride in its reputation for excellence in healthcare and service to its patients. This reputation has in part been established by the selfless personal attention given to patients by McLeod Health staff members.

Therefore, acceptance of tips, personal gratuities or expensive gifts by McLeod Health staff members, as members of the healthcare profession, is considered improper and highly unprofessional and will not be allowed. If the individual wishes to present a monetary gift, he or she should be referred to the McLeod Foundation office. Inexpensive non-monetary gifts that cannot be shared with co-workers may be used for personal purposes. Whenever a staff member has a doubt about the appropriateness of an inexpensive gift, his or her supervisor should be consulted.

McLeod Health organization employees who deal with suppliers must do so in a reputable, professional, and legal manner. To avoid the appearance or impropriety, McLeod Health employees should decline any gifts, tips or personal gratuities from vendors and patients. Vendors or suppliers hosting meals for a department as a thank you for doing business is permissible as long as every staff member is included, the meals are not extravagant and are not conducted on a frequent basis by the same vendor or become an expectation by the department. Discounts that are available to all McLeod Health employees and employees of other companies may be accepted.

Government Relations

Members of the staff are encouraged to be aware of government policies affecting McLeod Health activities and to direct concerns to Administration. Communications with government officials expressing an institutional position will be reviewed by the President of McLeod Health or by the Board of Trustees for approval. This requirement, however, is not intended to inhibit individual communications addressed to government officials written on personal letterhead and expressing personal opinions. McLeod Health does not make political contributions.

Valuing Individual Diversity

It is a McLeod Health principle to promote cultural diversity and equality of opportunity. Therefore, members of McLeod Health staff should respect the rights, dignity, and cultural differences of individuals at all times. Harassment of any type will not be tolerated.

Protection and Use of Assets

Travel and Entertainment

Travel and entertainment must be consistent with the needs of McLeod Health. McLeod's intent is that an individual should neither lose nor gain financially as a result of business travel and entertainment. Individuals are expected to spend McLeod's money carefully as they would their own.

Reporting Integrity

All financial reports, accounting records, expense accounts, time sheets and other documents must accurately and clearly represent the relevant facts or the true nature of a transaction. Improper or fraudulent accounting, documentation or financial reporting is contrary to the policy of McLeod Health and also may be in violation of applicable laws.

Internal Controls

McLeod Health has established control standards and procedures to ensure that assets are protected and properly used and that financial records, reports, and bills are accurate and reliable. All members of the McLeod Health staff share the responsibility for maintaining and complying with required internal controls and applicable laws and rules of federal and state programs

Compliance

All McLeod Health staff members are expected to comply with the McLeod standards of conduct, the McLeod Health Compliance Program and McLeod Health's policies and procedures. When in doubt, it is each individual's responsibility to seek clarification from their supervisor or Administration. Individuals who conduct themselves in ways incompatible with these standards are subject to dismissal. Employees who are aware of suspected misconduct, fraud, abuse of the institution's assets or other violation of the ethical standards of McLeod Health are responsible for reporting such matters to their supervisor or if they prefer, to the Department of Human Resources, the Corporate Compliance Officer or a member of the Corporate Compliance Office. Every effort will be made to protect the identity of the reporting individual, or an individual may elect to report anonymously. The Corporate Compliance Officer shall be primarily responsible for investigating such reports. At the conclusion of the investigation, upon recommendation by the Corporate Compliance Officer, management shall take timely remedial or other action as required by the circumstances.

Responsibilities of Employees

Each employee must know what the Compliance Program expects of employees, abide by these expectations, and be sensitive to situations that could lead to a violation of those expectations. McLeod Health will do everything possible to clearly convey each employee's responsibilities. If any employee is unclear about obligations under the Compliance Program, seek clarification from a manager, department head, or the Corporate Compliance Officer. Claims of ignorance or good intentions or bad advice, moreover, will not excuse noncompliance. It is essential, therefore, for all employees to know and obey their responsibilities under the Compliance Program.

The McLeod Health organization considers the actions of each employee under these policies to be significant indications of judgment and competence. Accordingly, those actions constitute an important element in the evaluation of the employee for position assignments and promotions.

Your business decisions and behavior while employed by McLeod Health should be governed by the principles contained in this publication and those contained in the Corporate Compliance manual. It is your responsibility to report any violations or suspected violations, according to the instructions Policy.

Failure to comply with these policies and failure to report possible misconduct may result in termination or other disciplinary action, civil penalties or criminal charges. Consequences to McLeod Health could be substantial monetary fines and loss of McLeod Health integrity.

Managers' Responsibilities

Managers of McLeod Health must ensure that the employees they supervise understand and comply with McLeod Health's high standards of business conduct. Managers must communicate the importance of compliance to every employee and actively promote adherence to the Compliance Program.

All department directors have been designated as Compliance Liaisons who have direct exposure to line employees. The Compliance Liaison's key role is to encourage the free exchange of comments, suggestions, and observations among the employees and to encourage employees to raise any compliance issues. The success and efficiency of the Compliance Program relies heavily on the participation of all employees and the Compliance Liaison is the pipeline that facilitates this communication. All managers must see to it that any actual or potential compliance issues be reported to a supervisor/department head, and/or the Corporate Compliance Officer. In addition, all managers must be accessible to employees who wish to report compliance issues. Managers also have the responsibility to ensure that no employee is retaliated against, in any way, for reporting a compliance issue when such reporting was made in a timely manner and in good faith.

Not less frequently than annually, review with your direct reports and such other employees as you may select this Code of Conduct and the McLeod Health Compliance Program.

Reporting Process

All members of the McLeod Health family are encouraged to report questionable conduct or concerns. There are many ways to do this.

Hot Line

The purpose of the Hot Line is to encourage the reporting of possible unethical or illegal conduct. Calls to the Hot Line should be thorough and contain enough information to conduct a proper investigation. Confidentiality is assured to the extent possible. No retaliation or harassment will be taken against anyone for using the Hot Line to make a report or to ask a question. The Hot Line number is 1-888-679-3531.

Drop Boxes

Drop Boxes can be found around McLeod facilities for the use of McLeod Health employees, personnel and/or patients. The Drop Boxes can be used as reporting mechanisms for persons who wish to report suspected misconduct or abusive procedures. This report may be anonymous, but McLeod Health encourages the reporting of all relevant information.

Ethical Conduct in the Workplace

Display good judgment and high ethical standards in your daily work activities.

All of the McLeod Health organization's business affairs must be conducted with honesty, fairness and integrity. These qualities are evidenced by truthfulness and the absence of deception or fraud. No set of standards, written rules, or procedures can substitute for the personal integrity, good judgment, and common sense required to meet the challenges of the daily work of McLeod Health employees. This is why it is essential that everyone have a sense of workplace ethics and honesty and a commitment to them.

Advertising and Marketing

Sell the McLeod health organization's services and products fairly and honestly, stressing their value and merits.

The McLeod Health organization's employees shall market and advertise McLeod Health organization's services and products fairly, honestly and in a non-deceptive manner, stressing their value and merits. Do not use tactics that misrepresent the McLeod Health organization's products and services or that unfairly undermine the products and services of a competitor. This includes the use of disparaging comments or innuendoes.

Financial Records

Keep honest and accurate financial records.

You must ensure that any financial record for which you are responsible accurately reflect transactions. The McLeod Health organization has created and implemented specific fiscal policies and procedures to ensure that the financial activities of the McLeod Health organization are recorded in accordance with generally accepted accounting principles and that financial information is fairly stated. The McLeod Health organization's books and records must not contain any false or misleading information and must conform to generally accepted accounting principles and the Finance Division's specific policies and procedures.

No undisclosed or unrecorded funds or assets may be established. All items of income and expense and all assets, allowances, and liabilities must be entered in the McLeod Health organization's financial records and must accurately and adequately described.

All payments must be for the purpose stated. All reports submitted to governmental authorities must be accurately made and all transactions shall be executed in accordance with management's authorization.

Proprietary McLeod Health Organization Information

Proprietary information about the McLeod Health organization must be kept confidential.

Proprietary or confidential information developed or acquired by the McLeod Health organization and not generally available to others is a valuable asset of the McLeod Health organization and must be kept confidential and be protected against theft, loss or improper disclosure. You shall not discuss, disclose or permit the disclosure of proprietary McLeod Health organization information, data, systems, pricing, finances or policies to any competitor of the McLeod Health organization or to any person who might be in a position to disclose such matters to the McLeod Health organization's competitors.

McLeod Health Organization Property

Use McLeod Health organization property for business only. Do not use McLeod Health organization property for personal reasons. The McLeod Health organization's assets, such as equipment and office supplies, must not be taken out of the McLeod Health organization facilities except for purposes of performing your job. If removed from the McLeod Health organization facilities, the property must be returned to the facility when it is no longer needed for McLeod Health organization business purposes.

Conflict of Interest

Each employee has a duty of loyalty to the McLeod Health organization.

McLeod Health organization employees and staff must avoid any action that may involve, or may appear to involve, a conflict of interest with their obligation to the McLeod Health organization.

Personal Activity

You may not realize any profit or gain as a result of your position with the McLeod Health organization apart from the McLeod Health organization's compensation/benefit programs. You must not become involved in non-McLeod Health organization related interests to the extent that you spend a substantial portion of the McLeod Health organization's normal business hours on such other interests.

A conflict of interest occurs if your activities or personal interests appear to or might influence the business decisions required by your responsibilities, are detrimental to the business of the McLeod Health organization, or result in an improper or illegal gain for you or a third party.

Employees should not hold a significant financial interest, serve as a director or officer of, receive compensation from, or provide consultation or other services to suppliers of the McLeod Health organization and its facilities, or competitors of the McLeod Health organization, in the health care industry without written consent of their supervisor. This does not, however, apply to personal investments in shares or other securities of corporations traded on major securities exchanges.

Outside Employment

McLeod does, however, recognize the fact that an employee may be justified under certain circumstances in accepting casual outside employment after working hours. Please refer to the Human Resources Policy and Procedure Manual, policy number 18322.300.85 on Outside Employment, for a full explanation of this established policy.

Disclosure of possible conflicts of interest

If any member of your immediate family (spouse, parents, brothers, sisters, and children) works for or consults with the McLeod Health organization, a supplier, a customer or competitor, you must disclose the relationship. Employees should disclose possible conflicts of interest involving themselves or their immediate families to their supervisor or the Corporate Compliance Officer who will evaluate the situation and provide any necessary guidance to avoid any appearance of impropriety.

Tips, Gratuities, and Gifts - Suppliers/Vendors

Billing

Always bill correctly for services rendered. McLeod Health bills only for services rendered, and all bills must comply with billing requirements for government-sponsored programs and other payers. McLeod Health employees must exercise care in assuming the accuracy of any written or oral report, including cost reports, made to any government agency or to the payer. McLeod Health will not tolerate false billings or false reports by McLeod Health employees to a government agency or other payer. Deliberate inaccurate billings or reports to government agencies or other payers may expose an employee to civil and criminal penalties as well as termination of employment and loss of benefits.

No Payments for Patient Referrals; No Prohibited Arrangements with Physicians

McLeod Health will comply with all laws pertaining to Medicare and Medicaid and other federal programs, including all laws involving fraud and abuse of these programs.

There are a number of laws governing Medicare and Medicaid and other federal health programs. These laws prohibit the payment of remuneration in return for the referral of Medicare or Medicaid patients or to induce the purchase of goods or services to be paid for by Medicare or Medicaid. They also prohibit making false claims for Medicare or Medicaid reimbursement.

No employee shall solicit or receive, or offer to pay or pay for remuneration of any type (including kickbacks, bribes or rebates) in return for referring or recommending the referral of an individual to another person, hospital or medical facility for services or in return for the purchase of goods or services

No employee shall offer or grant any benefit to a referring physician or other referral source on the condition that such physician or referral source refer or agree to refer any patients to the hospital.

You are urged to use caution when engaging in transactions that involve referral sources. Every agreement involving compensation or cross referrals with a physician or other referral source must be reviewed by legal counsel prior to its execution.

Compliance with Environmental Laws

The McLeod Health organization will protect the environment in its operations.

The McLeod Health organization is committed to promoting sound corporate environmental practices that will prevent damage to the environment, enhance human and community resources, and reduce or avoid exposure to environmental liabilities. If you detect an existing or potential condition hazardous to human health or the environment, you should report the condition immediately to the officer, department head or administrator to whom you have functional responsibility.

Prompt disclosure of such events is critical to effective remedial action and to McLeod Health organization's efforts to ensure that such events do not recur. Employees with responsibility for the proper handling and disposal of hazardous substances and infectious waste should ensure that contractors hired to dispose of such materials do so in a proper manner.

Compliance with Antitrust Laws

The McLeod Health organization will not engage in anti-competitive conduct in violation of antitrust laws.

Under the antitrust laws of the United States, certain agreements, whether explicit or implicit, with competitors, customers or others may constitute punishable crimes and result in severe personal and institutional civil damages if they produce an unreasonable restraint of trade or substantial lessening of competition.

Examples of conduct that may be anti-competitive include exclusive buying or selling agreements and certain mergers and acquisitions. The facts of a particular course of conduct are important to an evaluation of the anti-competitive consequences of such conduct and require expert legal guidance.

The McLeod Health organization recognizes that routine communications with competitors are appropriate and reasonable in many instances, but communications with competitors about matters that could be perceived to have the effect of lessening competition should take place only after consultation with legal counsel.

General business information about its competitors is important to the McLeod Health organization's efforts to maintain and improve upon its competitive position in the markets in which the McLeod Health organization operates. However, only legal and ethical means should be used to gather information about existing and potential competitors. You shall not:

Respond to any inquiry or survey from a competitor that requests information on prices, wages, marketing activity, acquisition or development plans, or any other competitive information;

Request from a competitor information on acquisitions or development plans or prices the competitor charges or pays for any goods or services; or

Knowingly share with a competitor, directly or through a third party, information regarding pay scales, wages, salary ranges or compensation formulas. Competitive information should be collected only from generally available industry sources and from information within the public domain; however, you may respond to appropriate requests for competitive information when the information is being gathered confidentially by a third party (e.g., Joint Commission on Accreditation of Healthcare Organizations, a government entity or a hospital association), and when such information will be made available to others only in summary form so no individual competitor is identifiable.

Payments or Gifts to Government Officials

Do not use McLeod Health organization funds for improper or illegal activities.

You may not make payments to government officials to secure sales or obtain favorable treatment. Gifts of substantial value to or extravagant entertainment of government officials or employees is prohibited because these actions could be construed as attempts to influence government decisions. Gifts, assistance or entertainment provided for any government official or employee should not compromise or appear to compromise that person's integrity. You also cannot use corporate funds to contribute to a political party, committee, organization or candidate. You may make personal contributions of your own choice, but such contributions are on a voluntary, personal basis and are not subject to reimbursement by the McLeod Health organization.

Equal Employment Opportunity

The McLeod Health organization does not discriminate in its employment practices. Employees will be treated with respect and courtesy.

No person may be discriminated against concerning recruitment, employment, promotion, termination of employment or any other term or condition of employment because of such person's race, color, creed, religion, age handicap, national origin, or any other bias prohibited by federal, state, or local law. No employee of the McLeod Health organization shall engage in any type of conduct whatsoever that could be construed as sexual harassment under the guidelines established by the Equal Employment Opportunity commission and as established by McLeod Health organization's policy prohibiting sexual harassment.

Policy

The McLeod Health organization will maintain a safe and healthful work place.

The McLeod Health organization and its employees are responsible for maintaining a safe and healthful work environment. The McLeod Health organization and its employees must comply with all federal, state, and local health and safety laws and regulations, including the rules and regulations of the Occupational Safety and Health Administration ("OSHA").

Government Requests

Consult the Corporate Compliance Officer about any non-routine requests from national, state and municipal government agencies for information.

It is the McLeod Health policy to cooperate with reasonable requests from any government agencies concerning the McLeod Health operations. The fact that a law enforcement agent requests information from McLeod Health does not mean a crime has been committed or even that the agent has concluded a crime was committed. If law enforcement agents seek to contact you directly, you are advised:

To ascertain the proper credentials of the investigator, including the name of the investigator, agency involved, and scope of the investigation;

That you have the right to speak or decline to speak, as all such conversation by you is entirely voluntary;

That you have the right to speak to an attorney before deciding to be interviewed;

That you can insist that if you agree to be interviewed, that an attorney be present. McLeod Health requests that you advise your supervisor, the Corporate Compliance Officer or the hospital attorney before responding to any requests which are outside the ordinary scope of routine reports which are regularly made to governmental authorities

Definitions

Building Life Safety System: the combination of individual Life safety features which maintain the compliance of the building with NFPA 101 Life Safety Code.

Life Safety Feature: A single component of the Building Life Safety System. May include but is not limited to, exits, doors, fire alarm system and automatic sprinkler system.

Risk Assessment: An evaluation of the effect any construction, renovation or alteration activities will have on the Building Life Safety System and the required measures to insure continued and equivalent protection to the building occupants during such activities.

Alternate Life Safety Measures (ALSM): Measures implemented to ensure an equivalent level of protection is provided to the building occupants when construction, alteration, or renovation activities temporarily impair a Life Safety Feature. May also be used during the time between the identification of a Building Life Safety System impairment and the PFI (Plan for Improvement) Project Completion

Construction, renovation or alteration activities: Activities inside of or around buildings which affect the Building Life Safety System. This may include small projects of one room or less to larger renovation areas of two rooms to the entire building.

Deactivations: The advance approval to temporarily impair part or all of a building Fire Protection System or utility service to perform required work. Deactivations must be approved by the McLeod Health Engineering Department before impairment of systems may occur.

Hot Work Permits: Permits requested by the project representative allowing work activities in buildings involving the use of possible ignition sources (i.e. welding, cutting, soldering etc...) Permits must be obtained from the McLeod Health Engineering Department before the work starts and shall be posted at the site of work.

Fire Watch: A method used to monitor an area for excessive combustible or flammable material build-up and for early detection of fires and potential ignition sources. A person (police, contractor, EHS) may be specifically assigned to provide a fire watch by observing ongoing hot work or perform a periodic visual check of the work site, floor, or entire building during periods where a Life Safety Feature is impaired.

Attachments:

1. Infection Control Risk Assessment (ICRA). Revision date: 03/18
2. Alternate Life Safety Assessment (ALSA). Revision date: 10/15/18
3. Engineering Action Plan. Revision date: 11/15/19
4. Interim Life Safety Matrix (ILSM) for Impairments with Durations Greater than Four (4) Hours. Revision date: 11/15/19

ALTERNATE LIFE SAFETY ASSESSMENT

PROJECT TITLE _____

ESTIMATED: PROJECT START DATE _____ COMPLETION DATE _____

ASSESSMENT		YES	NO
A.	Will any exits become blocked or obstructed and will temporary exit signage identifying alternate exits be necessary? IF YES, DO 1, 2 & 3		
B.	Will access to the ER become blocked or obstructed? IF YES, DO 1, 4 & 11		
C.	Will part of any fire alarm, detection, and/or suppression system be impaired or shut-down more than 4-hrs in a 24-hr period? IF YES, DO 5, 6, 9, 10 & 11		
D.	Will temporary, but equivalent fire alarm, detection, or fire-fighting equipment be necessary? IF YES, DO 2, 3, 6, 9 & 10		
E.	Will smoke or fire walls be breached or structural or compartmental fire safety features compromised? IF YES, DO 2, 3, & 10		
F.	Will it be necessary to erect any temporary construction partitions? IF YES, DO 7 & 11		
G.	Will the project result in the accumulation of debris or construction materials? IF YES, DO 2, 8, & 9		
H.	Will construction effect ground's safety (storage, excavations, equipment, etc.)? IF YES, DO 10 & 11		
I.	Will construction present other safety hazards? IF YES, DO 10 & 11		

"DO" ACTIONS

1. Post signage and document personnel training for alternative means of egress.
2. Adopt and document daily inspections of construction areas.
3. Conduct and document 2 fire drills per shift per quarter.
4. Meet with ER staff, EMS, Fire Dept. to develop plans; document.
5. Institute Fire Watch and develop alternate systems/policies (i.e. - covering smoke heads during welding operations and uncovering at end of each shift).
6. Test and document temporary systems monthly
7. Document fire resistive rating of partition material/structure.
8. Develop storage, housekeeping and debris removal policies/procedures.
9. Provide fire-fighting equipment and use training; document.
10. Provide training related to other safety hazards.
11. Increase surveillance of buildings, grounds and equipment, especially construction areas.

This is a planning guide only. For each item from the "DO" list a separate action plan may need to be developed to assign responsibility and schedule. This hospital is smoke free and policies related to smoking are not required

Evaluated by _____

Date _____

McLeod Health INFECTION CONTROL RISK ASSESSMENT AND PREVENTIVE MEASURES CHECKLIST FOR HOSPITAL CONSTRUCTION AND RENOVATION		Project No:
Location of Construction:		Project Start Date:
Project Coordinator:		Estimated Duration:
Contractor Performing Work:		Permit Expiration Date:
Supervisor:		Telephone:

Brief description of project scope: _____

Step One:

Indicate the Construction Project Activity **TYPE**:

Type A	Inspection and non-invasive activities Includes, but is not limited to: • Opening of more than one ceiling tile per 10 tiles • Installation of telephone and computer cabling • Painting (but not sanding) • Wall covering, electrical trim work, minor plumbing, and activities which do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
Type B	Small scale, short duration activities which create minimal dust Includes, but is not limited to: • Access to mechanical chase or shaft spaces • Cutting of walls or ceiling where dust migration can be controlled • Minor renovation of existing space • Wet sanding of walls
Type C	Work that generates a moderate to high level of dust Includes, but is not limited to: • Dry sanding of walls • Cutting of walls, removal of drywall or building finish components where work is limited to one room or suite (including removal of floor coverings, ceiling tiles, and casework) • Wall demolition or new wall construction • Minor duct work, plumbing work, or electrical work above ceilings (not including <u>system</u> demolition or installation) • Moderate renovation of existing space • Major cabling pulling activities, multiple rooms/lines where multiple access points are needed • Any activity which requires construction of a barrier that does not qualify as Type D
Type D	Major demolition and major construction projects Includes, but is not limited to: • Activities which require the closure of a unit/wing or relocation of an entire patient area • Demolition, removal, or installation of a complete cabling, HVAC, plumbing, medical gas, or electrical system • Demolition of major fixed building components, assemblies, fit-out elements, or structural elements • New construction located in close proximity (as determined by the Primary ICRA team) of the hospital building • Outdoor construction of new structures located in close proximity (as determined by the Primary ICRA team) to existing patient care facility • Excavation activities within close proximity (as determined by the Primary ICRA team) of hospital building

Step Two:

Indicate the **Risk level** for the job location. If more than one risk level is identified, select the higher risk level:

Low Risk	Medium Risk	High Risk	Highest Risk
- Office areas not attached to or adjoining patient care areas or used for patient interviews, exams, or evaluations - Public corridors and spaces not on or directly attached to patient units or treatment locations.	- Admissions - Breast Imaging - Cardiac Rehab - Clinical Laboratories, (except Microbiology and Virology) - Echocardiography - Cafeteria - Laundry - Off site outpatient clinics - Outpatient Rehab - Physical Therapy - PAT - Patient care areas not listed under “High” or Highest”	- Blood Bank - Main Kitchen - Central Processing - Dirty - Clin Labs Microbiology Lab - Clin Labs Virology Lab - Day Hospital - Emergency Department - Lab collection areas - Labor & Delivery - Newborn Nursery - Nuclear Medicine - Outpatient Surgery - Orthopedics - Pharmacy – locations that do not prepare intravenous meds - PACU - Procurement - Postpartum - Radiation Oncology - Radiology/MRI/CT/ Ultrasound - Respiratory Therapy	- Central Processing - Clean - C-Section Rooms - Cardiac Cath/EP Lab - Endoscopy - Hem-Onc - Hemodialysis - All ICUs - Interventional Radiology - Pharmacy – locations that prepare intravenous meds - Surgery/OR

Step Three:

Match the Risk Group and the Construction Type to identify the ICRA Classification Level.

- Indicate the ICRA Level: _____. If Class I or Class II risk group, skip steps 4 through 11. Additional permit from Epidemiology not required.

Construction Activity→	TYPE A	TYPE B	TYPE C	TYPE D
RISK GROUP ↓	ICRA Level↓:	ICRA Level↓:	ICRA Level↓:	ICRA Level↓:
Low Risk	I	II	II	III or IV
Medium Risk	I	II	III	IV
High Risk	I	III	III or IV	IV
Highest Risk	III	III or IV	III or IV	IV

Step Four:

Identify the areas surrounding the project area and the risk level for that location.

If more than one risk level is identified, select the higher risk level.

Unit Below	Unit Above	Lateral	Lateral	Behind	Front
Risk Group:	Risk Group:	Risk Group:	Risk Group:	Risk Group:	Risk Group

Step Five:

- Identify the specific site of activity eg. patient room, corridor, medication room.

Step Six:

- Identify issues related to HVAC, plumbing, and electrical in terms of the probability of unplanned outages that will impact patient care.

Step Seven:

- Water Incursion: Indicate potential risk of water damage outside construction zone:

Step Eight:

- Identify ICRA containment measures:

- Wall type: _____
- Ante-room (yes/no): _____
- Door Type: _____
- Size of HEPA negative air machine: _____
- Will a continuous read negative air pressure monitor (chart recorder) be used?

- Frequency of manual verifications and documentation of negative air:

- HVAC. Describe local or system isolation of work site: _____

- If temporary ventilation or humidification is necessary, how will this be accomplished:

Step Nine:

- Work Hours: Will the work be done during non-patient care hours?

- What shifts will the majority of the work be done?

Step Ten:

Has Infection Control been consulted on the design as it relates to:

▪ Clean and Soiled Utility rooms:	Yes	No	N/A	
▪ Hand washing sinks/Sanitizer Dispensers:	Yes	No	N/A	
▪ Support services space:		Yes	No	N/A
▪ Isolation (positive pressure) rooms:	Yes	No	N/A	
▪ Negative pressure rooms:	Yes	No	N/A	
▪ Wall and floor coverings:	Yes	No	N/A	
▪ Ceiling type:		Yes	No	N/A

Step Eleven:

Other construction and containment issues to be discussed with the construction team:

- Maintenance of barriers during project:
- Maintaining a clean job site daily:
- Only HEPA filtered 'shop style' vacuums may be used:
- Proper cleaning and removal of barriers at completion of project:
- Cleaning protocol:
- Commissioning Protocol:

INFECTION CONTROL PREVENTIVE MEASURES (BY CLASS)

CLASS I	1. Execute work by means to minimize raising dust from construction operations. (Close doors or use other means of containment when indicated). 2. Immediately replace any ceiling tile displaced for visual inspection.	3. Minimize dust and dirt. Clean area when dust and dirt build up. 4. Wet mop and/or vacuum with HEPA filtered vacuum when work is complete.
CLASS II	Engineering/Contractor Responsibilities during project: 1. In addition to the items contained in Class I.: 2. Provide active means to prevent air-borne dust from dispersing into atmosphere by closing doors, using portable containment units, or enclosing area with plastic sheeting or equivalent. When openings are made into existing ceilings, use portable containment devices or provide polystyrene enclosure around ladder sealing off opening, fitted tight to ceiling and floor. 3. Provide thorough cleaning of existing surfaces that become exposed to dust. 4. Seal unused doors with duct tape and post appropriate signs to prevent entry by others not engaged in the project. 5. Water mist work surfaces to control dust-generating activities that will cause dust to become airborne, such as cutting or sanding. 6. Block off and seal air vents as indicated. If exhaust must be maintained, use "clean air" machine or powered HEPA filters in exhaust path, or exhaust directly to outside. 7. Use tacky mats and carpet squares/dust mats at project entrance and exits to minimize dust dispersal. 8. Control spread of dust and debris by using covered carts or containers to remove debris through internal hospital paths. Cover must be dust tight and secured to container, not just laid on top.	9. Damp mop area during and after construction activities to control and remove dust. 10. Use HEPA filters on vacuums used for clean-up. 11. As work progresses, wipe down all horizontal surfaces using hospital-approved disinfectant. 12. Replace all ceiling tiles or reclose ceiling. Engineering/Contractor Responsibilities at completion of project: 13. Maintain all barriers/enclosures as practical until job is complete. 14. Replace all ceiling tiles or reclose ceiling. 15. Wipe down all horizontal surfaces using hospital-approved disinfectant. 16. Damp mop or extract floor with hospital-approved disinfectant. 17. If appropriate, vacuum all areas with HEPA filtered vacuum. 18. Clean HVAC system before closure is removed and operate system for 24 hours prior to final cleaning of job site. 19. Use HEPA filtered vacuum during removal of barriers as practical.
CLASS III	Engineering/Contractor Responsibilities during project: 1. In addition to the items contained in Class I and Class II. 2. Submit ICRA to the Department of Epidemiology and obtain an infection control permit before construction/demolition begins. 3. In consultation with the Engineering Department, put controls or barriers into place to prevent spread of particles through HVAC system and contamination of duct system in the area where work is being performed. 4. Complete all critical barriers or use portable containment unit before demolition/construction begins. <u>Throughout the work process, use appropriate barriers to control dust for type of work.</u> 5. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 6. Seal holes, pipes, conduits, and punctures appropriately. 7. Place adhesive mat at entrance outside work area and carpet mat inside work area. Adhesive mats or carpet mats at barricade entrances and in the anteroom shall be kept clean and changed daily or more often as needed to prevent accumulation of dust. 8. Place carpet mat inside construction area at exit for workers to wipe off shoes before leaving work area. 9. Any ceiling access panels opened for investigation beyond sealed areas shall be replaced immediately when unattended. 10. Wet mop frequently to keep dust at a minimum. 11. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area.	12. Contain construction waste before transport in tightly covered containers, carts, or tightly closed impervious bags. Containers must be wiped down before leaving area. 13. Use only designated elevator and/or route through facility for transporting construction materials to and debris from the worksite. 14. Clean worksite thoroughly before removing construction barriers. 15. Remove isolation controls or barriers from HVAC system after work is completed. Engineering/Contractor Responsibilities at completion of project: 16. Maintain all barriers/enclosures as practical until final cleaning is complete and final inspection is complete. 17. Replace all ceiling tiles or reclose ceiling. 18. Wipe down all horizontal surfaces using hospital-approved disinfectant. 19. Damp mop or extract floor with hospital-approved disinfectant. 20. If appropriate, vacuum all areas with HEPA filtered vacuum. 21. Clean HVAC system before closure is removed and operate system for 24 hours prior to final cleaning of job site. 22. Use HEPA filtered vacuum during removal of barriers as practical. 23. Once barriers are removed, the areas is to be thoroughly cleaned by Environmental Services.

CLASS IV	Engineering/Contractor Responsibilities during project: 1. In addition to the items contained in Class I and Class II. 2. Submit ICRA to the Department of Epidemiology and obtain an infection control permit before construction/demolition begins. 3. In consultation with the Engineering Department, put controls or barriers into place to prevent spread of particles through HVAC system and contamination of duct system in the area where work is being performed. 4. Complete all critical barriers or use portable containment unit before demolition/construction begins. <u>Throughout the work process, use appropriate barriers to control dust for type of work.</u> 5. Maintain negative air pressure within work site utilizing HEPA equipped air filtration units. 6. Seal holes, pipes, conduits, and punctures appropriately. 7. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site. 8. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker leaves the work area. 9. Place adhesive mat at entrance outside work area and carpet mat inside work area. Adhesive mats or carpet mats at barricade entrances and in the anteroom shall be kept clean and changed daily or more often as needed to prevent accumulation of dust. 10. Place carpet mat inside construction area at exit for workers to wipe off shoes before leaving work area. 11. Any ceiling access panels opened for investigation beyond sealed areas shall be replaced immediately when unattended. 12. Wet mop with a hospital-approved disinfectant frequently to keep dust at a minimum. 13. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 14. Contain construction waste before transport in tightly covered containers, carts, or tightly closed impervious bags. Containers must be wiped down before leaving area. 15. Use only designated elevator and/or route through facility for transporting construction materials to and debris from the worksite. 16. Clean worksite thoroughly before removing construction barriers. 17. Remove isolation controls or barriers from HVAC system after work is completed. Engineering/Contractor Responsibilities at completion of project: 18. Maintain all barriers/enclosures as practical until final cleaning is complete and final inspection is complete. 19. Wipe down all horizontal surfaces using hospital-approved disinfectant. 20. Damp mop or extract floor with hospital-approved disinfectant. 21. If appropriate, vacuum all areas with HEPA filtered vacuum. 22. Clean HVAC system before closure is removed and operate system for 24 hours prior to final cleaning of job site. 23. Use HEPA filtered vacuum during removal of barriers as practical. 24. Once barriers are removed, the areas is to be thoroughly cleaned by Environmental Services.

Signatures

Facilities: _____ Date: _____

Contractor's Representative: _____ Date: _____

Revised: 02/2012; 03/2012

McLeod Health

The Choice for Medical Excellence.

Interim Life Safety Matrix for Impairments with Durations Greater than Four (4) Hours

Life Safety System Impairments Resulting From Code Deficiencies, Construction Activities, or Maintenance and Testing.												
	Ensuring Alternate Egress	Fire Safety Cart	Emergency Forces Notification	Ensuring Alternate Life Safety Systems are Operational	Temporary Construction Barriers	Additional Fire Fighting Equipment	Prohibited Smoking	Controlling Combustible Loading	Conducting 2 Fire Drills Per Shift Per Quarter in All Areas*	Conducting 2 Fire Drills Per Shift Per Quarter in Local Area*	Increased Hazard Surveillance	Compartmentation Training of Personnel
Applicable Engineering Policies have been reviewed and implemented												
Life Safety Interruption Notice has been distributed												
EGRESS RESTRICTIONS GREATER THAN 4 HOURS												
1. Fire Door Latching Problem Not Immediately Repairable							X	X				X
2. Fire Exit Stairs Discharge Improperly	X		X				X		X			X
3. Excessive Travel Distance to an Approved Exit	X						X	X		X	X	
4. Absence of Two Remote Exits	X						X	X		X	X	X
5. Absence of Two Or More Building Exits	X						X	X	X	X	X	X
6. Blocking of an Exit Due to Construction Activities	X		X				X	X		X	X	X
7. Rerouting of Traffic Due to Construction Activities			X				X					
8. 25% of Smoke Detectors Removed from Service							X					
IMPAIRED FIRE ALARM/SPRINKLER SYS. GREATER THAN 4 HOURS												
1. Replacing Fire Alarm System		X	X	X			X	X	X		X	
2. Tagout of >25% of smoke detectors in one zone.		X	X	X		X	X	X	X		X	
3. Installing or renovating sprinkler system		X	X	X			X					X
4. Remove a fire alarm system (or one of its components) out of service for repair.		X	X	X			X					X
5. Remove a sprinkler system (or one of its components) out of service for repair.		X	X				X			X		
6. Disconnecting alarm devices for maintenance or repair.							X					
IMPAIRED FIRE/SMOKE BARRIERS GREATER THAN 4 HOURS												
1. Improperly protected vertical openings		X					X	X	X		X	X
2. Large penetrations in fire or smoke barriers		X					X	X				X
3. Corridor walls do not extend to the structure		X					X	X				X
4. Hazardous areas not properly protected		X					X	X			X	

1. The above list of deficiencies and issues is not meant to be all inclusive. Issues, deficiencies, etc. not noted above must be addressed on a case-by-case basis to ensure that appropriate ILSM responses are implemented.

2. Emergency Forces Notification via Engineering Life Safety System Interruption Notice is mandatory for all impairments with durations greater than 4 hours.

* For interruptions with durations greater than 30 days.

Project Name _____ Project N^o: _____

IDENTIFY

Identify the issue, challenge, or problem to be addressed

EVALUATE THE ISSUE

BACKGROUND

Give history of the issue/challenge, including the cause and what has been attempted or done to address the issue

Need - What needs to happen to effectively address this issue?

What needs to happen to effectively address this issue?

CONSTRAINTS

What factors are keeping you from addressing the issue?

RESOURCES

1) What resources are easily and readily available?

2) What resources are needed to address the challenge?

DEVELOP A MISSION STATEMENT

Refine the purpose of the action plan. Give a broad and concise description of your purpose and what you hope to accomplish.

CREATE GOALS

Remember "SMART "

Specific

Measurable

Achievable

Realistic

Time-Bound

CONSTRUCT ACTION STEPS

What are the possible solutions using the background you have developed. Action steps are a realistic list of solutions and activities that will address the challenge, thus fulfilling the goals and working to achieve the mission. As you write your action steps, keep in mind the need, constraints, resources available, and resources needed. Include (1) Who will be responsible for coordinating or carrying out the action? (2) A time by which the action might occur and (3) The intended outcome of the action.

Administrative Policy Manual

LIFE SAFETY and INFECTION CONTROL MEASURES DURING PERIODS OF
CONSTRUCTION AND OTHER IDENTIFIED DEFICIENCIES

PURPOSE: To provide additional life safety and infection control measures when there is increased risk of fire or infection that may result from periods impairment or shut-down of fire alarm, detection, and/or suppression systems; new construction; or major renovations on Medical Center property.

POLICY: Prior to the impairment or shut-down of fire alarm, detection, and/or suppression systems for periods of more than four (4) hours in a 24-hour period, construction and/or space renovations, a projects a risk assessment will be completed to determine appropriate Interim Life Safety Measures.

PROCEDURE:

1. The Medical Center's ICP, nurse epidemiologist, or his/her designee(s) will be involved in the planning process for construction/renovation projects, and will be invited to construction planning/operations meetings.
2. To identify hazards that could potentially compromise patient care, prior to construction or renovations, an Infection Control Risk Assessment will be performed using risk criteria established in the Infection Control Risk Assessment and Preventative Measures Checklist.
3. Prior to the impairment or shut-down of fire alarm, detection, and/or suppression systems for periods of more than four (4) hours in a 24-hour period, an Interim Life Safety Assessment shall be performed using risk criteria established in the Interim Life Safety Assessment.
4. Infection Control Risk Assessment and Preventative Measures Checklist Risk Assessment and Interim Life Safety Assessment tools can be found at the end of this document.
5. Each construction employer on a project is to:
 - a. Have a written safety program.
 - b. Ensure that all workers have received proper training; and
 - c. Designate a competent person to be on the construction site at all times that work is being performed.
5. Construction areas will be isolated from areas of non-construction by temporary walls that are smoke-tight and constructed of non-combustible or limited combustible materials. These walls are insulated if necessary for noise and temperature control, and may also serve as dust-proof and weatherproof barriers as required. Any temporary wall installed in the route of a designated exit will be constructed with a door to maintain emergency access round the construction area and so as not to obstruct exiting in any way. In the event that construction causes normal access routes to be obstructed, alternate routes are established to ensure safe exits and paths of egress throughout.
6. Construction debris is to be removed by construction personnel daily, or as necessary to maintain suitable working conditions in areas where construction is being performed, and to ensure that access routes remain unrestricted and accessible.
7. During the use of equipment which may temporarily obstruct access routes inside the building or traffic flow outside, alternate exit signage shall be installed and staff will be in-serviced. Hospital Security will be notified by construction personnel prior to any planned obstruction of traffic flow.
10. In the event of any obstruction or disruption to building operations, construction personnel are required to notify Hospital Engineering and Security as necessary to ensure and assist in maintenance of life safety.
12. Smoking is prohibited in and adjacent to construction areas.
13. To further ensure life safety throughout construction projects, all construction plans are reviewed and approved by the Authorities Having Jurisdiction (AHJ), prior to commencement of any construction or renovation.
14. The Medical Center's Engineering department will conduct or ensure that appropriate life safety inspections are conducted for projects in accordance with Life Safety Code requirements and
17. A copy of this policy is to be given to each outside contractor working on projects at McLeod Health.

ATTACHMENT D

INTERIM LIEN WAIVER FORM

OWNER:

McLeod Regional Medical Center of the Pee Dee, Inc.

GENERAL CONTRACTOR:

PROJECT NAME:

STATE OF _____

COUNTY OF _____

I/we have a contract with _____ [Other Contracting Party] to provide _____ for the improvements to the property described as the _____ (the "Project"), and upon receipt of \$ _____ hereby waive my/our construction lien rights for labor/materials provided through _____. [Date]

This waiver, together with all previous waivers, if any, covers all amounts due to us for contract improvements provided through the date shown above, excepting retainage.

ADDITIONAL WARRANTIES AND REPRESENTATIONS

(1) The undersigned signatory warrants and represents that he or she has full authority to execute this Partial Conditional Waiver of Lien for the firm or company listed below, has personal knowledge of the facts sworn to in this Partial Conditional Waiver of Lien and that such facts are true and correct.

(2) The undersigned has performed all work through _____, 20____, pursuant to the terms and conditions of its contract, and in conformance with all plans and specifications for the work.

(3) Any and all contractors, subcontractors, laborers, suppliers and materialmen that have provided labor, material or services to the undersigned for use or incorporation into the construction of the improvements to the Project have been paid and satisfied in full, and there are no outstanding claims of any character arising out of, or related to, the undersigned's activities on, or improvements to, the Project.

(4) The undersigned is not aware of any claims of lien, notices of lien, or any suits or claims for payment, loss or damage of any kind, nature or description which might constitute a lien or encumbrance upon the Project as of the date of this Partial Conditional Waiver of Lien.

(5) This Partial Conditional Waiver of Lien is specifically made for the benefit of the Owner and the Owner's lender (if any), and any other person or entity with a legal or equitable interest in the Project, and this Partial Conditional Waiver of Lien may be relied upon by any of the aforementioned parties or any other parties named herein.

(6) The undersigned is executing this Partial Conditional Waiver of Lien, as provided by law, for and on behalf of the firm or company listed below for the express purpose of inducing and receiving payment from the Owner (or lender) for work performed through the date of this Partial Conditional Waiver of Lien.

(7) This Partial Conditional Waiver of Lien constitutes a representation by the undersigned signatory, for and on behalf of the firm or company listed below, that the payment referenced above, once received, constitutes full and complete payment for all work performed, and all costs or expenses incurred (including, but not limited to, costs for supervision, field office overhead, home office overhead, interest on capital, profit, and general conditions costs) relative to the work or improvements at the Project as of the date of this Partial Conditional Waiver of Lien, except for the payment of retainage. The undersigned hereby specifically waives, quitclaims and releases any claim for damages due to delay, hindrance, interference, acceleration, inefficiencies or extra work, or any other claim of any kind it may have against the Owner, the Owner's lender (if any), the General Contractor (if this Waiver is signed by a subcontractor or supplier), or any other person or entity with a legal or equitable interest in the Project, as of the date of this Partial Conditional Waiver of Lien, except as follows: _____

(8) The amount of money set forth as due and owing in the immediately preceding Partial Conditional Waiver of Lien dated _____, 20____, has been received, and is deemed paid in full.

In Witness Whereof, the person signing this document, acting for and on behalf of the Undersigned and all of its employees, subcontractors, laborers, suppliers and materialmen, has placed his hand and seal this _____ day of _____, 20____.

FIRM OR COMPANY:

Sworn to and subscribed
before me this _____ day of _____, 20____.

Notary Public

(NOTARY SEAL)

My Commission Expires: _____

By: _____

Print Name: _____

Its: _____

ATTACHMENT E

FINAL LIEN WAIVER FORM

OWNER: McLeod Regional Medical Center of the Pee Dee, Inc.

GENERAL CONTRACTOR:

PROJECT NAME:

STATE OF _____

COUNTY OF _____

My/our contract with _____ [Other Contracting Party] to provide _____ for the improvements to the property described as the _____ (the "Project"), having been fully paid and satisfied upon receipt of \$ _____, all my/our construction lien rights against such property are hereby waived and released, without exception.

ADDITIONAL WARRANTIES AND REPRESENTATIONS

(1) The undersigned signatory warrants and represents that he or she has full authority to execute this Full Unconditional Waiver of Lien for the firm or company listed below, has personal knowledge of the facts sworn to in this Full Unconditional Waiver of Lien and that such facts are true and correct.

(2) The undersigned has performed all work required under its contract pursuant to all of the terms and conditions of its contract, and in conformance with all plans and specifications for the work.

(3) Any and all contractors, subcontractors, laborers, suppliers and materialmen that have provided labor, material or services to the undersigned for use or incorporation into the construction of the improvements to the Project have been paid and satisfied in full, and there are no outstanding claims of any character arising out of, or related to, undersigned's activities on, or improvements to, the Project.

(4) The undersigned is not aware of any claims of lien, notices of lien, or any suits or claims for payment, loss or damage of any kind, nature or description which might constitute a lien or encumbrance upon the Project as of the date of this Full Unconditional Waiver of Lien.

(5) This Full Unconditional Waiver of Lien is specifically made for the benefit of Owner and the Owner's lender (if any), and any other person or entity with a legal or equitable interest in the Project, and may be relied upon unconditionally by any of the aforementioned parties.

(6) The undersigned signatory is executing this Full Unconditional Waiver of Lien, as provided by law, for and on behalf of the undersigned for the express purpose of inducing and receiving final payment from the Owner (or lender) for work or improvements to the Project.

(7) This Full Unconditional Waiver of Lien constitutes a representation by the undersigned signatory, for and on behalf of the undersigned, that the payment referenced above, once received, constitutes full and complete payment for all work performed, and all costs or expenses incurred (including, but not limited to, costs for supervision, field office overhead, home office overhead, interest on capital, profit, and general conditions costs) relative to the work or improvements at the Project. The undersigned hereby specifically waives, quitclaims and releases any claim for damages due to delay, hindrance, interference, acceleration, inefficiencies or extra work, or any other claim of any kind it may have against the Owner, the Owner's lender (if any), the General Contractor (if this Waiver is signed by a subcontractor or supplier), or any other person or entity with a legal or equitable interest in the Project, relative to the work or improvements at the Project.

(8) The amount of money set forth as due and owing in the immediately preceding Full Unconditional Waiver of Lien dated _____, 20____, has been received, and is deemed paid in full.

In Witness Whereof, the undersigned signatory, acting for and on behalf of the firm or company listed below and all of its laborers, subcontractors, and suppliers, has placed his hand and seal this ____ day of _____, 20____.

FIRM OR COMPANY:

Sworn to and subscribed
before me this ____ day of _____, 20____.

Notary Public

(NOTARY SEAL)

My Commission Expires: _____

By: _____

Print Name: _____

Its: _____

CHANGE ORDER REQUEST COVER SHEET

To: McLeod Regional Medical Center of the Pee Dee, Inc.
Office of Procurement and Construction
PO Box 100551
Florence, SC 29502-0551
ATTN: Emily Lucero

FROM:

Project Name: _____

McLeod Project Number: _____

COR NO: REF BULLETIN NO. DATE

Description: _____

THE FOLLOWING IS A SUMMARY OF THE CHARGES ASSOCIATED WITH THIS CHANGE ORDER REQUEST AND IS ACCOMPANIED BY DETAILED BACK UP INFORMATION:

Line		
1	Materials (itemized breakdown attached):	Exclude sales tax
2	Rental Equipment (list separately):	Exclude sales tax
3	SUBTOTAL MATERIALS + EQUIPMENT (Lines 2+3)	
4	Labor (itemized breakdown attached):	
5	Payroll Taxes and Insurance (itemized breakdown attached):	
6	SUBTOTAL LABOR + PAYROLL TAXES & INSURANCE (Lines 4+5)	
7	Overhead and Profit	Line 6 times 8.0%
8	TOTAL MATERIALS + LABOR + PAYROLL TAXES (Lines 6 + 7)	
9	Sales Tax on Materials + Equipment	applicable sales tax % rate times line 3
10	TOTAL MATERIALS + LABOR + TAX + PROFIT (Lines 3 + 9)	
11	Subcontracted Work	
12	Subcontracted Name and Cost	
13	On Subcontracted COR Sheet	
14	TOTAL OF SUBCONTRACTOR WORK (Lines 11+12+13)	
15	Overhead & Profit on Subcontractors:	Line 14 times 3.0%
16	TOTAL SUBCONTRACTOR (Lines 14+15)	
18	Performance/Payment Bond:	
19	(NOTE: Overhead and Profit not allowed when billing for Performance/Payment Bond)	
20	TOTAL AMOUNT FOR CHANGE ORDER REQUEST (Lines 10+16)	

NOTE: The only time a contractor may request additional money for project management time on a project is when the change in question actually affects the critical path of the project.

NOTE: Charge for overhead and profit shall not exceed 15% total on base costs. Contractor, Subcontractor, and Sub-subcontractors shall provide invoices showing base costs on all products.

BID FORM

Owner:
McLeod Health Seacoast
1145 East Day Street
Florence, SC 29506

(Name of Bidder)

(Street or P.O. Box)

Architect:
DesignStrategies LLC
130 South Main Street
Greenville, SC 29601

(City, State, Zip Code)

(Telephone No.)

(Contractor's License No.)

(Bidder's License No.)

Gentlemen:

The undersigned, having carefully examined the Instructions To Bidders, Forms of Agreement Between Owner and Contractor and Drawings dated 12/24/2020 and all subsequent Addenda as prepared by the Architect, DesignStrategies LLC, and having visited the site and being familiar with all conditions and requirements of the Work, hereby agrees to furnish all labor and services and provide all products to complete the construction of:

**McLeod Health Seacoast
Seacoast Hospital 50-Bed Addition
Little River, SC**

in accordance with the bidding documents and for the following amount:

BASE BID

(LUMP SUM including any allowances)

(Words) _____

(Figures) \$ _____

PAYMENT AND PERFORMANCE BOND

(Words) _____

(Figures) \$ _____

BID BOND/GUARANTEE

(5% of Base Bid)

(Words) _____

(Figures) \$ _____

DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION:

The total number of days required to complete the project is _____ days.

The DATE OF COMMENCEMENT shall be established in the "Notice to Proceed."

The contractor shall not incur any expense chargeable to this Project including, but not limited to Preconstruction Services, unless authorized in writing by the Owner, until the Forms of Agreement Between Owner and Contractor, described in the Instructions To Bidders, have been executed by both the Owner and the Contractor, and a Notice to Proceed is issued.

The DATE OF SUBSTANTIAL COMPLETION shall be measured from the "Notice to Proceed."

The undersigned in submitting this bid, declares that he or his representative visited and fully investigated the site and has reviewed and is familiar with all project documents including all issued Addenda as prepared by the Architect and concerning this Project and that this bid is based on the requirements of said documentation as they affect this bid and the possible resulting Forms of Agreement Between Owner and Contractor.

SUBCONTRACTORS (list as applicable)

Concrete: _____

Structural Framing: _____

Masonry: _____

Roofing: _____

Glazing: _____

Millwork: _____

Painting: _____

Fire Protection: _____

Mechanical: _____

Plumbing: _____

Electrical: _____

ADDENDA

Addenda have been received as follows:

No. _____ Date: _____

No. _____ Date: _____

No. _____ Date: _____

SIGNATURE, AUTHORITY AND SEAL

Name of Bidder

SEAL:

By _____
Signature

Title _____
Printed

Date Bid Executed _____

END OF BID FORM

SECTION 011000 - SUMMARY

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. General Provisions
2. Work covered by the Contract Documents.
3. Type of the Contract.
4. Work phases.
5. Work under other contracts.
6. Products ordered in advance.
7. Owner-furnished products.
8. Use of premises.
9. Owner's occupancy requirements.
10. Work restrictions.
11. Rules of conduct.
12. Specification formats and conventions.

B. Related Sections include the following:

1. Division 01 Section "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.2 GENERAL PROVISIONS

- A. Contract Documents: The Contract Documents consist of the Agreement between Owner and Contractor, Procurement and Contracting Requirements (Division 00), Drawings, Specifications (Divisions 01 through 49), Addenda issued prior to execution of the Contract, and Modifications issued after execution of the Contract.
- B. Contract Documents Addressee: Regardless of syntax or graphic depiction, the Contract Documents are addressed directly to the Contractor.
- C. Correlation and Intent of the Documents: The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complimentary and what is required by one shall be as binding as if required by all.
1. The Contract Documents are diagrammatic in nature and are intended to express a design concept based upon the assemblage of manufactured products, materials, equipment, assemblies, systems, components, and accessories, and

- are not intended to be a complete set of instructions on how to construct the Project.
2. The Contract Documents are diagrammatic in nature and are intended to express a functional system based on the assemblage of components and are not necessarily intended to be a complete set of functional requirements. The intent of the documents is to provide working functional systems. Miscellaneous components, piping, conduit, valves, etc. not specifically showing but required for a complete and functioning system shall be included in the base project construction.
 3. Where only part of the Work is indicated, similar parts are considered repetitive. Where any detail is shown and components thereof are fully described, similar details not fully described are deemed to incorporate similar material and construction.
 4. Dimensions: The Contract Documents, even when dimensioned, are schematic in nature and are subject, but without limits, to the following:
 - a. Field coordination to reflect actual conditions.
 - b. Individual manufacturer's requirements.
 - c. Fitment between and amongst the selected products, materials, equipment, assemblies, systems, components, and accessories.
 5. Do not scale Drawings.
- D. Labor and Materials: Provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, ventilation, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent, and whether or not incorporated or to be incorporated into the Work.
- E. Architect's Administration: The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, subcontractors, sub-subcontractors, vendors, or their agents or employees, or any other persons or entities performing portions of the Work.
- F. Construction: Comply with NFPA 241 "Safeguarding Construction, Alteration, and Demolition Operations".
- G. Products, Materials, Equipment, Assemblies, Systems, Components, and Accessories:
1. The Contract Documents are performance based and result oriented.
 - a. The Drawings depict illustrations of generic products, materials, equipment, assemblies, systems, components, and accessories, and their interface with other generic products, materials, equipment, assemblies, systems, components, and accessories, to form a composite building project which will perform a design function to satisfy its intended purpose. The products, materials, equipment, assemblies, systems, components, and

accessories, shall be fabricated and installed in accordance with the selected manufacturers' designs, installation instructions, and tests to achieve the results intended, and guaranteed to the Owner by the Contractor and manufacturer for the specified time indicated.

- b. The specifications list multiple manufacturers of specific products, materials, equipment, systems, assemblies, components, and accessories, and the results expected by their use, which have been researched by the Architect as meeting certain common, but minimum standards of recommended use, quality, performance, and results, supported by the manufacturer's testing and willingness to warrant to the Owner their product for its intended use. If available or appropriate to the project design, there are indicated three or more manufacturers of products, materials, equipment, assemblies, systems, components, and accessories, having a similar purpose, function, quality, test results, suitability of use for its intended purpose, and warranty provisions. Consequently, no substitutions will be permitted during the bidding period.
2. Subsequent to bidding, in the event the Owner requires the Contractor to "value engineer" the project for the purpose of reducing costs, the Architect will, as an additional service and upon authorization by the Owner, evaluate the substitution proposed by the Contractor, in similar fashion to those included in the specification, and advise the Owner of the Architect's opinion and recommendation of acceptability and/or suitability of the proposed substitution. Absent such authorization to provide these additional services and/or absent a recommendation of the Architect to accept the substitution, any substitutions proposed by the Contractor and accepted by the Owner will be at their own respective risk. The preparation, execution, and submission of a change order incorporating the substitution into the Owner/Contractor Agreement, shall in no way be construed as a recommendation or approval by the Architect, who shall be indemnified and held harmless on account thereof.

1.3 WORK COVERED BY CONTRACT DOCUMENTS

A. Project Identification: Seacoast Hospital Bed Tower

1. Project Location:

Seacoast Hospital
Little River, South Carolina

B. Owner:

1. Owner's Representative: Dale Locklair Owner's Address:

For Overnight Deliveries:
McLeod Regional Medical Center
Dale Locklair

1145 East Day Street
Florence, SC 29501

C. Architect of Record and Firm Name:

1. Design Strategies LLC
130 South Main Street
Greenville, SC 29601

D. The Work consists, in general, of the following:

1. Interior upfit construction, Fourth Floor of the Bed Tower at Seacoast Hospital. "50-Bed" in project title also refers to beds created under a separate authority. The number of patient sleeping beds created by this project is 37.

1.4 DIVISION 01

- A. Division 01: Sections in Division 01 govern the execution of the Work of all Sections in the Specifications.

1.5 TYPE OF CONTRACT

- A. Project will be constructed under the following single prime contract: AIA Document A102-2007, Standard Form of Agreement Between Owner and Contractor.

1.6 WORK SEQUENCES

- A. The project requires the maintenance of ongoing operations within the existing hospital. In that regard, it is an important part of the construction of this project to maintain the continuity of service of the hospital. In achieving this requirement, it is the contractor's responsibility to provide and construct such interim shutdowns for utility connections that are necessary for the smooth integrated continuance of work.
- B. All of the specific events and durations of work as well as any other issues of construction sequence integral to the maintenance of the hospitals function shall be included on the contractor's schedule.

1.7 WORK UNDER OTHER CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Coordinate the Work of this Contract with work performed under other separate contracts.
- B. Preceding Work: None identified at this time.

- C. Concurrent Work: None identified at this time.
- D. Future Work: None identified at this time.

1.8 OWNER-FURNISHED PRODUCTS

- A. Owner will furnish products indicated. The Work includes providing support systems to receive Owner's equipment and making plumbing, mechanical, and electrical connections.
 - 1. Owner will arrange for and deliver Shop Drawings, Product Data, and Samples to Contractor.
 - 2. Owner will arrange and pay for delivery of Owner-furnished items according to Contractor's Construction Schedule.
 - 3. After delivery, Owner will inspect delivered items for damage. Contractor shall be present for and assist in Owner's inspection.
 - 4. If Owner-furnished items are damaged, defective, or missing, Owner will arrange for replacement.
 - 5. Owner will arrange for manufacturer's field services and for delivery of manufacturer's warranties to Contractor.
 - 6. Owner will furnish Contractor the earliest possible delivery date for Owner-furnished products. Using Owner-furnished earliest possible delivery dates, Contractor shall designate delivery dates of Owner-furnished items in Contractor's Construction Schedule.
 - 7. Contractor shall review Shop Drawings, Product Data, and Samples and return them to Architect noting discrepancies or anticipated problems in use of product.
 - 8. Contractor is responsible for receiving, unloading, and handling Owner-furnished items at Project site.
 - 9. Contractor is responsible for protecting Owner-furnished items from damage during storage and handling, including damage from exposure to the elements.
 - 10. If Owner-furnished items are damaged as a result of Contractor's operations, Contractor shall repair or replace them.
 - 11. Contractor shall install and otherwise incorporate Owner-furnished items into the Work.
 - 12. Unused materials returned for credit shall be credited to the Owner
- B. Owner-Furnished Products:
 - 1. See the Equipment Schedule, Project Specification for Owner Furnished and Contractor Installed Items, and other miscellaneous portions of the Contract Documents.
 - 2.
- C. MANAGEMENT OF OWNER – VENDOR CONTRACTS
 - 1. NURSE CALL

- a. General Contractor: Shall provide conduit, backboxes, power, access for wire routing, and related work for Owner selected Vendor to install the

Nurse Call system which includes the over-bed and room light control relays, and television interface. All wall penetrations shall be sleeved. General Contractor shall Firestop all penetrations of rated assemblies. General Contractor shall schedule, attend, and write minutes for Nurse Call system coordination and installation meetings. General Contractor shall manage submittal process, check installation drawings against construction documents and system routing for final review by the Architect and Owner. Schedule, sequence and installation of work shall be managed by the General Contractor to support the overall project schedule.

- b. Vendor: Rauland Borg, as the Owners selected Vendor for the Nurse Call system, shall provide and install all components of the Nurse Call system in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

2. PNEUMATIC TUBE SYSTEM

- a. General Contractor: Shall provide conduit, backboxes and power for low voltage communications between Tube stations, new switching units, and central tube system control. All wall penetrations shall be sleeved. Provide conduit, backboxes, and power for all new tube system components. Core existing structure as required for tube installation. Firestop penetrations of rated building assemblies. Fill abandoned tube cores or sleeves to restore structure and finish to conceal evidence of penetration. General Contractor shall coordinate work by tube system vendor to avoid conflicts with mechanical and architectural systems. General Contractor shall manage submittal process, checking installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule. Since the MRMC Bed Tower Renovation will be the first project under construction, the cost of the coordination and management of the renovation to the central systems and routing of the pneumatic tube conduit on the 1st floor shall be covered under the terms of the contract with the MRMC Bed Tower Reconstruction Contract. Installation of blower units on the first floor and the extension from the blower room to the ICU Tower shall be part of the ICU Tower Contract.
- b. Vendor: Pevco, as the Owners selected Vendor for the Pneumatic Tube system, shall provide and install all required components of the Pneumatic Tube system, including items such as new switching units, central tube system control, new delivery piping and tubes, etc. all in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit

copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

3. TELEMETRY & ANTENNAE NETWORK

- a. General Contractor: Shall provide conduit, backboxes, and power. Provide access for wire routing, including beyond the project site to central telemetry room in the new ICU Tower and source locations. All wall penetrations shall be sleeved. Firestop all penetrations of rated assemblies. General Contractor shall provide fire retardant plywood backer board to mount equipment in telemetry server room on 2nd floor tbd. General Contractor shall coordinate work by telemetry system vendor to avoid conflicts with mechanical, electrical and architectural systems. General Contractor shall manage submittal process, checking installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule. Installation cannot begin until after telemetry vendor has completed electronic area survey after construction of walls and ceiling grid. General Contractor shall be responsible for constructing the walls, ceilings, floors, raceway glazing, doors, power, lighting, millwork, etc. within the new Telemetry room in the new ICU Tower per the construction documents.
- b. Vendor: General Electric, as the Owners selected Vendor for Telemetry systems, shall provide and install all required components of the Telemetry system, including items such as relocating existing equipment from current location to new location, provide and install new equipment including installation of teletransmitter holders, install ceiling mounted antennae system, all connecting low voltage wiring, etc. all in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

4. SECURITY CAMERAS

- a. General Contractor: Shall provide conduit, backboxes and power for low voltage to ceiling mounted security cameras as shown on the construction documents. All wall penetrations shall be sleeved. Provide conduit, backboxes, and power for all camera system components. Core existing structure as required for installation. Firestop penetrations of rated building assemblies. General Contractor shall coordinate work by security camera vendor to avoid conflicts with mechanical, electrical and architectural systems. General Contractor shall manage submittal process, checking

installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule.

- b. Vendor: The Owners selected Vendor for Security Camera systems shall provide and install all required components of the security camera system, including items such as relocating existing equipment from current location to new location, provide and install new equipment, install ceiling mounted cameras, all connecting low voltage wiring, etc. all in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

5. OVERHEAD PAGING

- a. General Contractor: Shall provide conduit, backboxes and power for low voltage to ceiling mounted overhead paging as shown on the construction documents. All wall penetrations shall be sleeved. Core existing structure as required for installation. Firestop penetrations of rated building assemblies. General Contractor shall coordinate work by overhead paging vendor to avoid conflicts with mechanical, electrical and architectural systems. General Contractor shall manage submittal process, checking installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule.
- b. Vendor: The Owners selected Vendor for the Overhead paging System shall provide and install all required components of the overhead paging system, including items such as ceiling mounted speakers and all head end equipment, all connecting low voltage wiring, etc. all in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

6. CARD/KEYPAD ACCESS CONTROL

- a. General Contractor: Shall provide conduit, backboxes and power for low voltage to Card/KeyPad Access Control System as shown on the construction documents. All wall penetrations shall be sleeved. Provide conduit, backboxes, and power for all camera system components. Core existing structure as required for installation. Firestop penetrations of rated building assemblies. General Contractor shall coordinate work by access

control vendor to avoid conflicts with mechanical, electrical and architectural systems. General Contractor shall manage submittal process, checking installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule.

- b. Vendor: The Owners selected Vendor for Card/KeyPad Access Control systems shall provide and install all required components of the access control system, including wiring, head end equipment, access control devices and interconnection to the hospitals central access control system. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

7. INTERCOM

- a. General Contractor: Shall provide conduit, backboxes and power for low voltage to Intercom System as shown on the construction documents. All wall penetrations shall be sleeved. Provide conduit, backboxes, and power for all intercom system components. Core existing structure as required for installation. Firestop penetrations of rated building assemblies. General Contractor shall coordinate work by intercom vendor to avoid conflicts with mechanical, electrical and architectural systems. General Contractor shall manage submittal process, checking installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule.
- b. Vendor: The Owners selected Vendor for Intercom systems shall provide and install all required components of the intercom system including new equipment, intercom audio and video intercom devices, head end equipment and all connecting low voltage wiring, etc. all in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

8. TELEPHONE, DATA & CABLE T.V.

- a. General Contractor: Shall provide conduit, backboxes and power for low voltage to Telephone, Data AND Cable TV Systems as shown on the construction documents. All wall penetrations shall be sleeved. Provide conduit, backboxes, and power for all telephone and data system components. Core existing structure as required for installation. Firestop

penetrations of rated building assemblies. General Contractor shall coordinate work by telephone, data and cable TV system(s) vendor(s) to avoid conflicts with mechanical, electrical and architectural systems. General Contractor shall manage submittal process, checking installation drawings against construction documents and system routing for review by the Architect and Owner. Schedule and sequence procurement and installation process to support project schedule.

- b. Vendor: The Owners selected Vendor(s) for Telephone, Data and Cable TV Systems shall provide and install all required components of these systems, including items such as relocating existing equipment from current location to new location, provide and install new equipment, install devices as required, all connecting low voltage wiring, etc. all in coordination and cooperation with the General Contractor. The Vendor shall be compensated for his work directly by the Owner. The Vendor shall submit copies of shop drawings and submittals to the General Contractor for review and coordination with his scope of work, which shall also be reviewed by the Architect and Owner. Vendor shall coordinate training sessions and delivery of O&M manuals to Owner.

9. SIGNAGE

- a. General Contractor: Shall provide blocking for support in walls and above ceilings for heavy or overhead signs. The general contractor shall figure on blocking for 1 sign per door and 1 overhead sign per corridor intersection and at each cross corridor door.
- b. Vendor: Shall attend system design and coordination meetings. Coordinate location of engineering system devices to align with signage locations as shown on the plans. Coordinate general construction work with the installation process to meet the project schedule.

1.9 USE OF PREMISES

- A. General: Contractor shall have limited use of premises for construction operations only as required for the progress of the work. It is recognized that certain portions of the work include the extension of utilities from other parts of the existing building to service the ICU Tower, however for the most part, the contractor is limited to the bounds of the existing site fence in place at the project site.
- B. Use of Site: Limit use of premises to work in areas indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated unless required by necessary utility connections.
 - 1. Owner Occupancy: Allow for Owner occupancy of Project site and use by the public.
 - 2. Driveways and Entrances: Keep driveways parking garage, loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles. It is the intent to maintain the loading dock area for contractor access during the Interior Fitout Project.

- a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- C. Use of Existing Building: Maintain existing building in a weathertight condition throughout construction period. Repair damage caused by construction operations. Protect building and its occupants during construction period.

1.10 OWNER'S OCCUPANCY REQUIREMENTS

- A. Full Owner Occupancy: Owner will occupy site and existing adjacent buildings during entire construction period. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's day-to-day operations. Maintain existing exits, unless otherwise indicated.
 - 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
 - 2. Provide not less than ninety six (96) hours notice to Owner of activities that will affect Owner's operations.
- B. Owner Occupancy of Completed Areas of Construction: Owner reserves the right to occupy and to place and install equipment in completed areas of building, before Substantial Completion, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and partial occupancy shall not constitute acceptance of the total Work. Early Owner Occupancy of the Proposed Hemodialysis Unit on the second floor of the ICU Tower is anticipated.
 - 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied before Owner occupancy.
 - 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before Owner occupancy.
 - 3. Before partial Owner occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Owner will operate and maintain mechanical and electrical systems serving occupied portions of building.
 - 4. On occupancy, Owner will assume responsibility for maintenance and custodial service for occupied portions of building.

1.11 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed inside the existing building during normal business working hours of 7 a.m. to 7 p.m., Monday through Friday, except otherwise indicated. Please refer to the McLeod Construction Handbook for additional information.

- B. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Owner not less than 4 days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Owner's written permission.

1.12 RULES OF CONDUCT

- A. General: Enforce the following rules of conduct upon agents and employees of the Contractor, subcontractors, sub-subcontractors, vendors, or any other persons or entities performing portions of the Work. The rules of conduct apply to any location on the Owner's property. See additional Owner requirements in Section 013513 – "Special Project Procedures".
1. No smoking; no use of chewing tobacco; no use of snuff.
 2. No carrying of firearms; regardless of exposed, concealed, or permitted concealed.
 3. No using of profane, vulgar, or obscene speech or gestures.
 4. No expressing of verbal insults, threats, or harassment.
 5. No suggesting of physical threats or harassment.
 6. No socializing with the patients, and Owner's, employees, staff, and guests.
 7. No possessing of alcoholic beverages, including but not limited to, beers, ales, wines, and liquors.
 8. No possessing of illegal narcotics.
 9. No intoxication; i.e., no influence of illegal narcotics or alcoholic beverages. Alcoholic intoxication is defined as a breath alcohol test indicating a zero point zero two (0.02) or greater concentration of alcohol in the person's system.
 10. No soliciting, canvassing, or posting or distributing literature or materials for any purpose.
 11. No playing of radios or music.
 12. No exposed tattoos
 13. No team or club t shirts.
- B. Immediately expel from the Owners' property and prevent the return of any person violating any of the rules of conduct.

1.13 SPECIFICATION FORMATS AND CONVENTIONS

- A. Specification Format: The Specifications are organized into Divisions and Sections using the 50-division format and CSI/CSC's "MasterFormat" numbering system.
1. Section Identification: Sections in the Project Manual are in numeric sequence; however, the sequence is incomplete because all available Section numbers are not used. Consult the table of contents at the beginning of the Project Manual to determine numbers and names of Sections in the Contract Documents.

- B. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
1. Abbreviated Language: Language used in the Specifications and other Contract Documents is abbreviated. Words and meanings shall be interpreted as appropriate. Words implied, but not stated, shall be inferred as the sense requires. Singular words shall be interpreted as plural and plural words shall be interpreted as singular where applicable as the context of the Contract Documents indicates.
 2. Imperative mood and streamlined language are generally used in the Specifications. Requirements expressed in the imperative mood are to be performed by Contractor. Occasionally, the indicative or subjunctive mood may be used in the Section Text in which instance the same requirements apply to the Contractor as if written in the imperative mood.
 - a. The words "shall," "shall be," "shall comply with," or an appropriate indicative or subjunctive verb, depending on the context, are implied where a colon (:) is used within a sentence or phrase.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 011000

SECTION 012500 – SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for product substitutions.

1.2 DEFINITIONS

- A. Bidding Phase: The period subsequent to the release of the construction documents.
- B. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1.3 PROCEDURES

- A. Substitutions During the Bidding Phase:
 - 1. Substitutions: Substitution requests will not be considered.
- B. Substitutions During the Construction Phase:
 - 1. Process: Substitution requests will only be considered if submitted in writing, with the appropriate form, and only through the Contractor. Requests submitted directly by a subcontractor, by a sub-subcontractor, or by a vendor will not be considered.
 - a. Substitution requests included with submittals will be rejected.
 - 2. Documentation of Acceptance: The Contractor may make substitutions, only with the Consent of the Owner, after evaluation by the Architect, and in accordance with a Change Order.

1.4 SUBMITTALS

- A. Substitution Requests: Submit three (3) copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Substitution Request Form: Use facsimile of two (2) page form provided at end of Section.

2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Statement indicating why specified material or product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Research/evaluation reports evidencing compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.
 - i. Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - j. Cost information, including a proposal of change, if any, in the Contract Sum.
 - k. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.
 - l. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven (7) days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fourteen (14) days of receipt of request, or seven (7) days of receipt of additional information or documentation, whichever is later.
 - a. Form of Acceptance: Change Order.
 - b. Use product specified if Architect cannot make a decision on use of a proposed substitution within time allocated.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

- A. Timing: Architect will consider requests for substitution if received within thirty (30) days after the Notice to Proceed. Requests received after that time may be considered or rejected at discretion of Architect.
- B. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
 - 1. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations. Such additional costs incurred by the Owner will be deducted from the Contract Sum.
 - 2. Requested substitution does not require extensive revisions to the Contract Documents.
 - 3. Requested substitution is consistent with the Contract Documents and will produce indicated results.
 - 4. Substitution request is fully documented and properly submitted.
 - 5. Requested substitution will not adversely affect Contractor's Construction Schedule.
 - 6. Requested substitution has received necessary approvals of authorities having jurisdiction.
 - 7. Requested substitution is compatible with other portions of the Work.
 - 8. Requested substitution has been coordinated with other portions of the Work.
 - 9. Requested substitution provides specified warranty.
 - 10. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

PART 3 - EXECUTION

3.1 CONTRACTOR'S SUBSTITUTION REQUEST FORM

- A. Contractor's Substitution Request Form appears on the next two (2) pages.

CONTRACTOR'S SUBSTITUTION REQUEST FORM

Project:	McLeod Seacoast 2015 Projects	DesignStrategies Project No.:	0370.14
To:	DesignStrategies LLC	Requested by:	
	130 South Main Street		
	Greenville, SC 29601	Contract For:	
Fax:	864-527-6541	Section Name:	
Attn.:	David Wright	Section Number & Paragraph	
	dwright@designstrategies.net	Related Drawings:	

Specified Product/Fabrication Method

(List name/description; model no.; manufacturer): _____

Required Information for <i>Specified</i> Product:	Attached:
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Fabrication Drawings	☐
Samples (Where Applicable)	☐

Proposed Product/Fabrication Method

(List trade name/description; model no.; manufacturer): _____

Required Information for <i>Proposed</i> Product:	Attached:
Point by Point Comparative Product Data	☐
Tests	☐
Reports	☐
Fabrication Drawings	☐
Research/Evaluation Reports	☐
Samples (Where Applicable)	☐

List of Related Changes/Modifications: _____

Differences between proposed substitution and specified product: _____

Proposed product/fabrication method
affects other parts of the Work ☐ No ☐ Yes: Explain _____

Reason for Proposed Substitution (indicate below):

- ☐ Specified product is no longer available.
- ☐ Specified product is not available within time requirements of project schedule. This reason will only be considered within the first ten (10) percent of the Contract Time.
- ☐ Specified warranty is not available.
- ☐ Specified product is not compatible with other required products or systems.
- ☐ Proposed product offers advantage to Owner in the form of a credit in the amount of _____ dollars.
- ☐ Proposed product offers advantage to Owner in the form of a credit in the amount of _____ calendar days of construction.
- ☐ Proposed product offers advantage to Owner in the form of a credit in the amount of _____ dollars.
- ☐ Proposed product offers advantage to Owner in the form of energy savings as follows:

Undersigned Contractor Affirms:

- Proposed substitution has been fully investigated and determined to be equal to specified product as utilized for this project, except as noted herein.
- Qualifications of manufacturer, installer, and other specified parties meet the specified qualifications.
- Same Special Warranty will be furnished for proposed substitution as for the specified product unless otherwise indicated above.
- Same maintenance service and source for replacement parts, as applicable, is available as that specified.
- Proposed substitution does not affect dimensions and functional clearances, except as noted herein.
- Proposed substitution request complies with all aspects of the Contract Documents, except as indicated herein.

For and By the Contractor:

Submitted by: _____

Signed: _____

Firm: _____

Telephone: _____

Fax: _____

Architect's Actions:

Date Received: _____

Recommendation to Owner: _____

END OF SECTION 012500

SECTION 012600 – CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Sections include the following:
 - 1. Division 01 Section "Allowances" for procedural requirements for handling and processing allowances.
- C. Architect will issue supplemental instructions authorizing Minor Changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions."

1.2 BULLETINS (MODIFICATIONS)

- A. Form of Bulletin: The Architect may issue a Bulletin with a Bulletin Number that can be one of three forms; Architects Supplemental Instructions, Proposal Request, or Construction Change Directive. Only the Construction Change Directive changes the contract cost or time and must be signed by the Owner. Architects Supplemental Instructions or a Construction Change Directive that results in a change of cost or time must be incorporated into a Change Order.

1.3 PROPOSAL REQUESTS

- A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Proposal Requests issued by Architect are for information only. Do not consider them instructions either to stop work in progress or to execute the proposed change.
 - 2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

- a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.
 - d. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
- B. Contractor-Initiated Proposals: If latent or unforeseen conditions require modifications to the Contract, Contractor may propose changes by submitting a request for a change to Architect.
 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 4. Include costs of labor and supervision directly attributable to the change.
 5. Include an updated Contractor's Construction Schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 6. Comply with requirements in Division 01 Section "Product Requirements" if the proposed change requires substitution of one product or system for product or system specified.
- C. Proposal Request Form: Use AIA Document G709 for Proposal Requests.

1.4 ALLOWANCES

- A. Allowance Adjustment: To adjust allowance amounts, base each Change Order proposal on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.
 1. Include installation costs in purchase amount only where indicated as part of the allowance.
 2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other margins claimed.

3. Submit substantiation of a change in scope of work, if any, claimed in Change Orders related to unit-cost allowances.
 4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.
- B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the Purchase Order amount or Contractor's handling, labor, installation, overhead, and profit. Submit claims within fourteen (14) days of receipt of the Change Order or Construction Change Directive authorizing work to proceed. Owner will reject claims submitted later than fourteen (14) days after such authorization.
1. Do not include Contractor's or subcontractor's indirect expense in the Change Order cost amount unless it is clearly shown that the nature or extent of work has changed from what could have been foreseen from information in the Contract Documents.
 2. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

1.5 CHANGE ORDER PROCEDURES

- A. On Owner's approval of a Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.
1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012600

SECTION 012900 – PAYMENT PROCEDURES GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements necessary to prepare and process Applications for Payment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Allowances" for procedural requirements governing handling and processing of allowances.
 - 2. Division 01 Section "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
 - 3. Division 01 Section "Construction Progress Documentation" for administrative requirements governing preparation and submittal of Contractor's Construction Schedule and Submittals Schedule.
 - 4. Division 01 Section "Photographic Documentation" for requirements covering photographic documentation required with payment applications.

1.2 DEFINITIONS

- A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.3 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the Schedule of Values with preparation of Contractor's Construction Schedule.
 - 1. Correlate line items in the Schedule of Values with other required administrative forms and schedules, including the following:
 - a. Application for Payment forms with Continuation Sheets.
 - b. Submittals Schedule.
 - c. Contractor's Construction Schedule.
 - 2. Submit the Schedule of Values to Architect at earliest possible date but no later than seven (7) days before the date scheduled for submittal of initial Applications for Payment.
 - 3. Sub schedules: Where the Work is separated into phases requiring separately phased payments, provide sub schedules showing values correlated with each phase of payment.

- B. Format and Content: Use the Project Manual table of contents as a guide to establish line items for the Schedule of Values. Provide at least one line item for each Specification Section.
1. Identification: Include the following Project identification on the Schedule of Values:
 - a. Project name and location.
 - b. Name of Architect.
 - c. Architect's project number.
 - d. Contractor's name and address.
 - e. Date of submittal.
 2. Submit draft of AIA Document G703 Continuation Sheets.
 3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with the Project Manual table of contents. Provide several line items for principal subcontract amounts, where appropriate. Include separate line items under required principal subcontracts for operation and maintenance manuals, punch list activities, Project Record Documents, and demonstration and training.
 4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
 5. Provide a separate line item in the Schedule of Values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site. If specified, include evidence of insurance or bonded warehousing.
 6. Provide separate line items in the Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
 7. No payments to the contractor shall be made until the Schedule of Values has been approved by the Owner.
 8. Allowances: Provide a separate line item in the Schedule of Values for each allowance.
 9. Each item in the Schedule of Values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.
 - a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place shall be shown either as separate line items in the Schedule of Values.
 - b. Schedule Updating: Update and resubmit the Schedule of Values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.4 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment shall be consistent with previous applications and payments as certified by Architect and paid for by Owner.
 - 1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction Work covered by each Application for Payment is the period indicated in the Agreement.
- C. Payment Application Forms: Use AIA Document G702 and AIA Document G703 Continuation Sheets as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the Schedule of Values and Contractor's Construction Schedule. Use updated schedules if revisions were made.
 - 2. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three (3) signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within twenty-four (24) hours. Each copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from every entity who is lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit waivers of lien on forms, executed in a manner acceptable to Owner.
- G. Photographic Documentation: Submit photographic documentation as follows:

1. Initial Application for Payment: Preconstruction photographs.
 2. Application for Payment: Current periodic construction photographs.
- H. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include Owner's approval of the following:
1. List of subcontractors.
 2. Schedule of Values.
 3. Contractor's Construction Schedule (preliminary if not final).
 4. Products list.
 5. Submittals Schedule (preliminary if not final).
 6. List of Contractor's staff assignments.
 7. List of Contractor's principal consultants.
 8. Copies of building permits.
 9. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 10. Initial progress report.
 11. Report of preconstruction conference.
 12. Certificates of insurance and insurance policies.
 13. Performance and payment bonds.
 14. Data needed to acquire Owner's insurance.
 15. Initial settlement survey and damage report if required.
 16. Schedule of Attic Stock Items for owners review
- I. Application for Payment at Substantial Completion: After issuing the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- J. Final Payment Application: Submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
 5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
 6. AIA Document G707, "Consent of Surety to Final Payment."
 7. Evidence that claims have been settled.

8. Final meter readings for utilities being reimbursed by owner, a measured record of stored fuel to be credited to owner, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 012900

SECTION 013100 – PROJECT MANAGEMENT AND COORDINATION GENERAL

1.1 SUMMARY

- A. This Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:
 - 1. Coordination and performance requirements.
 - 2. Coordination Drawings.
 - 3. Administrative and supervisory personnel.
 - 4. Project meetings.
 - 5. Requests for Interpretation (RFIs).
- B. Related Sections include the following:
 - 1. Division 01 Section "Substitution Procedures" for preparing and submitting requests for substitutions.
 - 2. Division 01 Section "Construction Progress Documentation" for preparing and submitting Contractor's Construction Schedule.
 - 3. Division 01 Section "Contractor Qualifications" for establishing specific expertise of contractors and subcontractors.
 - 4. Division 01 Section "Submittal Procedures" for preparing and submitting submittals and the release for use of the architects electronic documents..
 - 5. Division 01 Section "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
 - 6. Division 01 Section "Closeout Procedures" for coordinating closeout of the Contract.

1.2 DEFINITIONS

- A. RFI: Request from Contractor seeking interpretation or clarification of the Contract Documents.
- B. Contractor: The entity with whom the Owner has contracted to provide the Work.

1.3 COORDINATION PROGRAM

- A. General: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, which depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components with other contractors to ensure maximum accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
 4. Where availability of space is limited, coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair of all components, including mechanical and electrical.
 5. Where required for maintenance of the existing facility, schedule temporary provisions and coordinate changeover and relocations.
 6. In Existing Buildings, conduct a thorough review of all available documentation and conduct field investigations of existing conditions to determine the accuracy of information and develop existing conditions documentation to be used in the development of the Coordination Drawings.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities and activities of other contractors to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's Construction Schedule.
 2. Preparation of the Schedule of Values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.
 9. Project closeout activities.
- C. Ceiling and Above Ceiling Coordination:
1. Ceilings: The Contract Drawings do not indicate the locations of the fire suppression system sprinkler heads and may not indicate the components of Owner furnished systems. Coordinate these systems as the designs of each evolve.
 2. Above Ceiling Spaces: Coordinate the above ceiling services, systems, and components amongst the participating subcontractors, sub-subcontractors, and Owner's vendors to ensure adequate and proper fitment and clearances and to ensure appropriate access by the Owner to maintenance items.
 3. Execution Sequence: After award of the Owner/Contractor Agreement and prior to commencement of construction, convene a meeting to introduce the coordination program and establish the program's impact upon the construction schedule. Attendees shall include the Owner, the Owner's Vendors and each

subcontractor, sub-subcontractor, and vendor responsible for work in or above the ceiling, which includes but is not limited to the following:

- a. Finished ceiling materials and assemblies.
 - b. Ceiling mounted equipment support systems
 - c. Recessed lighting fixtures, and other recessed products including fire protection boxes where required.
 - d. Sanitary waste and vent piping, and roof drainage piping.
 - e. Ductwork and appurtenances.
 - f. Fire protection systems and sprinkler or discharge heads.
 - g. Owner installed systems.
 - h. Pneumatic tube system.
 - i. HVAC, Medical Gas and Plumbing piping.
 - j. Water and gas piping.
 - k. Cable trays.
 - l. Electrical conduits.
 - m. Fire Alarm, smoke detection and smoke sampling systems
 - n. Firestopping.
 - o. Telemetry systems
 - p. Automation, communications, and electronic safety and security systems.
4. Priorities: The above list, in descending order, is the precedence for space priority. Recessed products and space for their installation has first priority; sanitary waste and vent piping and roof drainage piping has second priority, etc. However, the Owner, the Architect, and the consulting engineers, reserve the right to alter the priority to seek adequate and proper fitment and clearances and to ensure appropriate access by the Owner to maintenance items.
5. Assignments: Engage the sheet metal sub-subcontractor to prepare and provide the mechanical subcontractor electronic drawing files which shall serve as the basis for the coordination drawings. Verify and indicate on the coordination drawings all existing conditions including column locations, floor and roof structure including elevations to bottom of structure, shafts, vertical construction, any other significant construction; and, variances with the Contract Documents. See specification section 013300 for terms of the release of the architect's construction documents in electronic format.
- a. Sheet Metal Sub-subcontractor's Initial Deliverables: With reference and consideration to structural, reflected ceiling, fire protection, plumbing, HVAC, automation, electrical, communications, and electronic safety and security, draw to at least 1/4 inch scale or larger the proposed ductwork installation including duct sizes, dampers, grilles, registers, and related equipment, fully dimensioned to adjoining construction. Include plan and section views necessary to adequately depict all conditions horizontally and vertically.

- b. Convene meetings that include each participating subcontractor, sub-subcontractor, and vendor and prepare coordination drawings from a single base drawing produced by the sheet metal sub-subcontractor and coordinated by the mechanical subcontractor. At the meetings, identify and resolve conflicts. According to the list under "Execution Sequence" above, ensure that each participating subcontractor, sub-subcontractor, and vendor subsequently and simultaneously identifies and resolves conflicts and adds its respective products and requirements to the coordination drawings, fully dimensioned to adjacent systems and construction. Ensure that the resulting final coordination effort, documented by the completed coordination drawings, culminates in a satisfactorily buildable and functioning Work while simultaneously reflecting the intent of the Contract Documents.
 - c. Produce coordination drawings in sequence as required by the construction schedule.
 - d. Sheet Metal Sub-subcontractor's Progress Deliverables: When coordination drawings for the earliest scheduled area have been completed, via the mechanical subcontractor, provide the Contractor one electronic file for distribution to each participating and affected subcontractor, sub-subcontractor, and vendor.
6. Submittals: Modify shop drawings through the coordination process to reflect the final resolved locations of products prior to submittal for review.
7. Cooperation: Should a subcontractor, sub-subcontractor, or vendor fail to cooperate in the coordination program, hold said subcontractor, sub-subcontractor, or vendor responsible for all costs incurred for adjustments to the work of others made necessary to accommodate the uncooperative subcontractor's, sub-subcontractor's, or vendor's installations.
8. Changes: When a Proposal Request is issued, review the coordination drawings with the affected subcontractors, sub-subcontractors, and vendors and coordinate any revisions necessary to the work of others not directly affected by the Proposal Request.
- D. Services and Access Coordination:
- 1. Equipment Rooms: Avoid locating utilities and services along the floor. Run vertically and with eight (8) foot horizontal minimum clearance unless otherwise necessary to connect to equipment.
 - 2. Access Doors and Panels: The Contract Drawings do not generally indicate the locations of access doors and panels in ceilings. Provide coordination drawings indicating proposed locations for access. It is the intent that services requiring access be so located that access will not be necessary in rooms of significant design importance, including but not limited to, lobbies and waiting areas, conference rooms, and main public corridors or in finish ceilings of high grade materials including specialized wood construction and custom vaulted construction. Locate services requiring access above accessible ceilings and at

rooms of less design significance. Floor access doors have been provided under the Shell Package for access to the interstitial space.

- a. Where access is necessary in rooms of significant design importance, include access assemblies in decorative walls and ceilings constructed to be as inconspicuous as possible including blind fastening, concealed hinges and matching of surrounding finishes..
 - b. Provide access to fire protection, plumbing, HVAC, electrical, communications, and electronic safety and security items that may or will require partial or total service or replacement.
 - c. Products requiring access to components in areas of significant design importance shall be designed to be serviced within the unit or thru the location of remote devices, such as transformers for lights, unit chillers, etc in adjacent accessible spaces.
3. Floor Cleanouts: The drawings indicate the general location of floor cleanouts, however, floor cleanouts shall not be located in main public corridors or in patient rooms. Cleanouts shall be located by extending the sanitary piping into adjacent support rooms. Cleanouts shall be provided which include a recess for the installation of matching flooring.
 4. Architectural Elevations: The architectural drawings indicate specific locations for wall mounted Mechanical, Electrical, Plumbing, Low Voltage and other specialty items. The engineering designed locations of these devices is to be coordinated with the architectural elevations for purposes of alignment, centering and spacing prior to installation. The architectural elevations shall take precedence where conflicts exist. The contractor shall bring any conflicts to the attention of the architect for resolution prior to installation.
- E. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.
1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

1.4 PERFORMANCE REQUIREMENTS

- A. Responsibility: Be solely responsible for the following:
1. Delivering a complete and functioning Work inclusive of each and all requirements of the Contract Documents regardless of the location within the Contract Documents of the aforesaid requirements.
 2. Coordinating the proper assemblage and ensuring the proper fitment of each and all of the various elements comprising the Work.

3. Indicating or causing to be indicated on each submittal the materials and assemblages adjoining with and adjacent to the primary product or products being depicted on the aforesaid submittals.

B. Work within an Existing Building:

1. Routing for utility distribution including conduit, piping, etc. is diagrammatic and is intended to indicate start and finish points. Final routing maybe longer or shorter and shall be the contractors responsibility subject to approval of the architect as part of the overall coordination program.
2. The contractor shall include reasonable variations in routing in his scope of work in anticipation of these issues.

1.5 SUBMITTALS

A. Coordination Drawings: Prepare Coordination Drawings for efficient installation of different components, products, materials, systems, and assemblages.

1. General: Include the following drawings in the coordination drawing set and provide information required for proper sequential and spatial installation.
 - a. Interstitial Space Drawing: Show structure, piping, grids, conduit, and miscellaneous construction items, and required code clearances. Provide final locations for floor access doors.
 - b. Above Ceiling Drawings: Show structure, piping, grids, fixture layout, conduit, ductwork, fixtures, equipment supports, miscellaneous construction items, and required code and service clearances.
 - c. Mechanical and Electrical Room Plans: Show structure, equipment, panels, piping, ductwork, fixtures, and miscellaneous. Sanitary piping from the third floor shall be shown on the 2nd floor coordination drawings. See allowance section.
 - d. Sections and Elevations: Show spatial orientation of construction as necessary to verify proper installation and clearances required for installation.
2. Content: Project-specific information, drawn accurately to scale. Do not base Coordination Drawings on reproductions of the Contract Documents or standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, fire protection, plumbing, mechanical (HVAC), electrical, communications, and electronic safety and security systems.
 - b. Indicate field verified dimensions of existing structural, fire protection, plumbing, mechanical (HVAC), electrical, communications, and electronic safety and security systems including elements discovered that do not appear on drawings depicting existing conditions.
 - c. Indicate required installation sequences.

- d. Indicate dimensions shown on the Contract Drawings and make specific note of dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect for resolution of such conflicts. Dimension changes and difficult installations will not be considered changes to the Contract.
 - e. Existing Buildings: Indicate existing utilities to remain. Since existing utilities and construction may be discovered during demolition which were previously unknown, document these locations and distribute to Architect for review with notation of conflicts which may require modification to design. Provide recommended routing to resolve problems.
 - f. Drawings involving the 2nd floor truss level shall be prepared in 3D and shall incorporate the actual structural steel shop drawings complete with gusset plates and connections. It will be the owner's intent to provide coordinated utilities to permit the installation of a suspended ceiling during a future fitout phase for a Hemodialysis unit.
 - g. Coordination drawings shall include the Owners Vendor Drawings for their independent systems including but not limited to the Pneumatic Tube Installation and the Telemetry installation on the patient floors.
3. Sheet Size: At least 11 by 8-1/2 inches but no larger than 30 by 42 inches.
4. Number of Copies: Submit three (3) opaque copies of each submittal. Architect will retain one (1) copy; forward one (1) copy to the Owner; and, forward one (1) copy to the consulting mechanical engineer.
- a. Coordination Drawings Required for Operation and Maintenance Manuals: Submit two (2) more than the number of copies required for operation and maintenance manuals. Architect will retain one (1) copy; remainder will be returned. Mark up and retain one (1) returned copy as a Project Record Drawing.
- B. Key Personnel Names: Within Seven (7) days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home and office telephone numbers. Provide names, addresses, and telephone numbers of individuals assigned as standbys in the absence of individuals assigned to Project.
- 1. Post copies of list in Project meeting room, in temporary field office, and by each temporary telephone. Keep list current at all times.

1.6 ADMINISTRATIVE AND SUPERVISORY PERSONNEL

- A. General: In addition to Project Manager and Project Superintendent, provide other administrative and supervisory personnel as required for proper performance of the Work.

- B. Project Manager: Appoint a single representative who shall be assigned to this Project full-time and who shall have no other project assignments. The Project Manager shall have experience on at least two other projects of similar scope, size, and complexity; and, shall be a full time employee of the Contractor. Consultants or contract employees are not acceptable.
- C. Project Superintendent: Appoint a superintendent who shall be assigned to this Project full-time and who shall have no other project assignments. The Project Superintendent shall have at least five (5) years experience on other projects of similar scope, size, and complexity; and, shall be a full time employee of the Contractor. The Project Superintendent shall be on-site at all times when work is in progress.
 - 1. Provide sufficient support personnel so that the Project Superintendent can maintain full-time on-site superintendence without assuming tactical duties such as errands or delivery receiving.

1.7 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site, unless otherwise indicated.
 - 1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
 - 2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
 - 3. Minutes: Record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three (3) days of the meeting.
- B. Preconstruction Conference: Schedule a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than fourteen (14) days after execution of the Agreement. Hold the conference at Project site or another convenient location. Conduct the meeting to review responsibilities and personnel assignments.
 - 1. Attendees: Authorized representatives of Owner, Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Discuss items of significance that could affect progress, including the following:
 - a. Tentative construction schedule.
 - b. Phasing.
 - c. Critical work sequencing and long-lead items.

- d. Designation of key personnel and their duties.
 - e. Procedures for processing field decisions and Change Orders.
 - f. Procedures for RFIs.
 - g. Procedures for testing and inspecting.
 - h. Procedures for processing Applications for Payment.
 - i. Distribution of the Contract Documents.
 - j. Submittal procedures.
 - k. Preparation of Record Documents.
 - l. Use of the premises and existing building.
 - m. Work restrictions.
 - n. Owner's occupancy requirements.
 - o. Responsibility for and locations of temporary facilities and controls.
 - p. Construction waste management and recycling.
 - q. Parking availability.
 - r. Office, work, and storage areas.
 - s. Equipment deliveries and priorities.
 - t. First aid.
 - u. Security.
 - v. Progress cleaning.
 - w. Working hours.
3. Minutes: Record and distribute meeting minutes.
- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.
- 1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates. Attendees shall include the Owners Vendors as appropriate.
 - 2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. The Contract Documents.
 - b. Options.
 - c. Related RFIs.
 - d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility problems.
 - k. Time schedules.

- l. Weather limitations.
 - m. Manufacturer's written recommendations.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.*
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
 - 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
 - 6. *Note that Vendor Drawings which include installation of wiring, piping and components above a hung ceiling must be signed and sealed by a licensed professional in the State of South Carolina. This specific issue must be noted at this meeting in regards to the Owner's Vendor responsibilities. See Close Out Section for further owner coordination responsibilities regarding this issue.
- D. Progress Meetings: Conduct progress meetings at regular intervals. Coordinate dates of meetings with preparation of payment requests.
- 1. Attendees: Representatives of Owner and Architect, and any other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project. Review present and future needs of each entity present, including the following:
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's Construction Schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule

revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- b. Interface requirements.
 - c. Sequence of operations.
 - d. Status of submittals.
 - e. Deliveries.
 - f. Off-site fabrication.
 - g. Access.
 - h. Site utilization.
 - i. Temporary facilities and controls.
 - j. Work hours.
 - k. Hazards and risks.
 - l. Progress cleaning.
 - m. Quality and work standards.
 - n. Status of correction of deficient items.
 - o. Field observations.
 - p. RFIs.
 - q. Status of proposal requests.
 - r. Pending changes.
 - s. Status of Change Orders.
 - t. Pending claims and disputes.
 - u. Documentation of information for payment requests.
- 3. Minutes: Record the meeting minutes.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to parties who should have been present.
 - a. Schedule Updating: Revise Contractor's Construction Schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.
- E. Site Safety Meetings: The Owner shall conduct Site Safety Orientation Meetings for all employees working on the Campus. Attendance at these meetings is mandatory

1.8 REQUESTS FOR INTERPRETATION (RFIs)

- A. General: The RFI procedure is a process by which clarifications to the Contract Documents may be expedited. Because many questions may be answered directly, the following protocol is required in order to expedite this process.
- B. Procedure: Immediately upon discovery of the need for interpretation of the Contract Documents, initiate the request for interpretation process pursuant to the following procedure:

1. RFIs shall originate with Contractor. RFIs submitted by entities other than Contractor will be returned with no response.
 2. Prior to submitting a written RFI, contact the Architect by telephone, or by conference telephone call if required for issues affecting multiple disciplines, and discuss the issue to ascertain that the question is understood by all parties prior to written submittal.
 3. If an answer to the question can be provided during the call as a result of information in the contract documents or minor dimensional clarifications, the Contractor shall record and distribute a telephone memorandum which shall include:
 - a. The Architect's project number and name; the time and date of the telephone conversation; and, each attendees name, affiliation, and contract numbers.
 - b. The question and the answer.
 - c. No further response from the architect will be necessary unless an issue of understanding arises.
 4. If further review is required by the Architect, a formal written RFI may then be distributed for response. Indicate conversation date and attendees on the RFI form. RFI's will not be accepted without telephone verification.
 5. Make every effort to answer questions prior to submitting to Architect. The Owner will compensate the Architect for the time incurred to process and handle frivolous RFI's and deduct said compensation from the Contract Sum. The Architect shall be the sole judge of frivolousness.
 6. The telephone call may be a regularly scheduled event.
- C. Content of the RFI: Include a detailed, legible description of the item needing interpretation and the following:
1. Project name.
 2. Date.
 3. Name of Contractor.
 4. Name of Architect.
 5. RFI number, numbered sequentially.
 6. Specification Section number and title and related paragraphs, as appropriate.
 7. Drawing number and detail references, as appropriate.
 8. Field dimensions and conditions, as appropriate.
 9. Contractor's suggested solution(s). If Contractor's solution(s) impact the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 10. Contractor's signature.
 11. Attachments: Include drawings, descriptions, measurements, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

- a. Supplementary drawings prepared by Contractor shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.
 - b. Photographic Documentation: Provide sufficient and adequate views to thoroughly illustrate the situation at hand.
- 12. Indication of telephone verification with time, date, and attendees.
- D. Software-Generated RFIs: Software-generated form using the contractors system including the noted requirements.
 - 1. Attachments shall be electronic files in Adobe Acrobat PDF format.
- E. Architect's Action: Architect will review each RFI, determine action required, and return it. Allow an average of five (5) calendar days for Architect's response for each RFI. It is acknowledged and understood that some RFI's will take longer than others, especially those requiring multiple disciplines.
 - 1. RFIs received after 1:00 p.m., local time for the Architect, will be considered as received the following working day.
 - 2. RFI's received on a Friday will be considered as received the following Monday or the next following normal business day whichever occurs later.
 - 3. The following RFIs will be returned without action:
 - a. Requests for approval of submittals.
 - b. Requests for approval of substitutions.
 - c. Requests for coordination information already indicated in the Contract Documents.
 - d. Requests for adjustments in the Contract Time or the Contract Sum.
 - e. Requests for interpretation of Architect's actions on submittals.
 - f. Incomplete RFIs or RFIs with numerous errors.
 - g. Requests without telephone verification.
 - 4. Architect's action may include a request for additional information, in which case Architect's time for response will start again upon receipt of the additional information.
 - 5. Architect's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."
 - a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within seven (7) days of receipt of the RFI response.
 - 6. Architect's reply is not an authorization to proceed with work involving additional cost, additional time, or both. If any reply requires a change to the Contract Documents, a Change Order, a Construction Change Directive, or a Minor

Change (Architect's Supplemental Instructions) in the work must be executed in accordance with the Contract Documents.

- F. Contractor's Action: If questions arise from the Architect's response, re-submit the RFI requesting additions interpretation. Architect's time for response will start again upon receipt of the re-submittal.
 - 1. Mark RFI Log that RFI was received and re-submitted.
- G. On receipt of Architect's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Architect within seven (7) days if Contractor disagrees with response.
- H. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Use CSI Log Form 13.2B or software log with not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION(Not Used)

END OF SECTION 013100

SECTION 013200 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
 - 1. Contractor's Construction Schedule.
 - 2. Submittals Schedule.
 - 3. Weekly construction reports.
 - 4. Material location reports.
 - 5. Field condition reports.
 - 6. Special reports.
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for submitting the Schedule of Values.
 - 2. Division 01 Section "Project Management and Coordination" for submitting and distributing meeting and conference minutes.
 - 3. Division 01 Section "Photographic Documentation" for submitting construction photographs.
 - 4. Division 01 Section "Submittal Procedures" for submitting schedules and reports.
 - 5. Division 01 Section "Quality Requirements" for submitting a schedule of tests and inspections.

1.2 SUBMITTALS

- A. Qualification Data: For scheduling consultant.
- B. Submittals Schedule: Submit three (3) copies of schedule. Arrange the following information in a tabular format:
 - 1. Scheduled date for first submittal.
 - 2. Scheduled dates for re-submittals.
 - 3. Specification Section number and title.
 - 4. Submittal category (action, informational, or closeout).
 - 5. Name of subcontractor.
 - 6. Description of the Work covered.
 - 7. Scheduled date for Architect's final release or approval.
- C. Contractor's Construction Schedule: Submit three (3) opaque copies of initial schedule, large enough to show entire schedule for entire construction period.

1. Submit an electronic copy of schedule, using software indicated, on CD-R, and labeled to comply with requirements for submittals. Include type of schedule (Initial or Updated) and date on label.
 - a. Provide schedule in format required by Owner. The Owners preferred format at this time is Microsoft Project – most current version.
- D. Weekly Construction Reports: Submit three (3) copies at monthly intervals.
- E. Material Location Reports: Submit three (3) copies at monthly intervals.
- F. Field Condition Reports: Submit three (3) copies at time of discovery of differing conditions.
- G. Special Reports: Submit three (3) copies at time of unusual event.

1.3 COORDINATION

- A. Coordinate preparation and processing of schedules and reports with performance of construction activities and with scheduling and reporting of separate contractors.
- B. Coordinate Contractor's Construction Schedule with the Schedule of Values, list of subcontracts, Submittals Schedule, progress reports, payment requests, and other required schedules and reports.
 1. Secure time commitments for performing critical elements of the Work from parties involved.
 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 SUBMITTALS SCHEDULE

- A. Preparation: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, resubmittal, ordering, manufacturing, fabrication, and delivery when establishing dates.
 1. Coordinate Submittals Schedule with list of subcontracts, the Schedule of Values, and Contractor's Construction Schedule.
 2. Submittal: Submit concurrently with the first complete submittal of Contractor's Construction Schedule.

2.2 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of Final Completion.
 - 1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.
- B. Activities: Treat each story or separate area as a separate numbered activity for each principal element of the Work. Comply with the following:
 - 1. Procurement Activities: Include procurement process activities for long lead items and major items, requiring a cycle of more than forty-two (42) days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 2. Submittal Review Time: Include review and resubmittal times indicated in Division 01 Section "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's Construction Schedule with Submittals Schedule.
 - 3. Startup and Testing Time: Include time for startup and testing.
 - 4. Substantial Completion: Indicate completion in advance of date established for Substantial Completion, and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
- C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Work by Owner: Include a separate activity for each portion of the Work performed by Owner.
 - 3. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 4. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Division 01 Section "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
 - 5. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Coordination with existing construction.
 - b. Limitations of continued occupancies.
 - c. Uninterruptible services.
 - d. Partial occupancy before Substantial Completion.
 - e. Use of premises restrictions.
 - f. Provisions for future construction.
 - g. Seasonal variations.
 - h. Environmental control.

6. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:
 - a. Subcontract awards.
 - b. Submittals.
 - c. Purchases.
 - d. Mockups.
 - e. Fabrication.
 - f. Sample testing.
 - g. Deliveries.
 - h. Installation.
 - i. Tests and inspections.
 - j. Adjusting.
 - k. Curing.
 - l. Startup and placement into final use and operation.
 7. Area Separations: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:
 - a. Structural completion.
 - b. Permanent space enclosure.
 - c. Completion of mechanical installation.
 - d. Completion of electrical installation.
 - e. Substantial Completion.
 - f. Final Completion.
 8. Other Constraints: To Be Determined.
- D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and Final Completion.
- E. Computer Software: Prepare schedules using a program that has been developed specifically to manage construction schedules.
1. Owner may designate software suitable for his use.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Gantt-Chart Schedule: Submit a comprehensive, fully developed, horizontal Gantt-chart-type, Contractor's Construction Schedule within twenty-one (21) days of date established for the Notice to Proceed. Base schedule on the Preliminary Construction Schedule and whatever updating and feedback was received since the start of Project.
- B. CPM Schedule: Used at contractors option based on their preference.

- C. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line.
1. For construction activities that require 3 months or longer to complete, indicate an estimated completion percentage in ten (10) percent increments within time bar.

2.4 REPORTS

- A. Weekly Construction Reports: Prepare a weekly construction report recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. List of separate contractors at Project site.
 3. Approximate count of personnel at Project site.
 4. Equipment at Project site.
 5. Material deliveries.
 6. High and low temperatures and general weather conditions.
 7. Accidents.
 8. Meetings and significant decisions.
 9. Unusual events (refer to special reports).
 10. Stoppages, delays, shortages, and losses.
 11. Meter readings and similar recordings.
 12. Emergency procedures.
 13. Orders and requests of authorities having jurisdiction.
 14. Change Orders received and implemented.
 15. Construction Change Directives received and implemented.
 16. Services connected and disconnected.
 17. Equipment or system tests and startups.
 18. Partial Completions and occupancies.
 19. Substantial Completions authorized.
- B. Material Location Reports: At intervals indicated, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site.
- C. Field Condition Reports: Immediately on discovery of a difference between field conditions and the Contract Documents, prepare and submit a detailed report. Submit with a request for interpretation on form included in Section 01 13 00. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

- A. General: Submit one (1) copy of each special report directly to Owner and two (2) copies to Architect within one day of an occurrence. Distribute copies of report to parties affected by the occurrence.
- B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule seven (7) calendar days before each regularly scheduled progress meeting.
 - 1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 - 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 - 3. As the Work progresses, indicate Actual Completion percentage for each activity.
- B. Distribution: Distribute copies of approved schedule to Architect, Owner, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
 - 1. Post copies in Project meeting rooms and temporary field offices.
 - 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

END OF SECTION 013200

SECTION 013233 – PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Periodic construction photographs.
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for submitting photographic documentation with payment applications.
 - 2. Division 01 Section "Submittal Procedures" for submitting photographic documentation.
 - 3. Division 01 Section "Closeout Procedures" for submitting digital media as Project Record Documents at Project closeout.
 - 4. Division 02 Section "Selective Structure Demolition" for photographic documentation before selective demolition operations commence.

1.2 SUBMITTALS

- A. Construction Photographs: Submit two (2) prints of each photographic view within seven (7) days of taking photographs.
 - 1. Format: 8-by-10-inch smooth-surface matte prints on single-weight commercial-grade
 - 2. Identification: On back of each print, provide an applied label or rubber-stamped impression with the following information:
 - a. Name of Project.
 - b. Name of Contractor.
 - c. Date photograph was taken if not date stamped by camera.
 - d. Description of vantage point,
 - 3. Digital Images: Submit a complete set of digital image electronic files as a Project Record Document on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in filename for each image.
 - 2. Field Office Images: Maintain one set of images on CD-ROM in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.
- C. Preconstruction Photographs: Before commencement of demolition and starting construction, take digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points.
 - 1. Take sufficient photographs to show all existing conditions and adjacent property before starting the Work.
 - 2. Take sufficient photographs of existing buildings at points of connection to accurately record physical conditions at start of fitout construction.
- D. Periodic Construction Photographs: Take digital photographs as the project develops to cover the construction newly completed or newly commencing construction on a regular basis not less than weekly with the cutoff date associated with each Application for Payment. Select vantage points to show status of construction and progress since last photographs were taken.
 - 1. Take additional photographs as required to record major utilities in shafts before enclosing finishes are installed.

- E. Final Completion Construction Photographs: Final Construction Photography will not be required of the Contractor
- F. Specific Directed Photographs: Architect or Owner may issue requests for specific photographs, in addition to periodic photographs specified to cover certain field conditions noted during site visits.

END OF SECTION 013233

SECTION 013300 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.
- B. Related Sections include the following:
 - 1. Division 01 Section "Construction Progress Documentation" for submitting schedules and reports, including Contractor's Construction Schedule.
 - 2. Division 01 Section "Photographic Documentation" for submitting construction photographs.
 - 3. Division 01 Section "Quality Requirements" for submitting test and inspection reports.
 - 4. Division 01 Section "Mock-Ups" for mockup requirements.
 - 5. Division 01 Section "Product Requirements" for product substitution procedures.
 - 6. Division 01 Section "Closeout Procedures" for submitting warranties.
 - 7. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 8. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
 - 9. Division 01 Section "Demonstration and Training" for submitting videotapes of demonstration of equipment and training of Owner's personnel.

1.2 DEFINITIONS (Intentionally not alphabetized)

- A. Action Submittals: Written and graphic information that requires Architect's responsive action.
- B. Informational Submittals: Written and graphic information that does not require and will not receive Architect's responsive action.
- C. Closeout Submittals: Written and graphic information that is exclusive for closeout documents.
- D. No Exception Taken: Information indicated on the submittal conforms to the information given and the concept or intent expressed in the Contract Documents.
- E. Non-responsive: Failing to conform to the requirements of the Contract Documents.

- F. Correct as Noted: Information indicated on the submittal conforms to the information given and the concept or intent expressed in the Contract Documents with the exception of the required corrections or modifications that are indicated. If this block is checked in the top section of the review stamp, Fabrication and Installation may be undertaken and resubmission is not required. If this block is checked in the middle section of the review stamp fabrication and installation MAY NOT be undertaken and resubmittal is required
- G. Revise and Resubmit for Record: Information indicated on the submittal conforms to the information given and the concept or intent expressed in the Contract Documents with the exception of the required corrections or modifications that are indicated. Resubmission with the corrections and modifications incorporated into the submittal is required for record purposes. Fabrication and installation may be undertaken prior to re-submittal.
- H. Rejected: Information indicated on the submittal fails to conform to the information given and the concept or intent expressed in the Contract Documents. Resubmission is required.
- I. Review not Required: Only those submittals specifically identified in Division 02 through 49 sections are required to be submitted to the Architect. It is the prerogative of the Contractor to process whatever submittals may be necessary to properly execute the Work but which otherwise are not required by the Contract Documents.

1.3 SUBMITTAL PROCEDURES

- A. Submittal Time: Furnish all submittals to the Architect no later than one hundred twenty (120) days from the date of the Notice to Proceed. Submittals received after that time will be considered non-responsive and may not be reviewed.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 - 2. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received. Such action by the Architect is not an acceptable reason for a delay claim.
- C. Submittal Flow Process: The flow of submittals is from the Contractor to the Architect, to the Consultant if applicable thence back to the Architect, and back to the Contractor.

1. Submittals received directly from a subcontractor, a sub-subcontractor, or a vendor will be considered non-responsive, may be returned, but regardless, will not be reviewed.
 2. Submittals may be sent directly to a consultant if they are for the specific review of that consultant. The consultant shall receive the required number of submittals with one copy sent to the architect for record and logging in order to expedite the submittal process. Submittal distribution shall be a line item on the submittal schedule prepared by the contractor.
- D. Submittals for Consultants: Although the submittals will be handled through the Architect, the review will be exclusively that of the Consultant.
- E. Submittals Schedule: Comply with requirements in Division 01 Section "Construction Progress Documentation" for list of submittals and time requirements for scheduled performance of related construction activities.
- F. 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 fourteen (14) 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 fourteen (14) days for review of each resubmittal.
 3. Consultant's Review: For structural, fire protection, plumbing, mechanical (HVAC), electrical, and communications engineering submittals, allow an additional seven (7) days to the times indicated for each of the initial and resubmittal reviews.
- G. Calendar Time: Submit each required submittal for initial review according to the Submittal Schedule. Submittals for initial review received after that times indicated on the Submittals Schedule will be considered non-responsive and may incur limited review.
- H. 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. Provide a space of adequate size on label or beside title block to record Contractor's review and approval markings and action taken by Architect.
 3. 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.
 - 1) Submittal number shall use Specification Section number followed by a decimal point and then a sequential number (e.g., 06 10 00.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., 06 10 00.01.A).
 - 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.
 - l. Other necessary identification.
- I. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- J. Additional Copies: Unless additional copies are required for final submittal, and unless Architect observes noncompliance with provisions in the Contract Documents, initial submittal may serve as final submittal.
- 1. Additional copies submitted for maintenance manuals will be marked with action taken and will be returned.
- K. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Architect will discard submittals received from sources other than Contractor.
- 1. Transmittal Form: Use Contractor's standard form.
- L. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
 - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
 - 3. Resubmit submittals until they are marked "No Exception Taken" or "Correct as noted" with Fabrication/Installation authorization.
 - 4. Resubmittals for record will not be processed if they have been marked Correct & Resubmit for Record.
- M. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

- N. Use for Construction: Use only final submittals with mark indicating "Approved" or "Approved as noted" action taken by Architect.

1.4 CONTRACTOR'S USE OF ARCHITECT'S CAD FILES

- A. General: At the written request of the Contractor and subject to the Owner's approval, copies of the Architect's background CAD files may be available to the Contractor for the Contractor's use in connection with Project subject to the following conditions:
1. The background CAD files will be distributed in the current state of the Drawings as the project goes to Contract. Updated files during the construction contract administration phase will not be distributed.
 2. The CAD files will be a set of Compact Disks distributed to the Contractor only. Distribution by the Contractor to subcontractors and suppliers is at the Contractor's risk.
 3. Use of the CAD files is at the Contractor's, subcontractors', and suppliers' risk; and, a CAD release form shall be fully executed before the CAD files are released.
- B. Contractor's Use of Instruments of Service in Electronic Form
1. The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with the contract shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers
 2. The Architect may, with the concurrence of the Owner, furnish to the Contractor versions of Instruments of Service in electronic form. The Contract Documents executed or identified in accordance with Subparagraph 1.5.1.2 shall prevail in case of an inconsistency with subsequent versions made through manipulatable electronic operations involving computers
 3. The Contractor shall not transfer to any parties other than sub-contractors or reuse Instruments of Service in electronic or machine-readable form without the prior written consent of the Architect. All such documents shall be used for the sole and limited purpose of shop drawing preparation, all other purposes being expressly prohibited without prior written consent of the Architect
 4. Instruments of Service in electronic form will be provided pursuant to paragraph 1.5.3.1 above upon execution of a purchase agreement by the Contractor (also referred to herein as the Purchaser). Contractor is responsible for obtaining similar agreements from sub-contractors when files are further distributed. The agreement will include the following provisions:
 - a. The Architect agrees to prepare a read only disk containing Drawings as listed on the attached Order Form. Certain drawing information in the title block such as professional seals and corporate logos may be removed.

- b. Payment is due upon execution of this Agreement. Delivery of disk will be made within 10 working days of receipt of payment, barring equipment breakdowns or other incidents beyond the control of the Architect.
- c. The Architect makes no representations as to the accuracy of the information contained in the files because design drawings are diagrammatic in nature and are not intended to provide dimensional accuracy at a level needed for other purposes. Additionally, the drawing information may not contain addendum information or drawing revisions made by hand to the original documents which were released for construction. For these reasons, the Purchaser understands that the use of the information provided is at his own risk. Accordingly, The Purchaser agrees to indemnify and hold the Architect harmless from all claims arising out of the use of the information contained on the disk provided by the Architect to the Purchaser, including defense cost.

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. Information must be specially prepared for submittal because standard printed data is not suitable for use. Submit as Shop Drawings, not as Product Data.
 - 2. Mark each copy of each submittal to show which products and options are applicable.
 - 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's catalog cuts.
 - d. Wiring diagrams showing factory-installed wiring.
 - e. Printed performance curves.
 - f. Operational range diagrams.
 - g. Compliance with specified referenced standards.
 - h. Testing by recognized testing agency.
 - 4. Number of Copies:
 - a. Submit three (3) copies of Product Data for Architect's review, unless otherwise indicated.

- b. Submit five (5) copies of Product Data for Consultant's review, unless otherwise indicated.
 - c. Architect will return one (1) copy. Mark up and retain one returned copy as a Project Record Document.
- 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. Roughing-in and setting diagrams.
 - d. Wiring diagrams showing field-installed wiring, including power, signal, and control wiring.
 - e. Shopwork manufacturing instructions.
 - f. Templates and patterns.
 - g. Schedules.
 - h. Notation of coordination requirements.
 - i. Notation of dimensions established by field measurement.
 - j. Relationship to adjoining construction clearly indicated.
 - k. Seal and signature of professional engineer if specified.
 - l. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 - 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 11 by 8-1/2 inches but no larger than 30 by 42 inches.
 - 3. Number of Copies:
 - a. Submit three (3) opaque (bond) copies of each submittal for Architect's review, unless otherwise indicated.
 - b. Submit five (5) opaque (bond) copies of each submittal for Consultant's review, unless otherwise indicated.
 - c. Architect will return one (1) copy. Mark up and retain one returned copy as a Project Record Document.
- D. Samples, General: 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. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 - 2. Identification: Attach label on unexposed side of Samples that includes the following:

- a. Generic description of Sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate Specification Section.
3. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
- E. 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.
 1. Number of Samples:
 - a. Submit three (3) full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line, unless otherwise indicated.
 - b. Architect will return two (2) full sets with options selected.
- F. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 1. Number of Samples:
 - a. Submit three (3) sets of Samples, unless otherwise indicated.
 - b. Architect will return two (2) sets of Samples. Mark up and retain one (1) returned Sample set as a Project Record Sample.
- G. Product Schedule or List: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location.
 1. Number of Copies:
 - a. Submit three (3) copies of Product Schedule or List for Architect's review, unless otherwise indicated.
 - b. Submit five (5) copies of Product Schedule or List for Consultant's review, unless otherwise indicated.
 - c. Architect will return one (1) copy. Mark up and retain one returned copy as a Project Record Document.

- H. Submittals Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."
- I. Attic Stock Schedule: Within 60 days from the notice to proceed, prepare a schedule indicating the technical specification requirements for Attic Stock indicating the item and the required quantity for the owners review. This schedule shall be reviewed and approved by the owner prior to ordering the attic stock items. Items which are indicated in the technical specification but which the Owner decides will not be needed shall be credited to the owner by change order.
- J. Application for Payment: Comply with requirements specified in Division 01 Section "Payment Procedures."
- K. Schedule of Values: Comply with requirements specified in Division 01 Section "Payment Procedures."
- L. Subcontract List: Unless otherwise required to be submitted with the Bid Form, prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Use CSI Form 1.5A.
 - 1. Number of Copies:
 - a. Submit five (5) copies of subcontractor list, unless otherwise indicated.
 - b. Architect will return two (2) copies. Mark up and retain one returned copy as a Project Record Document.

2.2 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 - 1. Number of Copies: Submit two (2) copies of each submittal, unless otherwise indicated. Architect will not return copies.
 - 2. Certificates and Certifications: Provide a notarized statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
 - 3. Test and Inspection Reports: Comply with requirements specified in Division 01 Section "Quality Requirements."
- B. Coordination Drawings: Comply with requirements specified in Division 01 Section "Project Management and Coordination."
- C. Contractor's Construction Schedule: Comply with requirements specified in Division 01 Section "Construction Progress Documentation."

- D. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
- E. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification (WPS) and Procedure Qualification Record (PQR) on AWS forms. Include names of firms and personnel certified.
- F. Installer Certificates: Prepare written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
- G. Manufacturer Certificates: Prepare written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- H. Product Certificates: Prepare written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- I. Material Certificates: Prepare written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- J. Material Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- K. Product Test Reports: Prepare written reports indicating current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- L. Research/Evaluation Reports: Prepare written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project.
- M. Preconstruction Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- N. Compatibility Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

- O. Field Test Reports: Prepare reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- P. Maintenance Data: Prepare written and graphic instructions and procedures for operation and normal maintenance of products and equipment. Comply with requirements specified in Division 1 Section "Operation and Maintenance Data."
- Q. Design Data: Prepare written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.
- R. Manufacturer's Instructions: Not required.
- S. Manufacturer's Field Reports: Prepare written information documenting factory-authorized service representative's tests and inspections. Include the following, as applicable:
 - 1. Statement on condition of substrates and their acceptability for installation of product.
 - 2. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 - 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
- T. Insurance Certificates and Bonds: Prepare written information indicating current status of insurance or bonding coverage. Include name of entity covered by insurance or bond, limits of coverage, amounts of deductibles, if any, and term of the coverage.
- U. Construction Photographs: Comply with requirements specified in Division 01 Section "Photographic Documentation."
- V. Material Safety Data Sheets (MSDS): Submit information directly to Owner; do not submit to Architect. Architect will not review submittals that include MSDS and will return them for resubmittal without the MSDS.

2.3 DELEGATED DESIGN

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.
- B. Delegated-Design Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services. Actual calculations shall not be reviewed and shall be returned without review
 2. Number of Copies:
 - a. Submit two (2) copies of delegated design submittal statement, unless otherwise indicated.
 3. Delegated Design Submittals are not reviewed by the Architect but are for information only. The delegated design professional whose signature and seal is affixed to the submittals is solely responsible for content and accuracy.

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. Answer subcontractor's, sub-subcontractor's, or vendor's questions and mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 1. Submittals absent of the Contractor's certification statement as being reviewed, checked, and approved for compliance with the Contract Documents, are not acceptable, will be considered non-responsive, and will be rejected.
 2. The approval stamp certifies that the submission is appropriate for the intended use and the material submitted will meet the intent of the contract documents. Manufacturers or subcontractors that have concerns with the installation or appropriateness of the project specified items shall indicate their concerns on the

appropriate submittal and provide alternate solutions to the issue. Any additional cost involved and agreed to shall be handled by the Change Order Process.

3.2 ARCHITECT'S ACTION

- A. General: Architect will not review submittals that do not bear Contractor's approval stamp and will return them without action.
- B. Architect's review of Contractors submittals will be limited to examination of an initial submittal and one resubmittal. The Owner is entitled to obtain reimbursement from Contractor for amounts paid to the Architect for evaluation of additional re-submittals.
- C. Action Submittals: Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Architect will stamp the cover or first page or sheet of each submittal with an action stamp and will mark stamp appropriately to indicate action taken, using the following stamp:

☐ No Exception
Taken

☐ Correct as
Noted

Fabrication / Installation may be undertaken. Approval does not authorize changes to the Contract Sum or Contract Time

☐ Revise & Resubmit
For Record

☐ Correct as
Noted

Fabrication and / or
Installation MAY NOT
be undertaken. In Resubmitting,
limit corrections to items
marked.

☐ Rejected

☐ Review Not
Required

Review / approval neither extends nor alters any contractual obligations of the Architect or Contractor.

By _____ Date _____

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- D. Informational Submittals: Architect will review each submittal and will not return it. Architect will forward each submittal to appropriate party.
- E. Partial Submittals: Partial submittals are not acceptable, will be considered non-responsive, may be returned, but regardless, will not be reviewed.
- F. Submittals not required by the Contract Documents will not be reviewed and may be discarded.
- G. Submittals intended to be requests for product substitutions or requests for interpretation are not acceptable, will be considered non-responsive, and will be rejected.

END OF SECTION 013300

SECTION 013513 SPECIAL PROJECT PROCEDURES

PART 1 - GENERAL

1.1 SPECIAL PROJECT PROCEDURES

- A. Construction and Renovation Policy.

1.2 DOCUMENT AVAILABILITY

- A. A copy of Handbook for Contractors is included in the Project Manual following this page.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PROCEDURES

- A. Follow the requirements of the Special Project Procedures.
- B. On the event of conflicting requirements between these requirements and other requirements of the specifications, the terms and conditions of this document shall take precedence.

END OF SECTION 013513

SECTION 013533 – INFECTION CONTROL PROCEDURES GENERAL

1.1 SUMMARY

- A. This Section includes requirements for infection control procedures for health care renovations and additions.
- B. Temporary infection controls include, but are not limited to, the following:
 - 1. Special dust control facilities.
 - 2. Temporary HVAC ducting and control items.
 - 3. Material and waste transport requirements.
 - 4. Temporary and final cleaning provisions.
 - 5. Construction personnel requirements.
 - 6. Interim life safety measures.

1.2 RELATED SECTIONS

- A. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
- B. Division 01 Section "Temporary Facilities and Controls" for temporary facilities and controls for other than infection control requirements.
- C. Division 01 Section "Execution Requirements" for additional progress cleaning requirements.

1.3 DEFINITIONS

- A. ASHE is the American Society for Healthcare Engineering of the American Hospital Association and is the promulgator of the procedures required in this Section.
- B. Construction Activity Types are defined by the amount of dust that is generated, the duration of the activity, and the scope of shared HVAC systems. In the event of a question regarding the construction activity type for any activity, request a clarification from the Architect.
 - 1. A description of each of the four Types is located in Part 3 of this Section.
- C. Patient Risk Groups are defined by the vulnerability of the patient population or risk associated with medical procedures performed in the different departments of the health care facility. In the event of a question regarding the infection control risk group for any activity, request a clarification from the Owner.

1. A description of each of the four Groups is located in Part 3 of this Section.

- D. Continuity: The un-interruption of that which exists and the temporary extension of existing assemblies, systems, and services to maintain the health and safety of hospital patients, staff, and guests.

1.4 PROJECT RISK ASSESSMENT

- A. Determine the level of Infection Control Activity Classification necessary for the Work by matching construction activity with the designated Patient Risk Group in the matrix located in Part 3 of this Section. Provide the associated infection control procedures.

1.5 PERFORMANCE REQUIREMENTS

- A. Dust: Conduct construction activities, which cause disturbance of existing dust or create new dust, in tight enclosures by cutting off any flow of particles into patient areas.
- B. Odor: Construct temporary infection controls to ensure that fumes and vapors emanating from construction activities are force ventilated to the exterior and sufficiently away from outside air intakes to prevent odors and fumes entering into Owner occupied non-construction areas. Where ventilation to the exterior is infeasible, use air filtration units equipped with activated carbon filters to control odors emanating from construction activities.
- C. Provide continuous airflow into construction area not less than 100 FPM at barricade entrances with doors fully open.
- D. Maintain a minimum pressure differential of 0.010 inch water gauge between Owner occupied spaces and adjoining construction areas.
- E. Maintain continuity of existing fire barrier, smoke barrier, and smoke tight assemblies. Maintain continuity of existing fire detection, annunciation, and suppression systems. Provide a temporary but equivalent system when any fire alarm, selection, or suppression system is impaired.

1.6 SUBMITTALS

- A. Interim Infection Control Measures Program: Submit coordination drawings and narrative that indicates the measures proposed for use, proposed locations, and proposed time duration for their operation. Identify options if proposed measures are later determined to be inadequate. Include, but without limits, the following:
1. Locations of dust-control facilities at each phase of the work.
 2. HVAC system isolation.

3. Location and system description of proposed air filtration system discharge.
4. Dust-control measures.
5. Waste management plan.
6. Personnel traffic and materials flow diagrams.
7. Implementation and maintenance of interim life safety measures.
8. Training program.

1.7 TRAINING

- A. General: Prior to commencing the Work, provide intensive training in infection control procedures for each worker.
- B. Include in the training, but without limits, the following topics:
 1. Sources of molds, bacteria, and viruses.
 2. Construction related infections.
 3. Reasons for and types of barriers.
 4. Use of HEPA filtered air scrubbers.
 5. Personal protective equipment.
 6. Personal hygiene.
 7. Patient risk groups.
 8. General infection control measures, including but not limited to, the requirements of the Owner, the Contract Documents, and the Owner's risk management consultant, and other specifics emanating from the infection control procedures preconstruction conference.
 9. Contractor responsibilities.
- C. Measurement: Include in the training, means to measure each worker's understanding and retention of the information.
- D. Repetition: Conduct the training as often as necessary to include workers new to the project and to include workers whose performance indicates a need for re-training.

1.8 QUALITY ASSURANCE

- A. Infection Control: Comply with Owner's Infection Control requirements.
- B. Tests and Inspections: Arrange for Owner's personnel to perform required inspection. Obtain required certifications and authorizations.
- C. The Owner will monitor biological counts in vicinity of construction work on an as needed basis. Whenever safe levels as determined by Owner are exceeded, Correct conditions immediately.
 1. Stop work on the project whenever a hazardous infection control deficiency exists.

2. Take immediate action to correct deficiencies.
- D. Preinstallation Conference: Conduct conference at Project site. Comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to infection control procedures including, but not limited to, the following:
1. Meet with Architect and Owner's infection control representative.
 2. Review methods and procedures related to infection control.
 3. Review and finalize construction schedule. Verify phases.
 4. Verify the maintenance of paths of egress and paths for constructions materials delivery to the construction area and debris removal from the construction area.
 5. Examine existing conditions for compliance with requirements.
 6. Review regulations and requirements for patients', staff, and guests', health and safety.
 7. Review temporary closure procedures for items including but not limited to open ducts, open pipes, and other incomplete constructions, assemblies, and systems.
 8. Review interim life safety measures.
 9. Review training program for workers.
- E. IICM/ILSM Monitoring: Provide documented daily inspection of areas under interim infection control measures and interim life safety measures.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
1. Comply with requirements in Section 015000 – "Temporary Facilities and Controls".
- B. Temporary Construction Materials:
1. Polyethylene Sheet: Provide the following or comparable product by another manufacturer:
 - a. Product: Dust Control Awareness Barrier.
 - b. Description: Polyethylene; 6 mils thick.
 - c. Flame Spread Index: ASTM E 84, 15.
 - d. Smoke Developed Index: ASTM E 84, 70.
 - e. NFPA Classification: Class A.
 - f. State of California Certification: # F-50701.
 - g. City of Boston Certification: # 33419.

- h. Color: Opaque white with green "Awareness" text.
 - i. Manufacturer: [N]CASE; Post Office Box 220365; Charlotte, North Carolina; 800 947 1975.
 - 2. Lumber and Plywood: Fire-treated, comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry".
 - 3. Insulation: Unfaced fiberglass batts, comply with requirements in Division 07 Section "Thermal Protection".
 - 4. Barrier Doors: Solid core, fire rated, wood in metal frame, painted; comply with requirements in Division 08 Section "Hollow Metal Doors and Frames" and "Flush Wood Doors".
 - 5. Door Hardware: Comply with requirements in Division 08 Section "Door Hardware".
 - 6. Steel Framing: Comply with requirements in Division 09 Section "Non-Structural Metal Framing".
 - 7. Gypsum Board: Fire-rated; comply with requirements in Division 09 Section "Gypsum Board".
 - a. Joint Compound: USG Sheetrock Brand Lightweight All Purpose with dust control, or Architect approved substitution.
 - 8. Painting: Comply with requirements in Division 09 Section "Painting".
- C. Dust Control Adhesive-Surface Walk-off Mats: Provide minimum size mats of 36 x 60 inches as manufactured by 3M, St. Paul, Minnesota 55144, or approved comparable product.
- D. Disinfectant: Owner approved hospital grade disinfectant. Submit product data and sample directly to Owner for approval prior to use.
- E. Control Cube: Portable Ceiling Access Module, "Kontrol Kube Jr." with heavy duty vinyl enclosure as manufactured by Fiberlock Technologies Inc. 680 Putnam Avenue, Cambridge Massachusetts 02139, or approved comparable product.
- F. Shoe Protection: Disposable medical shoe covers acceptable to Owner.
- G. Coveralls: Disposable coveralls acceptable to Owner.
- 2.2 EQUIPMENT
- A. General: Provide equipment suitable for use intended.
 - B. Air Filtration Units: HEPA primary and secondary filters, HEPA-equipped portable unit with 4-stage filtration and activated carbon filters to control organic vapors; sized to accommodate the spatial volumes at hand and to maintain performance requirements. Subject to compliance with requirements, provide products by one of the following or another manufacturer:

1. Abatement Technologies Inc., Duluth, Georgia., 800 634-9091.
 2. Advanced Containment Systems Inc., Houston, Texas.
- C. Exhaust Hoses: Heavy duty, flexible steel reinforced:
1. Ventilation Blower Hose, WPG, Federal Hose Mfg. Co., Painesville, Ohio.
 2. Comparable equipment may be used subject to approval in advance by the Owner.
- D. HEPA Equipped Air Filtration Units: Connect to normal power, gang to a single switch for emergency shutoff, and run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate temporary facilities to ensure full and complete protection of hospital patients, employees, and guests.
- B. Provide each facility ready for use when needed to avoid delay. Maintain and modify as required. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- C. Obtain Infection Control Permit prior to commencing work, when required.
- D. Complete construction barriers indicated on approved coordination drawings prior to commencing work.
- E. Install barriers so that construction and seals maintain full and complete integrity under air pressures.
- F. Walk-off Mats: Provide tack surface walk-off mats at entrances to interior work areas adjacent to Owner-occupied spaces. Replace mats as necessary to keep foot dust and contaminants from Owner occupied non-construction areas but not less than daily during demolition work.

3.2 SPECIAL HVAC CONTROL REQUIREMENTS

- A. Isolation of HVAC: Isolate HVAC system in area where work is to be performed, in accordance with approved coordination drawings, prior to commencing work.
- B. Maintain indicated air velocity into and negative air pressure within work area using HEPA and activated carbon filter-equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.

1. Continually monitor pressure differential to ensure that indicated pressure differential is maintained.
 2. Connect exhaust side of HEPA and activated carbon filter equipped air filtration units directly to exterior and sufficiently away from outside air intakes to prevent dust, fumes and vapors from entering into Owner occupied non-construction areas.
- C. Perform daily construction cleanup and final cleanup using approved, HEPA-filter-equipped vacuum equipment.

3.3 BARRIER FACILITIES INSTALLATION

- A. Temporary Partitions: Provide and maintain floor-to-ceiling dustproof partitions and temporary enclosures to separate areas occupied by Owner to limit dust, fumes, and vapor migration and to protect from noise. Select rating to duplicate rating of permanent partitions.
1. Construct one-hour fire-rated dustproof partitions according to UL Design U465 (GA file No. WP 1081) except with not less than 4 inch wide studs on 16 inch centers and with joints and perimeters taped according to GA-214 Level 3.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than sixty (60) inches between doors.
 - b. Doors and Frames: 45 minute labeled fire door and frame assemblies.
 2. Construct two-hour fire-rated dustproof partitions according to UL Design U411 (GA file No. WP 1616) except with not less than 4 inch wide studs on 16 inch centers and with joints and perimeters taped according to GA-214 Level 3.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than sixty (60) inches between doors.
 - b. Doors and Frames: 90 minute labeled fire door and frame assemblies.
 3. Insulate partitions to provide noise protection to occupied areas.
 4. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 5. Protect air-handling equipment.
 6. Weather strip openings.
- B. Single Room Projects: Seal closed doors with tape applied over the frame and door for projects that can be contained to a single room.
- C. Multi-Room Projects: Erect the following barriers when construction, demolition, or reconstruction can not be contained within a single room:

1. Short Duration Barrier: Airtight sheet fire retardant polyethylene barrier extending from floor to ceiling. Seal seams to prevent dust, debris, and fumes from escaping the construction area into the adjacent occupied spaces.
 2. Long Duration Barrier: Required for Infection Control Risk Groups III and IV. Temporary partitions, as described earlier in this Section, to prevent dust, debris, and fumes from escaping the construction area into the adjacent occupied spaces.
 3. Provide barriers at penetration of ceiling envelopes, chases, and ceiling spaces to stop movement of air and debris.
 4. Provide anteroom and double entrance openings that allow workers to remove protective clothing or vacuum off existing clothing.
 - a. Overlap flap minimum 2 feet wide at polyethylene enclosures for personnel access.
 5. Provide barriers at elevator shafts, stairways, and other vertical chases within the field of construction.
 6. Paint surfaces of temporary partitions that are exposed to hospital patients and staff.
- D. Construct temporary construction barriers and closures, below and above ceilings, air tight.

3.4 INFECTION CONTROL PROCEDURES

- A. Maintain equipment including HEPA-filter equipped vacuums, dust mops, wet mops, brooms, buckets, and clean wiping rags for removing dust from adjacent occupied areas.
 1. Brooms: The possession or use of brooms within interior construction areas and in Owner occupied spaces adjoining construction areas is prohibited.
- B. Contain work areas outside of construction barriers, including spaces above ceilings, with full height polyethylene sheet barrier, taped air tight.
- C. Immediately cleanup dust tracked outside of construction area.
 1. Remove dust tracked outside of barrier immediately utilizing HEPA filtered vacuum and / or damp mop.
- D. Remove debris in tightly covered and sealed containers.
- E. Immediately replace ceiling access panels opened for investigation beyond sealed areas.
- F. Block off existing ventilation ducts within the construction area with dust tight assembly capable of withstanding airflow.

- G. When openings are made into existing ceilings, use Control Cube or provide polyethylene enclosure around ladder, sealing off opening, fitted tight to ceiling and floor. Thoroughly clean surfaces that are exposed to dust.
- H. When access panels are opened in occupied areas for work above ceilings, use Control Cube or polyethylene enclosure around ladder, sealing off opening, fitted tight to ceiling and floor.
- I. Perform vacuuming outside sealed work areas with a certified HEPA filtered vacuum.
- J. Maintain indicated airflow and pressure differential from clean area through anteroom and into work area.
- K. Seal, openings in walls, floors, ceilings, and structural decks, around pipe, duct, and conduit penetrations, and in punctures and cut-outs.
- L. Wipe equipment and transport device wheels using Owner approved disinfectant when traversing near or through sterile corridors.

3.5 OPERATION OF INFECTION CONTROL FACILITIES

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
 - 1. Require personnel entering interior work areas to wear shoe covers and coveralls, as required by Owner; provide for disposal of shoe covers and coveralls at entrances to interior work areas.
- B. Maintenance: Maintain facilities in operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
 - 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.
 - 2. Maintain integrity of dust-control and HVAC-control measures throughout project. Replace damaged seals, tapes, and weatherstrips.

3.6 ENVIRONMENTAL MONITORING

- A. Maintain equipment and replace of HEPA and other filters in accordance with manufacturer's recommendations.
- B. Owner periodically will perform field inspection and testing.
- C. Air Quality Monitoring: Periodically check the quality of the air outside of each temporary partition to ensure that no dust or contaminants are entering the occupied

space. Collect air current cultures and test for colony-forming units on air current plates.

1. Frequency of Testing: Determined by Owner.
2. Acceptable Measure of Test Results: Determined by Owner.

D. Record Keeping:

1. Maintain throughout the term of the Work, a detailed written log including but not limited to the time, day, date, location, benchmark units of measure, and person executing each of the following:
 - a. Walk-Off Mats: Record condition at each monitoring; discarding used and installing new.
 - b. Pressure Differential Monitoring: Record the actual pressure differential indicated at each time of reading.
 - c. Dustproof Barriers: Record the condition of the dustproof barriers at each periodic inspection.
 - d. HVAC Systems and Equipment: Record the status and condition of the HVAC systems at each periodic inspection.
 - e. Personnel and Materials Movement: Record the name of each person and a brief description of each product passing into and out of the construction area.

3.7 ENFORCEMENT

- A. For breach of this infection control policy, Owner will stop the Work. Associated costs incurred by the Owner as well as costs for correction for the work, will be deducted from a subsequent pay application.
 1. The Owner will record the following:
 - a. Document each violation with photographs.
 - b. Extract Contractor or Department information from the work log.
 - c. Maintain a record of infection control violations.
- B. The Owner reserves the right to modify the infection control procedures at any time.
- C. Violations of infection control policies may affect status as a responsible Contractor for bidding future work.

3.8 TERMINATION AND REMOVAL

- A. 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.

1. Materials and facilities that constitute temporary facilities are the property of Contractor.
2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements in Division 1 Section "Closeout Procedures."
 - a. Vacuum work areas thoroughly using HEPA filter vacuums.
 - b. Wet mop floors and wipe surfaces with approved disinfectant.
 - c. Upon completion of Contractor's final cleaning, coordinate inspection and cleaning by Owner's personnel.

3.9 CONSTRUCTION PROJECT ACTIVITIES

- A. Determine the designation of the Construction Project Activity Type (A, B, C, or D) for the Primary Containment Area from the following table and select the corresponding type on the Project Risk Assessment Table.

	CONSTRUCTION PROJECT ACTIVITY TYPE DESCRIPTION (by ASHE)
TYPE A	Inspection and Non-Invasive Activities. Includes but is not limited to: Removal of ceiling tiles for visual inspection limited to 1 inspection per 50 square feet. Painting (but not sanding) Wall covering, electrical trim work, minor plumbing, and activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection.
TYPE B	Small-scale, short duration activities that create minimal dust. Includes but is not limited to: Installation of telephone and computer cabling. Access to chase spaces. Cutting of walls or ceiling where dust migration can be controlled.
TYPE C	Work that generates a moderate to high level of dust or requires demolition or removal of any fixed building components or assemblies. Includes but is not limited to:

	Sanding walls for painting or wall coverings. Removal of floor coverings, ceiling tiles, and casework. New wall construction. Minor ductwork or electrical work above ceilings. Major cabling activities. Any activity that cannot be completed within a single work shift.
TYPE D	Major demolition and construction projects. Includes but is not limited to: Activities that require consecutive work shifts. Requires heavy demolition or removal of a complete cabling system. New construction.

3.10 PATIENT RISK GROUPS (by ASHE)

- A. Determine the appropriate Patient Risk Group for the Primary Containment Area from the following table and select the corresponding Group on the Project Risk Assessment Table. If more than one risk group will be affected, select the higher risk group. The Owner reserves the right to require a higher risk than that indicated below.

GROUP 1 LOW	GROUP 2 MEDIUM	GROUP 3 HIGH	GROUP 4 HIGHEST
1. Office areas 2. <i>Admitting and Discharge</i> 3. <i>General Storage</i> 4. <i>Parking</i> 5. <i>Volunteer Services</i> 6. <i>Library</i> 7. <i>Medical Records</i> 8. <i>Engineering</i> 9. <i>Meeting and Classrooms</i>	1. Cardiology 2. Echocardiography 3. Nuclear Medicine 4. Physical Therapy 5. Radiology / MRI 6. Respiratory Therapy 7. <i>Clinic</i> 8. <i>Long Term Care Units</i>	1. CCU 2. Emergency Room 3. Labor and Delivery 4. Laboratories (Specimen) 5. Newborn Nursery 6. Outpatient Surgery 7. Pediatrics 8. Pharmacy 9. Post Anesthesia Care Unit 10. Surgical Units	1. Any area caring for immunocompromised patients 2. Burn Unit 3. Cardiac Catheterization Laboratory 4. Central Sterile Supply 5. Intensive Care Units 6. Medical Unit 7. Negative Pressure Isolation Rooms 8. Oncology

GROUP 1 LOW	GROUP 2 MEDIUM	GROUP 3 HIGH	GROUP 4 HIGHEST
10. <i>Environmental services</i>	9. <i>Materials Management</i> 10. <i>Computer Rooms</i> 11. <i>Morgue</i> 12. <i>Outpatient Areas</i> 13. <i>Sports Medicine</i>	11. <i>Physical Therapy</i> 12. <i>Food Service</i>	9. Operating Rooms 10. C-Section Rooms 11. Endoscopy 12. Dialysis 13. Renal Services / Transplant 14. Anesthesia and Pump Areas

Areas indicated by *New Times Roman italics* are those areas not listed by the American Society for Healthcare Engineering but that appeared on non-ASHE versions.

3.11 PROJECT RISK ASSESSMENT TABLE (by ASHE)

- A. Infection Control consultation is required when the construction activity and risk level indicate that Class III and Class IV control procedures are necessary.

PATIENT RISK GROUP ↓	CONSTRUCTION ACTIVITY CLASS			
	TYPE "A"	TYPE "B"	TYPE "C"	TYPE "D"
Group 1 (Low)	I	II	II	III / IV
Group 2 (Medium)	I	II	III	IV
Group 3 (High)	I	II	III / IV	IV
Group 4 (Highest)	II	III / IV	III / IV	IV

3.12 INFECTION CONTROL REQUIREMENTS BY ACTIVITY CLASS (by ASHE)

- A. Class I

During Construction Project:

1. Execute work by methods that minimize raising dust from construction operations.

2. Immediately replace a ceiling tile displaced for visual inspection.

Upon Completion of Project:

3. Clean work area upon completion of task.

B. Class II

During Construction Project:

1. Provide active means to prevent air-borne dust from dispersing into atmosphere.
2. Water mist work surfaces to control dust while cutting.
3. Seal unused doors with duct tape.
4. Block off and seal air vents.
5. Place dust mat at entrance and exit to work area.
6. Remove or isolate HVAC system in areas where work is being performed.

Upon Completion of Project:

7. Wipe work surfaces with disinfectant.
8. Contain construction waste before transport in tightly covered containers.
9. Wet mop and/or vacuum with HEPA-filtered vacuum before leaving work area.
10. Remove isolation of HVAC system in areas where work is being performed.

C. Class III: Obtain Infection Control Permit from Owner prior to commencing work.

During Construction Period:

1. Comply with requirements for Class II.
2. Remove or isolate HVAC system in area where Work is being done to prevent contamination of the duct system.
3. Complete all critical barriers to seal area from non-work area or implement control cube method before construction begins.
4. Maintain negative air pressure within work site utilizing HEPA and activated carbon equipped air filtration units.
5. Contain construction waste before transport in tightly covered containers.
6. Cover transport receptacles or carts. Tape covering unless solid lid.

Upon Completion of Project:

7. Do not remove barriers from work area until completed project is inspected by Owner's Safety Department and Infection Control Department and thoroughly cleaned by the Owner's Environmental Services Department
8. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
9. Vacuum work area with HEPA filtered vacuums.
10. Wet mop work area with disinfectant.
11. Remove isolation of HVAC systems in areas where work is being performed.

- D. Class IV: Obtain Infection Control Permit from Owner prior to commencing work.

During Construction Period:

1. Isolate HVAC system in area where work is being done to prevent contamination of duct system.
2. Complete all critical barriers to seal area from non-work area or implement control cube method before construction begins.
3. Maintain negative air pressure within work site utilizing HEPA and activated carbon equipped air filtration units.
4. Seal holes, punctures, and penetrations of pipes, ducts, and conduits.
5. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using a HEPA vacuum cleaner before leaving work site, or they can wear cloth or paper coveralls that are removed each time they leave work site.
6. All personnel entering work site are required to wear shoe covers. Shoe covers must be changed each time the worker exists the work area.
7. Do not remove barriers from work area until completed project is inspected by Owner's Safety Department and Infection Control Department and thoroughly cleaned by the Owner's Environmental Services Department

Upon Completion of Project:

8. Remove barrier material carefully to minimize spreading of dirt and debris associated with construction.
9. Contain construction waste before transport in tightly covered containers.
10. Cover transport receptacles or carts. Tape covering unless solid lid.
11. Vacuum work area with HEPA-filtered vacuums.
12. Wet mop area with disinfectant.
13. Remove isolation of HVAC system in areas where work is being performed.

3.13 INFECTION CONTROL CONSTRUCTION PERMIT(Two Pages)

INFECTION CONTROL CONSTRUCTION PERMIT (by ASHE)			Permit No.:		
Location of Construction:			Project Start Date:		
Project Coordinator:			Estimated Duration:		
Contractor performing Work:			Permit Expiration Date:		
Superintendent:			Telephone:		
YES	NO	CONSTRUCTION ACTIVITY	YES	NO	PATIENT RISK GROUP
		TYPE A: Inspection, non-invasive activities.			Group 1: Low risk
		TYPE B: Small scale, short duration activities, minimal dust levels.			Group 2: Medium risk
		TYPE C: Activity generates moderate to high dust level or requires demolition or removal of any fixed building components or assemblies; one work shift for completion.			Group 3: High risk
		TYPE D: Major demolition and construction activities requiring consecutive work shifts.			Group 4: Highest risk
CLASS I		1. Execute work by methods to minimize raising dust from construction activities. 2. Immediately replace any ceiling tile displaced for visual inspection. 3. Minor demolition for Remodeling.			

CLASS II	1. Provide active means to prevent airborne dust from dispersing into atmosphere. 2. Water-mist work surfaces to control dust while cutting. 3. Seal unused doors with duct tape. 4. Block off and seal air vents. 5. Wipe surfaces with disinfectant.	6. Contain construction waste before transport in tightly covered containers. 7. Wet mop and/or vacuum with HEPA filtered vacuum before leaving work area. 8. Place dust mat at entrance and exit of work area. 9. Remove or isolate HVAC system in areas where work is being performed.

CLASS III	1. Obtain infection control permit before construction begins. 2. Isolate HVAC system in area where work is being done to prevent contamination of the duct system.	6. Vacuum work with HEPA filtered vacuums. 7. Wet mop with disinfectant.
Date		8. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction.
Initial	3. Complete all critical barriers or implement control cube method before construction begins. 4. Maintain negative air pressure within work site utilizing HEPA and activated carbonequipped air filtration units. 5. Do not remove barriers from work area until completed project is thoroughly cleaned by Environmental Services Department.	9. Contain construction waste before transport in tightly covered containers. 10. Cover transport receptacles or carts. Tape covering. 11. Remove or isolate HVAC system in areas where work is being performed.
CLASS IV	1. Obtain infection control permit before construction begins. 2. Isolate HVAC system in area where work is being done to prevent contamination of duct system.	7. All personnel entering worksite are required to wear shoe covers. 8. Do not remove barriers from work area until completed project is thoroughly cleaned by the Environmental Services Department.
Date		

Initial	3. Complete all critical barriers or implement control cube method before construction begins. 4. Maintain negative air pressure within work site utilizing HEPA and activated carbonequipped air filtration units. 5. Seal holes, pipes, conduits, and punctures appropriately. 6. Construct anteroom and require all personnel to pass through this room so they can be vacuumed using an HEPA vacuum cleaner before leaving work site or they can wear cloth or paper coveralls that are removed each time they leave the work site.	9. Vacuum work area with HEPA filtered vacuums. 10. Wet mop with disinfectant. 11. Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction. 12. Contain construction waste before transport in tightly covered containers. 13. Cover transport receptacles or carts. Tape covering. 14. Remove or isolate HVAC system in areas where work is being performed.
Additional requirements:		
Date Initials	Date Initials Exceptions / Additions to this Permit are described on attached memoranda	
Permit request by:	Permit authorized by:	
Date:	Date:	

END OF SECTION 013533

SECTION 014000 – QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
 - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
 - 3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.
- C. Related Sections:
 - 1. Division 01 Section "Construction Progress Documentation" for developing a schedule of required tests and inspections.
 - 2. Division 01 Section "Mockups" for mockup requirements.
 - 3. Division 01 Section "Cutting and Patching" for repair and restoration of construction disturbed by testing and inspecting.
 - 4. Divisions 02 through 49 Sections for specific test and inspection requirements.

1.2 DEFINITIONS

- A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

- C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
1. Assembly Mockups: Mockups of building assemblies erected separately from the building but on the project site, consisting of multiple products, assemblies and subassemblies.
 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
 3. Visual Mockups: Mockups for purpose of color selection and acceptance of aesthetic affect.
- D. Preconstruction Testing: Tests and inspections performed specifically for the Project before products and materials are incorporated into the Work to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- F. Source Quality-Control Testing: Tests and inspections that are performed at the source, i.e., plant, mill, factory, or shop.
- G. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work. This specification includes field testing on in place sections of exterior wall, waterproofing, etc.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.
1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade or trades.
- J. Experienced: When used with an entity or individual, "experienced" means having successfully completed previous projects similar in nature, size, and extent to this

Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.3 CONFLICTING REQUIREMENTS

- A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.4 INFORMATIONAL SUBMITTALS

- A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.
- B. Contractor's Quality-Control Manager Qualifications: For supervisory personnel.
- C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.
 - 1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.
- D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- E. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
 - 1. Specification Section number and title.
 - 2. Entity responsible for performing tests and inspections.
 - 3. Description of test and inspection.
 - 4. Identification of applicable standards.
 - 5. Identification of test and inspection methods.
 - 6. Number of tests and inspections required.

7. Time schedule or time span for tests and inspections.
8. Requirements for obtaining samples.
9. Unique characteristics of each quality-control service.

1.5 CONTRACTOR'S QUALITY-CONTROL PLAN

- A. Quality-Control Plan, General: Submit quality-control plan within 21 days of Notice to Proceed, and not less than fourteen days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.
- B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.
 1. Project quality-control manager may also serve as Project superintendent and shall not have other Project responsibilities.
- C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.
- D. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:
 1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.
 2. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."
 3. Owner-performed tests and inspections indicated in the Contract Documents, including tests and inspections indicated to be performed by the Commissioning Authority.
- E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.
- F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.6 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
1. Date of issue.
 2. Project title and number.
 3. Name, address, and telephone number of testing agency.
 4. Dates and locations of samples and tests or inspections.
 5. Names of individuals making tests and inspections.
 6. Description of the Work and test and inspection method.
 7. Identification of product and Specification Section.
 8. Complete test or inspection data.
 9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and reinspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of technical representative making report.
 2. Statement on condition of substrates and their acceptability for installation of product.
 3. Statement that products at Project site comply with requirements.
 4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 6. Statement whether conditions, products, and installation will affect warranty.
 7. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Name, address, and telephone number of factory-authorized service representative making report.
 2. Statement that equipment complies with requirements.
 3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 4. Statement whether conditions, products, and installation will affect warranty.
 5. Other required items indicated in individual Specification Sections.

- D. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.
- E. Special Inspections: Prepare and submit the following written reports for items performed by the contractor:
 - 1. Contractor's Statement of Responsibility.
 - 2. Fabricator's Certificate of Compliance.

1.7 QUALITY ASSURANCE

- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Contractor, Subcontractor, and Sub-subcontractor Qualifications:
 - 1. A contractor, subcontractor, or sub-subcontractor knowledgeable of the Procurement and Contracting Requirements and of the General Requirements for this Work.
 - 2. A contractor, subcontractor, or sub-subcontractor expert at that portion of the Work for which it has been engaged.
 - 3. A contractor, subcontractor, or sub-subcontractor who understands its portion of the Work, that its portion of the Work includes whatever labor and materials are necessary for a complete application, installation, or assembly, ready for use, and that the results are in compliance with the Contract Documents and applicable codes, as a minimum.
 - 4. A contractor, subcontractor, or sub-subcontractor knowledgeable with the industry or trade standards applicable to its portion of the Work and has trained or has caused the training of its workers to have full knowledge of those industry or trade standards.
 - 5. A contractor, subcontractor, or sub-subcontractor who applies the industry or trade standards applicable to its portion of the Work.
 - 6. A contractor, subcontractor, or sub-subcontractor who employs only those workers who are skilled at that contractor's, subcontractor's, or sub-subcontractor's industry or trade and, where certification programs exist for that contractor's, subcontractor's, or sub-subcontractor's industry or trade employs only those workers who are certified.
 - 7. A contractor, subcontractor, or sub-subcontractor who understands how its portion of the Work interfaces with other construction activities that precede, that are concurrent with, and that follow the contractor's, subcontractor's, or sub-subcontractor's portion of the Work, and whose interfaces are executed in a collaborative and cooperative manner.

- C. **Manufacturer Qualifications:** A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. **Fabricator Qualifications:** A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- E. **Installer Qualifications:** A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.
- F. **Professional Engineer Qualifications:** A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.
- G. **Specialists:** Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- H. **Testing Agency Qualifications:** An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and where required by authorities having jurisdiction, that is acceptable to authorities.
 - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
 - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- I. **Manufacturer's Technical Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. **Factory-Authorized Service Representative Qualifications:** An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

- K. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. Provide sizes and configurations of test assemblies, mockups to adequately demonstrate capability of products to comply with performance requirements.
 - d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
 - e. When testing is complete, remove test specimens, assemblies, mockups. Do not reuse products on Project.
 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.

1.8 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.
1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
 2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
 2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

- a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
- 3. Notify testing agencies at least 48 hours in advance of time when Work that requires testing or inspecting will be performed.
- 4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
- 5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
- 6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Division 01 Section "Submittal Procedures."
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.
- F. Contractor Employed Testing Agency Responsibilities: Cooperate with Architect in performance of duties. Provide qualified personnel to perform required tests and inspections.
 - 1. Notify Architect promptly of irregularities or deficiencies observed in the Work during performance of its services.
 - 2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
 - 3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
 - 4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service.
 - 5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
- G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
 4. Facilities for storage and field curing of test samples.
 5. Delivery of samples to testing agencies.
 6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.
1. Schedule times for tests, inspections, obtaining samples, and similar activities.
- I. Schedule of Tests and Inspections: See Structural Drawings.
- 1.9 SPECIAL TESTS AND INSPECTIONS
- A. See Structural Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Prepare a record of tests and inspections. Include the following:
1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

Contractor's Statement of Responsibility

Each contractor responsible for the construction or fabrication of a system or component designated in the Quality Assurance Plan must submit a Statement of Responsibility.

Project:

Contractor's Name:

Address:

License No.:

Description of designated building systems and components included in the Statement of Responsibility:

Contractor's Acknowledgment of Special Requirements

I hereby acknowledge that I have received, read, and understand the Quality Assurance Plan and Special Inspection program.

I hereby acknowledge that control will be exercised to obtain conformance with the construction documents approved by the Building Official.

Signature

Date

Contractor's Provisions for Quality Control

Procedures for exercising control within the contractor's organization, the method and frequency of reporting and the distribution of reports is attached to this Statement.

Identification and qualifications of the person(s) exercising such control and their position(s) in the organization are attached to this Statement.

Fabricator's Certificate of Compliance

Each approved fabricator that is exempt from Special Inspection of shop fabrication and implementation procedures per section 1704.2 of the International Building Code must submit a *Fabricator's Certificate of Compliance* at the completion of fabrication.

Project:

Fabricator's Name:

Address:

Certification or Approval Agency:

Certification Number:

Date of Last Audit or Approval:

Description of structural members and assemblies that have been fabricated:

I hereby certify that items described above were fabricated in strict accordance with the approved construction documents.

Signature

Date

Title

Attach copies of fabricator's certification or building code evaluation service report and fabricator's quality control manual.

END OF SECTION 014000

SECTION 014010 - MOCKUPS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This section includes requirements for field mockup construction.

1.2 RELATED SECTIONS

- A. Division 01 Sections for general requirements.
- B. Division 02 through 49 Sections for field testing of mockups.
- C. Division 02 through 49 Sections for applicable construction requirements.

1.3 DEFINITIONS

- A. Assembly Mockups: Full-size, physical assemblies that are constructed on-site. Mockups are used to verify selections made under sample submittals, to demonstrate aesthetic effects and, where indicated, qualities of materials and execution, and to review construction, coordination, testing, or operation; they are not Samples.
- B. Visual Mockups: Mockup for visual review of colors, textures, and character of actual building materials for purposes of final selection and acceptance.
- C. Full Room Mockups: Complete sample rooms, fabricated as early in the construction process as possible, for the Architect and Owner to make final decisions on room function, details, materials, and finishes. The mockups set workmanship standards for the project.

1.4 SUBMITTALS

- A. Provide submittals according to requirements of Division 02 through 49 sections.
- B. Shop Drawings. Coordinated drawings of mockup assembly. Indicate details, dimensions, connections, tolerances, and the relationship of the various parts to each other and to adjoining work.
- C. Samples and Product Data. Prior to delivery of materials for mockup, submit product data and samples of materials intended for use in the construction of the mockup.

Indicate characteristics such as scale, color and texture of finishes; and sizes, shapes, and physical properties of the materials to be used in the Work.

- D. Submittals are not considered approved until after acceptance and review of the field mockup assemblies.

1.5 QUALITY ASSURANCE

- A. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:
 - 1. Build mockups in location and of size indicated or, if not indicated, as directed by Architect.
 - 2. Demonstrate the proposed range of aesthetic effects and workmanship.
 - 3. Obtain Architect's approval of mockups before starting work, fabrication, or construction.
 - a. Allow seven (7) days for initial review and each re-review of each mockup.
 - 4. Approved mockups establish the standard by which the Work will be judged.
 - 5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
 - 6. Demolish and remove mockups not incorporated into the construction when directed, unless otherwise indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Provide new materials according to requirements of Division 02 through 49 sections.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before ordering materials for construction of mockups, obtain approval by Architect of the following:
 - 1. Materials.
 - 2. Submittals.
 - 3. Quality stands and installation methods.

3.2 INSTALLATION

- A. Execute installations according to requirements of Division 02 through 49 sections.
- B. Maintain and protect mockups for the life of the project or until the Architect indicates that the mockup is no longer necessary.
- C. Remove mockups, which are not part of the construction, when directed by Architect.
- D. Change and modify mockups until accepted by Architect.

3.3 ASSEMBLY MOCKUPS

- A. General: Construct assembly mockups as indicated on the Drawings and described in the applicable Division 02 through 49 Sections.
- B. Install mockups where directed by Architect or as indicated on the Drawings.
- C. Penetration Firestopping: Provide a minimum of 10 mockups of the most prevalent assemblies that will be found in the construction amongst all trades. Provide each mock up separate of the construction in order to be able to use it for comparison to installed work.

3.4 VISUAL MOCKUPS

- A. General: Construct visual mockups as indicated on the Drawings and described in the applicable Division 02 through 49 Sections.
- B. Install mockups as part of the ongoing fitout construction as noted on the drawings.

3.5 FULL ROOM MOCKUPS

- A. Full Room Mockups shall serve as both Assembly and Visual Mockups. The Full Room Mockup shall be complete with ceilings, doors, walls, finishes, equipment, fixtures and trim. The full room mockup shall be reviewed by members of the McLeod Staff for location of outlets, gases, specialties and other construction aspects. Minor changes and adjustments will be required prior to approval. McLeod Hospital shall provide final approval to the location and appearance of the various components. Early completion and review of the mockup construction is an important part of the approval process and sufficient time must be allotted to this process. The mock up room shall serve as a standard for the construction of the remaining patient rooms, and confirmation of match to construction of the existing patient units. Full Room mockups are not required to have functional plumbing and medical gas fixtures, except shower drains should work for drainage testing. Lighting fixtures shall be operational.

- B. The Owner shall arrange for Owner Purchased Equipment to be delivered to the Contractor for Installation and placement by the General Contractor. The Owner may choose to stage various mock procedures and patient types as part of the approval process.

3.6 FIELD QUALITY CONTROL

- A. Protect mockups from the elements by using non-staining, weather-resistant membrane.
- B. Inspection: Notify Architect fourteen (14) days prior to the start of mockup construction and submit progress schedule to allow Architect to schedule inspections during and after construction of mockups.
- C. Provide convenient and safe access to mockups during construction for visual inspections by Architect, Owner, and other interested parties.
- D. At approximately fifty (50) percent completion of each mockup, request Architect's preliminary review and obtain preliminary approval before completing each mockup. Incorporate changes or modifications requested by the Architect into the mockup assembly while it is being constructed.
 - 1. Should mockup assembly fail to receive the approval of the Architect, dismantle and rebuild at no additional cost and to the extent necessary until the Architect's approval has been obtained.
- E. Allow sufficient time for the construction, rebuilding, and completion of each mockup and the periodic inspections by the Architect, to avoid delay in the construction schedule.
- F. Obtain Architect's approval of each finished mockup before commencing the corresponding portion of the Work.
 - 1. Approvals include but are not limited to the following:
 - a. Materials.
 - b. Device Locations
 - c. Quality standards.
 - d. Assembly.
 - e. Methods of installation.

3.7 MOCKUP SCHEDULE

- A. Assembly Mockups:

1. Penetration firestopping.
 2. Millwork Examples: Portions of typical reception desk, base cabinet, wall cabinet, wall paneling, and wood ceiling. Mockups, after modifications have been made to receive approval by Architect and Owner, may be incorporated into the project.
 3. GWB Examples: Reveals (including intersections and at corner guards), Level 5 finished wall below wall wash light fixture. Mockups, after modifications have been made to receive approval by Architect and Owner, may be incorporated into the project.
- B. Visual Mockups:
1. Paint and sheet wall protection, to verify color match.
 2. Natural wood and wood-grained PLAM, to verify color match.
- C. Full Room Mockups
1. Typical patient room, nurse work alcove, and patient toilet/shower complete. Mockups, after modifications have been made to receive approval by Architect and Owner, may be incorporated into the project.

END OF SECTION 014010

SECTION 014200 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are those included in AIA Document A201 regardless of whether this Document is or is not a part of the Contract Documents.
- B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated.
- C. "Day": Means a calendar day, unless otherwise specifically defined.
- D. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "approved," "required," and "permitted" have the same meaning as "directed."
- E. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- F. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- G. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- H. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.
- I. "Provide": Furnish and install, complete and ready for the intended use.
- J. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents, unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.
- D. Abbreviations and Acronyms for Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale Research's "Encyclopedia of Associations" or in Columbia Books' "National Trade & Professional Associations of the U.S."
- B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.
- C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.
- D. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014200

SECTION 014310 – CONTRACTOR QUALIFICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Qualifications and requirements for contractors, subcontractors, sub-subcontractors, and their vendors and suppliers.

1.2 DEFINITIONS

- A. Contractor: A person or entity who has a direct contract relationship with the Owner to perform a portion of or all of the Work.
- B. Subcontractor: A person or entity who has a direct contract relationship with a contractor to perform a portion of the Work.
- C. Sub-subcontractor: A person or entity who has a direct contract relationship with a subcontractor to perform a portion of the Work.

1.3 SUBCONTRACTUAL RELATIONS

- A. Subcontractor: By appropriate agreement, require each subcontractor, to the extent of the Work performed by the subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the subcontractor's work, which the Contractor, by these Documents, assumes toward the Owner. Require each subcontractor to enter into similar agreements with each of its sub-subcontractors.

1.4 PERFORMANCE REQUIREMENTS

- A. Each contractor, subcontractor, and sub-subcontractor warrants the following:
 - 1. The said contractor, subcontractor, or sub-subcontractor is knowledgeable of the Procurement and Contracting Requirements and of the General Requirements for this Work.
 - 2. The said contractor, subcontractor, or sub-subcontractor is an expert at that portion of the Work for which it has been engaged.
 - 3. The said contractor, subcontractor, or sub-subcontractor understands its portion of the Work, that its portion of the Work includes whatever labor and materials are necessary for a complete and fully functional application, installation, or

assembly, ready for use, and that the results are in compliance with the Contract Documents and applicable codes, as a minimum.

4. The said contractor, subcontractor, or sub-subcontractor is knowledgeable with the industry or trade standards applicable to its portion of the Work and has trained or has caused the training of its workers to have full knowledge of those industry or trade standards, and is familiar with the other work related restrictions associated with work within an operational hospital.
5. The said contractor, subcontractor, or sub-subcontractor shall apply the industry or trade standards applicable to its portion of the Work.
6. The said contractor, subcontractor, or sub-subcontractor shall employ only those workers who are skilled at that contractor's, subcontractor's, or sub-subcontractor's industry or trade and, where certification programs exist for that contractor's, subcontractor's, or sub-subcontractor's industry or trade, shall employ only those workers who are certified.
7. The said contractor, subcontractor, or sub-subcontractor understands how its portion of the Work interfaces with other construction activities that precede, that are concurrent with, and that follow the said contractor's, subcontractor's, or sub-subcontractor's portion of the Work, and that said interfaces are executed in a collaborative and cooperative manner.

- B. Superintendent: Each contractor, subcontractor, or sub-subcontractor shall employ a competent superintendent who shall be in attendance during the performance of its portion of the Work.

1.5 SUBMITTALS

- A. Certifications: At the request of the Architect, provide a copy of each worker's certification where certification programs exist for that worker's industry or trade.

1.6 QUALITY ASSURANCE

- A. Contractor's Responsibility: Each contractor warrants that each of its subcontractors, vendors, and suppliers fully understands its performance requirements.
- B. Subcontractor's Responsibilities: Each subcontractor warrants that each of its sub-subcontractors, vendors, and suppliers fully understands its performance requirements.
- C. Sub-subcontractor's Responsibilities: Each sub-subcontractor warrants that each of its vendors and suppliers fully understands its performance requirements.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 014310

SECTION 015000 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Sections include the following:
 - 1. Division 01 Section "Summary" for limitations on utility interruptions and other work restrictions.
 - 2. Division 01 Section "Submittal Procedures" for procedures for submitting copies of implementation and termination schedule and utility reports.
 - 3. Division 01 Section "Infection Control Procedures" for limitations on work adjacent to the existing hospital.
 - 4. Division 01 Section "Execution" for progress cleaning requirements.
 - 5. Divisions 02 through 49 Sections for temporary heat, ventilation, and humidity requirements for products in those Sections.

1.2 GENERAL PROVISIONS

- A. Safety Precautions and Programs: Assume total responsibility for initiating, maintaining, and supervising all safety precautions, programs, devices, protections, and any other safety endeavors in connection with the performance of the Contract.

1.3 DEFINITIONS

- A. Permanent Enclosure: As determined by Architect, permanent or temporary roofing is complete, insulated, and weathertight; exterior walls are insulated and weathertight; and all openings are closed with permanent construction or substantial temporary closures.

1.4 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, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

- B. Water Service: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
- C. Electric Power Service: Subject to confirming the adequacy of the Owner's electric service and distribution, electric power from Owner's existing system is available for use for lighting and for small tools without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.
 - 1. Provide electric power service and pay for service installation from the project jobsite to the existing hospital power source in the Central Plant for any material hoist or personnel hoist required for the project construction.

1.5 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Other Informational Submittals:
 - 1. Photographs: Show existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by construction operations.

1.6 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.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
- C. Regulatory Requirements: Comply with governing EPA notification regulations before beginning dewatering. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.7 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Installer of each permanent service shall assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

- B. Standby Labor: All standby labor associated with the operation of temporary facilities and equipment or with the operation of permanent facilities and equipment under contractor control shall be the contractor's responsibility.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Pavement: Repair or replace any permanent pavement damaged during the construction of the project..
- B. Chain-Link Fencing: Minimum 2-inch, 0.148-inch thick, galvanized steel, chain-link fabric fencing; with vinyl stripping and for limitation of view into site minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch OD top rails.
- C. Portable Chain-Link Fencing: Minimum 2-inch, 9-gage, galvanized steel, chain-link fabric fencing; minimum 6 feet high with galvanized steel pipe posts; minimum 2-3/8-inch OD line posts and 2-7/8-inch OD corner and pull posts, with 1-5/8-inch OD top and bottom rails. Provide concrete or galvanized steel bases for supporting posts.
- D. Plywood Fencing: Minimum 8'-0" high painted fencing using 4 x 4 treated posts and suitable sub framing, 1/2" exterior grade plywood and suitable gates as required. Fencing shall be painted. Plywood Fencing is the preferred system and shall be used unless owner approves otherwise.
- E. Lumber and Plywood: Comply with requirements in Division 06 Section "Miscellaneous Rough Carpentry."
- F. Gypsum Board: Minimum 1/2 inch thick by 48 inches wide by maximum available lengths; Type X panels with tapered edges. Comply with ASTM C 36/C 36M.
- G. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.
- H. Paint: Comply with requirements in Division 09 painting Sections.

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.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.
 - 1. Store combustible materials apart from building.

2.3 EQUIPMENT

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled for type of fuel being consumed, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use. Prior to use, all heating equipment must be inspected and approved by the owner.
 - 3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction. Clean and restore system to like new condition.

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. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
- C. Water Service: Use of Owner's existing water service facilities will be permitted, as long as facilities are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
 1. Where installations below an outlet might be damaged by spillage or leakage, provide a drip pan of suitable size to minimize water damage. Drain accumulated water promptly from pans.
- D. 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.
 1. Toilets: Use of Owner's existing toilet facilities is prohibited.
- E. Heating and Cooling: Provide temporary heating and cooling 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.
- F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- G. Electric Power Service: Use of Owner's existing electric power service will be permitted, as long as equipment is maintained in a condition acceptable to Owner.
- H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system. Remove system at end of practical use.
- I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel.

3.3 SUPPORT FACILITIES INSTALLATION

- A. General: Comply with the following:
 - 1. Provide non-combustible construction for offices, shops, and sheds located within construction area or within an area designated by the owner for these operational facility requirements Comply with NFPA 241.
 - 2. Maintain support facilities until near Substantial Completion. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. 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.
- C. Parking: Use designated areas of Owner's existing parking areas for construction personnel.
- D. Project Identification and Temporary Signs: Provide Project identification and other signs. Install signs where required to inform public and individuals seeking entrance to Project. Unauthorized signs are not permitted.
 - 1. Provide temporary, directional signs for construction personnel and visitors.
 - 2. Maintain and touchup signs so they are legible at all times.
- E. 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 01 Section "Execution" for progress cleaning requirements.
 - 1. Dust and Waste Control: Maintain dust control and waste management procedures throughout the Work and at all times. Provide chutes, closeable containers, and other devices as necessary.
- F. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
 - 1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- G. Existing Elevator Use: Use of existing elevators will only be permitted as approved by the Owner.
- H. Temporary Stairs:

1. Existing Stair Usage: Use of existing stairs will only be permitted as approved by the Owner. Repair any damage to stair construction to like new condition regardless of source of damage.

3.4 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 airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.
- C. Pest Control: Use practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.
- D. Site Enclosure Fence: Furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
 1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations. Note that site fencing has been provided in part under previous projects. Revise and relocate existing fencing as required for secure construction operations
- E. Security Enclosure and Lockup: Install substantial temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security.
- F. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- G. Covered Walkway: Erect structurally adequate, protective, covered walkway for passage of individuals along adjacent site areas subject to falling objects. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.
 1. Construct covered walkways using scaffold or shoring framing.
 2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
 3. Paint and maintain in a manner approved by Owner and Architect.

- H. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.
- I. Temporary Partitions: Comply with requirements in Division 01 Section "Infection Control Procedures".
- J. Temporary Partitions: Provide dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.
 - 1. Construct dustproof partitions with 2 layers of 3-mil polyethylene sheet on each side. Cover floor with 2 layers of 3-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant plywood.
 - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.
 - 2. Insulate partitions to provide noise protection to occupied areas.
 - 3. Seal joints and perimeter. Equip partitions with dustproof doors and security locks.
 - 4. Protect air-handling equipment.
 - 5. Weather strip openings.
 - 6. Provide walk-off mats at each entrance through temporary partition.
 - 7. Comply with infection control procedures where required.
- K. 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. Prohibit smoking in construction areas and anywhere on the Owner's property.
 - 2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
 - 3. 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.
 - 4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
 - 5. Fire Extinguishers: Provide not less than one portable fire extinguisher at each stair way at each floor, in each storage area, and in each storage shed, and at additional locations as required by the authority having jurisdiction.
 - a. Fire Extinguisher: Multipurpose chemical; UL rating, 20A-120 BC.

3.5 WORK SITE SECURITY

- A. Guard Service: Contractors Option. The Owner shall not provide or be responsible for site security within the contractor's construction area.
- B. Provide a photo identification badge of and for each agent or employee of the Contractor, subcontractors, sub-subcontractors, vendors, Owner, Architect, Architect's consultants, and any other person needing access to the site. This badge is provided by the Owner's Vendormate system. Each employee is required to attend a 2 hour safety orientation program in order to receive his identification badge.
 - 1. Deny access to the Work site to any person failing to have a valid identification badge in their immediate possession.
 - 2. Comply with McLeod Medical Center Policy for Badging found in the McLeod Construction Manual contained in specification Section 013513.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. 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.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.
- D. 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.
 - 1. Materials and facilities that constitute temporary facilities are property of Contractor.
 - 2. At Substantial Completion, clean and renovate permanent facilities used during construction period. Comply with final cleaning requirements specified in Division 01 Section "Closeout Procedures."

END OF SECTION 015000

SECTION 016000 – PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; and, special warranties.
- B. Related Sections include the following:
 - 1. Division 01 Section "Allowances" for products selected under an allowance.
 - 2. Division 01 Section "Alternates" for products selected under an alternate.
 - 3. Division 01 Section "References" for applicable industry standards for products specified.
 - 4. Division 01 Section "Closeout Procedures" for submitting warranties for Contract closeout.
 - 5. Divisions 02 through 49 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.2 DEFINITIONS

- A. Products: Items purchased for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise. Products salvaged or recycled from other projects are not considered new products.
- B. Basis-of-Design Product Specification: Where a specific manufacturer's product is named and accompanied by the words "basis of design," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

1.3 SUBMITTALS

- A. Product List: Submit a list, in tabular form, showing specified products. Include generic names of products required. Include manufacturer's name and proprietary product names for each product.
1. Coordinate product list with Contractor's Construction Schedule and the Submittals Schedule.
 2. Form: Tabulate information for each product under the following column headings:
 - a. Specification Section number and title.
 - b. Generic name used in the Contract Documents.
 - c. Proprietary name, model number, and similar designations.
 - d. Manufacturer's name and address.
 - e. Supplier's name and address.
 - f. Installer's name and address.
 - g. Projected delivery date or time span of delivery period.
 - h. Identification of items that require early submittal approval for scheduled delivery date.
 3. Completed List: Within forty-two (42) days after date of Notice to Proceed, submit three (3) copies of completed product list. Include a written explanation for omissions of data and for variations from Contract requirements.
 4. Architect's Action: Architect will respond in writing to Contractor within fourteen (14) days of receipt of completed product list. Architect's response will include a list of unacceptable product selections and a brief explanation of reasons for this action. Architect's response, or lack of response, does not constitute a waiver of requirement to comply with the Contract Documents.
- B. Basis-of-Design Product Specification Submittal: Provide the same information as required for every other type of product listing format.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.
- B. The manufacturer shall review the proposed use and installation of the products specifies and/or furnished and shall notify the Contractor and Architect promptly in writing of any deviation or potential deviation from the manufacturers intended use and recommended installation conditions that would affect the long term reliability and durability of the product.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4. Inspect products on delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected.
- C. Storage:
 - 1. Store products to allow for inspection and measurement of quantity or counting of units.
 - 2. Store materials in a manner that will not endanger Project structure.
 - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
 - 4. Store cementitious products and materials on elevated platforms.
 - 5. Store foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
 - 6. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
 - 7. Protect stored products from damage and liquids from freezing.
 - 8. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
 - 1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.

2. Special Warranty: Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.
- B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.
1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
 2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.
 3. Refer to Divisions 02 through 49 Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Division 01 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise indicated, that are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Where products are accompanied by the term "match sample," sample to be matched is Architect's.
 6. Descriptive, performance, and reference standard requirements in the Specifications establish "salient characteristics" of products.
 7. Or Equal: Where products are specified by name and accompanied by the term "or equal" or "or approved equal" or "or approved," comply with provisions in Part 2 "Comparable Products" Article to obtain approval for use of an unnamed product.
- B. Product Selection Procedures:

1. Product: Where Specifications name a single product and manufacturer, provide the named product that complies with requirements.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements.
3. Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed that complies with requirements.
4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements.
5. Available Products: Where Specifications include a list of names of both products and manufacturers, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
6. Available Manufacturers: Where Specifications include a list of manufacturers, provide a product by one of the manufacturers listed, or an unnamed manufacturer, that complies with requirements. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product.
7. Product Options: Where Specifications indicate that sizes, profiles, and dimensional requirements on Drawings are based on a specific product or system, provide the specified product or system. Comply with provisions in Part 2 "Product Substitutions" Article for consideration of an unnamed product or system.
8. Basis-of-Design Product: Where Specifications name a product and include a list of manufacturers, provide the specified product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with provisions in Part 2 "Comparable Products" Article for consideration of an unnamed product by the other named manufacturers.
9. Visual Matching Specification: Where Specifications require matching an established Sample, select a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
 - a. If no product available within specified category matches and complies with other specified requirements, comply with provisions in Part 2 "Product Substitutions" Article for proposal of product.
10. Visual Selection Specification: Where Specifications include the phrase "as selected from manufacturer's colors, patterns, textures" or a similar phrase, select a product that complies with other specified requirements.
 - a. Standard Range: Where Specifications include the phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color,

pattern, density, or texture from manufacturer's product line that does not include premium items.

- b. Full Range: Where Specifications include the phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

PART 3 - EXECUTION (Not Used)

END OF SECTION 016000

SECTION 017300 – EXECUTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes general procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Field engineering and surveying.
3. General installation of products.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Site Safety
9. Mold prevention.
10. Complete heating and cooling correction period.
11. Correction of the Work.

- B. Related Sections include the following:

1. Division 01 Section "Project Management and Coordination" for procedures for coordinating field engineering with other construction activities.
2. Division 01 Section "Submittal Procedures" for submitting surveys.
3. Division 01 Section "Cutting and Patching" for procedural requirements for cutting and patching necessary for the installation or performance of other components of the Work.
4. Division 01 Section "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.

1.2 DEFINITIONS

- A. Correction of Work: The correction of work is defined in Paragraph 12.2 in AIA Document A 201-2007 and said definition applies to this Work regardless of the form or content of the General Conditions at hand.

1.3 SUBMITTALS

- A. Certificates: Submit certificate signed by land surveyor certifying that location and elevation of improvements comply with requirements.
- B. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Existing Conditions: The existence and location of site improvements, utilities, and other construction indicated as existing are not guaranteed. Before beginning work, investigate and verify the existence and location of mechanical and electrical systems and other construction affecting the Work.
 - 1. Before construction, verify the location and points of connection of utility services.
- B. Existing Utilities: The existence and location of utilities and construction indicated as existing are not guaranteed.
- C. Acceptance of Conditions: Examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.
 - 1. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.
 - b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
 - 2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 - 3. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - 4. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.

5. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
- B. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.
- C. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents, submit a request for information to Architect. Include a detailed description of problem encountered, together with recommendations for changing the Contract Documents.

3.3 CONSTRUCTION LAYOUT

- A. Record Log: Maintain a log of layout control work. Record deviations from required lines and levels. Include beginning and ending dates and times of surveys, weather conditions, name and duty of each survey party member, and types of instruments and tapes used. Make the log available for reference by Architect.

3.4 FIELD ENGINEERING

- A. Identification: Owner will identify existing benchmarks, control points, and property corners.

3.5 INSTALLATION

- A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.
 1. Make vertical work plumb and make horizontal work level.
 2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
 3. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
 4. Maintain minimum headroom clearance of eight (8) feet in spaces without a suspended ceiling.

- B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.
- C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.
- D. Sequencing and Fitment: Ensure that each component, material, product, assembly, and system is applied or installed in its appropriate sequence and that the each component, material, product, assembly, and system properly fits with adjacent or adjoining components, materials, products, assemblies, and systems.
- E. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.
- F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.
- G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.
- H. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - 3. Coordinate installation of anchorages. 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.
- I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
- J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.6 OWNER-INSTALLED PRODUCTS

- A. Site Access: Provide access to Project site for Owner's construction forces.

- B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction forces or by other Owner Contracted Construction Forces.
 - 1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
 - 2. Preinstallation Conferences: Include Owner's construction forces at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction forces if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

- A. General: Clean Project site and work areas daily, including common areas. Coordinate progress cleaning for joint-use areas where more than one installer has worked. Enforce requirements strictly. Dispose of materials lawfully.
 - 1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 - 2. Do not hold materials more than seven (7) days during normal weather or three (3) days if the temperature is expected to rise above 80 deg F.
 - 3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
- B. Site: Maintain Project site free of waste materials and debris.
- C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.
 - 1. Remove liquid spills promptly.
 - 2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.
- D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.
- E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

- F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.
- G. Waste Disposal: Burying or burning waste materials on-site will not be permitted. Washing waste materials down sewers or into waterways will not be permitted.
- H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.
- I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

- A. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.
- B. Adjust operating components for proper operation without binding. Adjust equipment for proper operation.
- C. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- D. Manufacturer's Field Service: If a factory-authorized service representative is required to inspect field-assembled components and equipment installation, comply with qualification requirements in Division 01 Section "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

- A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.
- B. Comply with manufacturer's written instructions for temperature and relative humidity.

3.10 MOLD PREVENTION

- A. Ensure that construction activities are executed in such a manner to prevent moisture damage.
 - 1. Render areas, that incur spills or leaks, dry within time period established by US Environmental Protection Agency.
 - 2. Replace products damaged by moisture or mold.
- B. Assume full responsibility for any and all claims, costs, attorney's fees, and expenses whatsoever arising out of the presence of mold.

3.11 COMPLETE HEATING AND COOLING CORRECTION PERIOD

- A. The one-year period for correction of Work is extended for elements of the heating, ventilating, and air-conditioning system as required to incorporate the period of one complete heating season – November 1 through April 1 – and one complete cooling season – April 2 through October 31.

3.12 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes. Comply with requirements in Division 01 Section "Cutting and Patching."
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. Restoration of Damaged Property: If any direct or indirect damage is done to public or private property, existing or new, resulting from any act, omission, neglect, or misconduct, restore the damaged property to a condition equal to that existing before the damage. Replace, repair, or restore as directed by the Architect and the Owner or make good such damage in an acceptable manner to the Architect and to the Owner.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

END OF SECTION 017300

SECTION 017329 – CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedural requirements for cutting and patching.
- B. Related Sections include the following:
 - 1. Division 02 Section "Selective Structure Demolition" for demolition of selected portions of the building.
 - 2. Divisions 02 through 49 Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.
 - 3. Division 07 Section "Penetration Firestopping" for patching fire-rated construction.

1.2 DEFINITIONS

- A. Cutting: Removal of in-place construction necessary to permit installation or performance of other Work. Cutting includes, but is not limited to, the cutting of nominally completed and previously existing work in order to accommodate the coordination of the work or the installation of other work, or to uncover other work for access or inspection, or to obtain samples for testing or similar purposes. Cutting, as defined here, excludes integral cutting during shop fabrication and manufacturing; and, drilling necessary to install fasteners and similar operations.
- B. Patching: Fitting and repair work required to restore surfaces to original conditions after installation of other Work.

1.3 SUBMITTALS

- A. Cutting and Patching Proposal: Submit a proposal describing procedures at least seven (7) days before the time cutting and patching will be performed, requesting approval to proceed. Include the following information:
 - 1. Extent: Describe cutting and patching, show how they will be performed, and indicate why they cannot be avoided.
 - 2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building's appearance and other significant visual elements.

3. Products: List products to be used and firms or entities that will perform the Work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utility Services and Mechanical/Electrical Systems: List services/systems that cutting and patching procedures will disturb or affect. List services/systems that will be relocated and those that will be temporarily out of service. Indicate how long services/systems will be disrupted.
6. Structural Elements: Where cutting and patching involve adding reinforcement to structural elements, submit details and signed and sealed engineering calculations showing integration of reinforcement with original structure.
7. Architect's Approval: Obtain approval of cutting and patching proposal before cutting and patching. Approval does not waive right to later require removal and replacement of unsatisfactory work.

1.4 QUALITY ASSURANCE

- A. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio.
- B. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operating elements include but are not limited to the following:
 1. Primary operational systems and equipment.
 2. Air or smoke barriers.
 3. Fire-detection, annunciation, and suppression systems.
 4. Mechanical systems piping and ducts.
 5. Control systems.
 6. Communication systems.
 7. Conveying systems.
 8. Electrical wiring systems.
 9. Operating systems of special construction in Division 13 Sections.
- C. Miscellaneous Elements: Do not cut and patch miscellaneous elements or related components in a manner that could change their load-carrying capacity that results in reducing their capacity to perform as intended, or that result in increased maintenance or decreased operational life or safety. Miscellaneous elements include but are not limited to the following:
 1. Structural steel, including but not limited to, structural members, lintels, equipment supports, and similar components.
 2. Structural concrete.
 3. Structural floor and roof assemblies.
 4. Bearing walls.
 5. Water, moisture, or vapor barriers.

6. Membranes and flashings.
7. Exterior curtain-wall construction.
8. Equipment supports.
9. Piping, ductwork, vessels, and equipment.
10. Noise- and vibration-control elements and systems.

- D. Visual Requirements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

1.5 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. General: Comply with requirements specified in other Sections.
- B. In-Place Materials: Use materials identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.
1. If identical materials are unavailable or cannot be used, use materials that, when installed, will match the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with in-place finishes or primers.
 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

3.3 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
 - 1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
- B. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
 - 1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 - 2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 - 3. Concrete or Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 - 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 - 5. Proceed with patching after construction operations requiring cutting are complete.
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as

invisible as possible. Provide materials and comply with installation requirements specified in other Sections.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate integrity of installation.
 2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
 3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 4. Existing Floors: Patch to a level and uniform surface unless sloping to drains. Plane to a Class A tolerance in accordance with ACI 301 and that is true to within 1/8 inch in ten (10) feet, non-cumulative, as determined by using a ten (10) foot straightedge placed anywhere on the slab in any direction.
 5. Dust and Contaminants: Prevent the passage of dust and contaminants via holes cut through existing walls or floors by temporary sealing at the end of each day if permanent sealing can not be accomplished on the day that the hole is cut.
 6. Fire and Smoke Rated Assemblies: Where existing concealed or exposed fireproofing, smoke proofing, fire rated assemblies, and smoke rated assemblies are found to be disturbed or are disturbed due to demolition or new construction, patch using materials and products to match existing and to maintain existing fire and smoke ratings.
 7. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
- D. Cleaning: Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.

END OF SECTION 017329

SECTION 017700 – CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
 - 4. Attic Stock Requirements
- B. Related Sections include the following:
 - 1. Division 01 Section "Payment Procedures" for requirements for Applications for Payment for Substantial and Final Completion.
 - 2. Division 01 Section "Photographic Documentation" for submitting Final Completion construction photographs and negatives.
 - 3. Division 01 Section "Execution" for progress cleaning of Project site.
 - 4. Division 01 Section "Project Record Documents" for submitting Record Drawings, Record Specifications, and Record Product Data.
 - 5. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 6. Division 01 Section "Demonstration and Training" for requirements for instructing Owner's personnel.
 - 7. Divisions 02 through 49 Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.2 REQUIREMENTS

- A. Organization: Organize closeout documents according to each specification section and in the sequence in the Table of Contents. Closeout documents organized according to subcontractor or by any other method are not acceptable.
- B. Format: Paper as described, only. Electronic means including but not limited to ftp site posting, portable data storage, and email are not acceptable.

1.3 SUBSTANTIAL COMPLETION

- A. Preliminary Procedures: Before requesting inspection for determining date of Substantial Completion, complete the following. List items below that are incomplete in request.
1. Prepare a list of items to be completed and corrected (punch list), the value of items on the list, and reasons why the Work is not complete.
 2. Advise Owner of pending insurance changeover requirements.
 3. Submit specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 4. Obtain and submit releases permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 5. Prepare and submit Project Record Documents, operation and maintenance manuals, Final Completion construction photographs, damage or settlement surveys, property surveys, and similar final record information.
 6. Deliver tools, spare parts, extra materials, and similar items to location designated by Owner. Label with manufacturer's name and model number where applicable.
 7. Make final changeover of permanent locks and deliver keys to Owner if keys transfer is via Contractor. Advise Owner's personnel of changeover in security provisions.
 8. Complete startup testing of systems.
 9. Submit test/adjust/balance records.
 10. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 11. Advise Owner of changeover in heat and other utilities.
 12. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
 13. Complete final cleaning requirements, including touchup painting.
 14. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
 15. Owner will execute clinical cleaning.
- B. DHEC and Horry County Inspections:
1. Contractor shall coordinate, complete, and document all inspections required by the Horry County.
 2. DHEC will require inspections on a phase-by-phase basis when all above-ceiling work is complete and when spaces are ready to be occupied by the Owner. The Contractor shall schedule these inspections through the Architect, giving at least one month advance notice. The Contractor shall be responsible for preparing, maintaining, and providing copies of the inspection manuals and other materials required by DHEC.

- C. Inspection: Submit a written request for inspection for Substantial Completion. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for Final Completion.
 3. The Architect will make only one (1) substantial completion inspection. The Owner will deduct from the Contract Sum amounts paid to the Architect for each additional inspection.

1.4 FINAL COMPLETION

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
1. Submit a final Application for Payment according to Division 01 Section "Payment Procedures."
 2. Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report and warranty.
 5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. The Architect will make only one (1) final completion inspection. The Owner will deduct from the Contract Sum amounts paid to the Architect for each additional inspection.

1.5 LIST OF INCOMPLETE ITEMS (CONTRACTORS PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A.
1. Organize list of spaces in sequential order.
 2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
 3. Include the following information at the top of each page:
 - a. Project name.
 - b. Date.
 - c. Name of Architect.
 - d. Name of Contractor.
 - e. Page number.

1.6 WARRANTIES

- A. Submittal Time: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated.
- B. Partial Occupancy: Submit properly executed warranties within fourteen (14) days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
 - B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Clean exposed hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - e. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - f. Sweep concrete floors broom clean in unoccupied spaces.
 - g. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.
 - h. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.

- i. Remove labels that are not permanent.
 - j. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - k. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - l. Replace parts subject to unusual operating conditions.
 - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 - n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 - o. Clean ducts, blowers, and coils if units were operated without filters during construction.
 - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - q. Leave Project clean and ready for occupancy.
- C. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.
- D. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

3.2 ATTIC STOCK

- A. Deliver attic stock items to an area defined by owner to receive the stored material. Attic Stock shall be verified with the list of requirements of the technical specification and the schedule of attic stock items required by other sections of the specification.

END OF SECTION 017700

SECTION 017823 – OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 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, finishes, systems, and equipment.
- B. Related Sections include the following:
 - 1. Division 01 Section "Submittal Procedures" for submitting copies of submittals for operation and maintenance manuals.
 - 2. Division 01 Section "Closeout Procedures" for submitting operation and maintenance manuals.
 - 3. Division 01 Section "Project Record Documents" for preparing Record Drawings for operation and maintenance manuals.
 - 4. Divisions 02 through 49 Sections for specific operation and maintenance manual requirements for the Work in those Sections.

1.2 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.

1.3 ACTION SUBMITTALS

- A. Initial Submittal: Submit to Owner one (1) draft copy of each manual at least fourteen (14) days before requesting inspection for Substantial Completion. Include a complete operation and maintenance directory. Owner will return one copy of draft and mark whether general scope and content of manual are acceptable.

- B. Final Submittal: Submit to Owner one (1) copy of each manual in final form at least seven (7) days before final inspection. Owner will return copy with comments within fourteen (14) days after final inspection.
 - 1. Correct or modify each manual to comply with Owner's comments. Submit one (1) copies of each corrected manual within fourteen (14) days of receipt of Owner's comments.

1.4 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 2 - PRODUCTS

2.1 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."

2.2 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. Name and address of Architect.
 7. 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: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - 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. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes or compact discs for computerized electronic equipment.
4. Supplementary Text: Prepared on 8-1/2-by-11-inch white bond paper.
5. 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.

2.3 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.

2.4 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.

2.5 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.

2.6 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. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. 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. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. 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.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

- A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.
- B. 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.
- C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.
- D. 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.
- E. 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.

- F. 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 01 Section "Project Record Documents."
- G. Comply with Division 01 Section "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 017823

SECTION 017839 – PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 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 01 Section "Closeout Procedures" for general closeout procedures.
 - 2. Division 01 Section "Operation and Maintenance Data" for operation and maintenance manual requirements.
 - 3. Divisions 02 through 49 Sections for specific requirements for Project Record Documents of the Work in those Sections.

1.2 SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies: Submit copies of Record Drawings as follows:
 - a. Initial Submittal: Submit one set of marked-up full-size Record Prints. Architect will review the general scope of changes, additional information recorded, and determine if quality of drafting is acceptable and that scope is complete to the best of his knowledge.
 - b. Final Submittal: Submit two (2) sets of marked-up full-size Record Prints,
- B. Record Specifications: Submit two (2) copies of Project's Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit two (2) copies 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 in addition to submittal as Record Product Data.

- D. Miscellaneous Record Submittals: Submit two (2) copies of each Miscellaneous Record Submittal.
- E. Contractor Provided Fabrication Drawings: Provide Cad files of fabricated construction including ductwork, piping, structural steel and concrete framing, major electric conduit and ductbank runs, and site utility construction. Marked up record drawings shall be coordinated and consistent with the fabrication drawings provided.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one full-size 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. Locations and depths of underground utilities.
 - d. Revisions to routing of piping and conduits.
 - e. Revisions to electrical circuitry.
 - f. Actual equipment locations.
 - g. Duct size and routing.
 - h. Locations of concealed internal utilities.
 - i. Changes made by Change Order or Construction Change Directive.
 - j. Changes made following Architect's written orders.
 - k. Details not on the original Contract Drawings.
 - l. Field records for variable and concealed conditions.
 - m. Record information on the Work that is shown only schematically.

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.
- B. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing Record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared Record Drawings into Record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- C. Format: Identify and date each Record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize Record Prints and newly prepared Record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.
 - e. Name of Contractor.

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. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.

3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. Note related Change Orders, Record Product Data, and Record Drawings where applicable.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 3. Note related Change Orders, Record Specifications, and Record Drawings where applicable.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Refer to other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Immediately before Substantial Completion, complete miscellaneous records and place in good order, properly identified and bound or filed, ready for use and reference. Miscellaneous records include, but are not limited to, the following:
 1. Ambient and substrate condition tests.
 2. Certifications received in lieu of labels on bulk products.
 3. Testing and qualification of trades persons.
 4. Documented qualification of installation firms.
 5. Load and performance testing.
 6. Inspections and certifications by governing authorities.
 7. Leakage and water-penetration tests.
 8. Fire-resistance and flame-spread test results.
 9. Final inspection and correction procedures.

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.

- 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.
- C. Availability: Provide access to currently updated Project Record Documents for Owner's or Architect's reference during normal working hours. Record Drawings shall be reviewed periodically by the Owners Representative. Deficient record drawings shall be cause for reduction of the Contractors application for payment.

3.2 SUBMITTAL DISTRIBUTION

- A. Project Record Submittals: Architect will transmit one copy to the Owner and will retain one copy.

END OF SECTION 017839

SECTION 017900 – DEMONSTRATION AND TRAINING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for instructing Owner's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.
- B. Related Sections include the following:
 - 1. Divisions 02 through 49 Sections for specific requirements for demonstration and training for products in those Sections.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit to Owner two (2) copies of outline of instructional program for demonstration and training, including a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
 - 1. At completion of training, submit two (2) complete training manuals for Owner's use.
- B. Qualification Data: For instructor.
- C. Attendance Record: For each training module, submit list of participants and length of instruction time.
- D. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 QUALITY ASSURANCE

- A. Instructor Qualifications: A factory-authorized service representative, complying with requirements in Division 01 Section "Quality Requirements," experienced in operation and maintenance procedures and training.

1.4 COORDINATION

- A. Coordinate instruction schedule with Owner's operations. Adjust schedule as required to minimize disrupting Owner's operations.
- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Owner.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and equipment not part of a system, as required by individual Specification Sections, and as follows:
 - 1. Fire-protection systems, including fire alarm, and fire-extinguishing systems.
 - 2. Intrusion detection systems.
 - 3. Medical equipment, including medical gas equipment and piping.
 - 4. Heat generation, including steam distribution piping, and water distribution piping.
 - 5. Refrigeration systems, including pumps, and distribution piping.
 - 6. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
 - 7. HVAC instrumentation and controls.
 - 8. Electrical service and distribution, including panelboards, uninterruptible power supplies, and motor controls.
 - 9. Lighting equipment and controls.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.

- f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
- 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.
 - b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project Record Documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
- 3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
- 4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
- 5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.

6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:
 - a. Diagnosis instructions.
 - b. Repair instructions.
 - c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - d. Instructions for identifying parts and components.
 - e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- B. Set up instructional equipment at instruction location.

3.2 INSTRUCTION

- A. Engage qualified instructors to instruct Owner's personnel to adjust, operate, and maintain systems, subsystems, and equipment not part of a system.
 1. Owner will furnish Contractor with names and positions of participants.
- B. Scheduling: Provide instruction at mutually agreed on times. For equipment that requires seasonal operation, provide similar instruction at start of each season.
 1. Schedule training with Owner with at least seven (7) days' advance notice.

- C. Evaluation: At conclusion of each training module, assess and document each participant's mastery of module by use of a demonstration performance-based test.
- D. Documentation:
 - 1. Issue written minutes of each training session.
 - 2. Provide video documentation of each training session.
- E. Cleanup: Collect used and leftover educational materials and give to Owner. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 017900

SECTION 035413 - GYPSUM CEMENT UNDERLAYMENT

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 self-leveling, gypsum cement underlayment for application below interior floor coverings.

1.3 ALLOWANCES

- A. Provide gypsum cement underlayment as part of underlayment allowance. Base bid shall include allowance sufficient to cover gypsum cement underlayment to an average depth of 1/4" over the entire project area.

1.4 UNIT PRICES

- A. Work of this Section is affected by underlayment unit price.

1.5 PREINSTALLATION MEETINGS

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

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans indicating substrates, locations, and average depths of underlayment based on survey of substrate conditions.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Installer who is approved by manufacturer for application of underlayment products required for this Project.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with manufacturer's written instructions for substrate temperature, ventilation, ambient temperature and humidity, and other conditions affecting underlayment performance.
 - 1. Place gypsum cement underlayments only when ambient temperature and temperature of substrates are between 50 and 80 deg F.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Comply with ASTM E 119; 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.
- 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.
- C. IIC-Rated Assemblies: For IIC-rated assemblies, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 492 and classified according to ASTM E 989 by an independent testing agency.

2.2 GYPSUM CEMENT UNDERLAYMENTS

- A. Gypsum Cement Underlayment: Self-leveling, gypsum cement product that can be applied in minimum uniform thickness of 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Ardex K 15 or approved equal.
 - 2. Cement Binder: Gypsum or blended gypsum cement as defined by ASTM C 219.
 - 3. Compressive Strength: Not less than 5500 psi at 28 days when tested according to ASTM C 109/C 109M.
 - 4. Underlayment Additive: Resilient-emulsion product of underlayment manufacturer, formulated for use with underlayment when applied to substrate and conditions indicated.

- B. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch; or coarse sand as recommended by underlayment manufacturer.
 - 1. Provide aggregate when recommended in writing by underlayment manufacturer for underlayment thickness required.
- C. Water: Potable and at a temperature of not more than 70 deg F.
- D. Reinforcement: For underlayment applied to wood substrates, provide galvanized metal lath or other corrosion-resistant reinforcement recommended in writing by underlayment manufacturer.
- E. Primer: Product of underlayment manufacturer recommended in writing for substrate, conditions, and application indicated.
- F. Corrosion-Resistant Coating: Recommended in writing by underlayment manufacturer for metal substrates.
- G. Surface Sealer: Designed to reduce porosity as recommended by manufacturer for type of floor covering to be applied to underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for conditions affecting performance of the Work.
- B. Proceed with application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Prepare and clean substrate according to manufacturer's written instructions.
 - 1. Treat nonmoving substrate cracks according to manufacturer's written instructions to prevent cracks from telegraphing (reflecting) through underlayment.
 - 2. Fill substrate voids to prevent underlayment from leaking.
- B. Concrete Substrates: Mechanically remove, according to manufacturer's written instructions, laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants that might impair underlayment bond.
 - 1. Moisture Testing: Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates do not exceed a maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

- C. Adhesion Tests: After substrate preparation, test substrate for adhesion with underlayment according to manufacturer's written instructions.

3.3 APPLICATION

- A. Use underlayment to level sloped and uneven existing concrete floor areas so that substrate is flat and level. Carefully check and level all toilet/shower rooms to ensure correct drainage.
- B. General: Mix and apply underlayment components according to manufacturer's written instructions.
 - 1. Close areas to traffic during underlayment application and for time period after application recommended in writing by manufacturer.
 - 2. Coordinate application of components to provide optimum adhesion to substrate and between coats.
 - 3. At substrate expansion, isolation, and other moving joints, allow joint of same width to continue through underlayment.
- C. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- D. Apply underlayment to produce uniform, level surface.
 - 1. Apply a final layer without aggregate to product surface.
 - 2. Feather edges to match adjacent floor elevations.
- E. Cure underlayment according to manufacturer's written instructions. Prevent contamination during application and curing processes.
- F. Do not install floor coverings over underlayment until after time period recommended in writing by underlayment manufacturer.
- G. Apply surface sealer at rate recommended by manufacturer.
- H. Remove and replace underlayment areas that evidence lack of bond with substrate, including areas that emit a "hollow" sound when tapped.

3.4 PROTECTION

- A. Protect underlayment from concentrated and rolling loads for remainder of construction period.

END OF SECTION 035413

SECTION 064023 - INTERIOR ARCHITECTURAL WOODWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Interior wood frames, jambs, and windows.
 - 2. Wood ceiling grids and PLAM finished panels.
 - 3. Shop finishing of woodwork.
- B. Interior architectural woodwork includes wood furring, blocking, shims, and hanging strips unless concealed within other construction before woodwork installation.
- C. Related Sections include the following:
 - 1. Specification Section 064116 Plastic Laminate Faced Architectural Cabinets
 - 2. Specification Section 064219 Plastic Laminate Faced Wood Paneling
 - 3. Specification Section 099123 Interior Painting
 - 4. Specification Section 099300 Staining
 - 5. Specification Section 123661 Simulated Stone Countertops and Thresholds

1.2 SUBMITTALS

- A. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
- B. Samples:
 - 1. Lumber and panel products for transparent finish, for each species and cut, finished on one side and one edge.
 - 2. Samples of all hardware.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- D. Mockups: Provide full scale at locations determined by the Architect for the purpose of verifying that material, finishes, detailing, and coordination with related construction and accessories are acceptable. Minor revisions to these aspects may be required after review of the mockup. Approved mockups may remain in place as part of the completed construction. See Division 1 for listing of Mockup Construction Required.

- E. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of woodwork.
- B. Quality Standard: Unless otherwise indicated, comply with AWI's "Architectural Woodwork Quality Standards."
 - 1. Provide AWI Quality Certification Program labels and certificates for woodwork, including installation.

1.4 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.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Wood Species and Cut for Transparent Finish (WD-2): Architect to select. Base price on Quarter Sawn Cherry solid wood, Grade AA, no sapwood allowed. Orient quarter sawn figure to appear on primary visible surface.
- B. Wood Species and Cut for Paint Finish: Poplar, Grade FAS with no knots or other defects on visible surfaces.
- C. Wood Products:
 - 1. Medium-Density Fiberboard: ANSI A208.2, Grade MD, made with binder containing no urea formaldehyde.
 - 2. Particleboard: ANSI A208.1, Grade M-3.
 - 3. Softwood Plywood: DOC PS 1.
 - 4. Veneer-Faced Panel Products (Hardwood Plywood): HPVA HP-1, made with adhesive containing no urea formaldehyde.
 - 5. Manufacturers: Subject to compliance with requirements, provide products as indicated on the finish plans.

2.2 MISCELLANEOUS MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, fire-retardant-treated, kiln-dried to less than 15 percent moisture content.
- B. Adhesives, General: Do not use adhesives that contain urea formaldehyde.

2.3 FIRE-RETARDANT-TREATED MATERIALS

- A. General: For applications indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction, and comply with testing requirements; testing 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, 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 beyond the centerline of the burners at any time during the test.
 - 1. Kiln dry plywood after treatment to a maximum moisture content of 19 and 15 percent respectively.
- C. For exposed items indicated to receive a stained or natural finish, use organic resin chemical formulations that do not contain colorants, and provide materials that do not have marks from spacer sticks on exposed face.
- D. Do not use material that does not comply with requirements for untreated material or is warped or discolored.
- E. Identify fire-retardant-treated wood with appropriate classification marking of testing and inspecting agency acceptable to authorities having jurisdiction.
 - 1. For exposed plywood indicated to receive a stained or natural finish, mark back of each piece.
- F. Application: All loose laid veneer panels in wooden grid ceilings.

2.4 FABRICATION

- A. General: Complete fabrication to maximum extent possible before shipment to project site. Where necessary for fitting at site, provide allowance for scribing, trimming, and fitting.
 - 1. Interior Woodwork Grade: AWI Premium. All running trim and veneer assemblies are Grade AA.

2. Shop cut openings to maximum extent possible. Sand edges of cutouts to remove splinters and burrs.

B. Interior wood frames, jambs, and windows:

1. For transparent-finished trim items wider than available lumber, use veneered construction. Do not glue for width.
2. Backcut or groove backs of flat trim members and kerf backs of other wide, flat members, except for members with ends exposed in finished work.
3. Assemble casings in plant except where limitations of access to place of installation require field assembly.

C. Wood Ceiling Grids and PLAM Finished Panels

1. 1x4 solid wood grid members; straight or curved laminated as indicated. Spline in top edge to retain panel.
2. MDF backing panels for ceiling panels and grid panels shall be fire rated Class B MDF panels.
3. Plastic Laminate (PLAM) finish panels as selected by the Architect:
 - a. Loose atop grid for service access.
 - b. Attached near bottom of grid as infill.
 - c. Modify grid and panels to accommodate light fixtures.

2.5 SHOP FINISHING

- A. Finish architectural woodwork at fabrication shop. Defer only final touchup, cleaning, and polishing until after installation.
- B. Backpriming: Apply one coat of sealer or primer, compatible with finish coats, to concealed surfaces of woodwork. Apply two coats to back of paneling.
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish System: Clear Catalyzed Urethane.
 3. Staining: Match approved sample for color.
 4. Sheen: Match architects sample.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Before installation, condition woodwork to average prevailing humidity conditions in installation areas. Examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.
- B. Grade: Install woodwork to comply with requirements for the same grade specified in Part 2 for fabrication of type of woodwork involved.
- C. Install woodwork level, plumb, true, and straight to a tolerance of 1/8 inch in 96 inches. Shim as required with concealed shims.
- D. Scribe and cut woodwork to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. 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. Use fine finishing nails for exposed fastening, countersunk and filled flush with woodwork and matching final finish if transparent finish is indicated.
- F. Do not use pin nails for fastening or support of woodwork. Pin nails may only be used to temporarily secure work while adhesives cure or other fasteners are installed.
- G. Install with minimum number of joints possible, using full-length pieces (from maximum length of lumber available) to greatest extent possible. Scarf running joints and stagger in adjacent and related members. Scarf joints shall be flush to minimize appearance in stained wood, and conceal appearance in painted wood. Fill gaps, if any, between top of base and wall with plastic wood filler, sand smooth, and finish same as wood base if finished.

END OF SECTION 064023

SECTION 064116 - PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

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. Plastic-laminate-faced architectural cabinets with solid wood trim.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced architectural cabinets unless concealed within other construction before cabinet installation.
 - 3. TV mounting Brackets
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets and concealed within other construction before cabinet installation.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesive for bonding plastic laminate fire-retardant-treated materials and cabinet hardware and accessories.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.
- B. Shop Drawings: Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.

1. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
2. Show locations and sizes of cutouts and holes for electrical switches and outlets and other items installed in architectural plastic-laminate cabinets.
3. Indication plastic laminate type, grade, color and grain direction.

C. Samples for Verification:

1. Plastic laminates, 12 by 12 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.
2. Wood-grain plastic laminates, 12 by 24 inches, for each type, pattern and surface finish, with one sample applied to core material and specified edge material applied to one edge.
3. Thermoset decorative panels, 12 by 12 inches, for each color, pattern, and surface finish, with edge banding on one edge.
4. .050 edge banding, 12" piece for each color, pattern and surface finish.
5. Corner pieces as follows:
 - a. Cabinet-front frame joints between stiles and rails, as well as exposed end pieces, 18 inches high by 18 inches wide by 6 inches deep.
 - b. Miter joints for standing trim.
6. Exposed cabinet hardware and accessories, one unit for each type and finish.
7. One TV Mounting Bracket

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and fabricator.
- B. Product Certificates: For the following:
 1. Thermoset decorative panels.
 2. High-pressure decorative laminate.
 3. Adhesives.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- D. Evaluation Reports: For fire-retardant-treated materials, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: 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. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical plastic-laminate cabinets including full-room mockup, part of a typical reception desk, base cabinet, wall cabinet and typical door and drawer conditions with all hardware. See Division 1 Specification for additional information on mockup requirements.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar operations that could damage woodwork have been completed in installation areas. If cabinets must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install cabinets until building is enclosed, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support cabinets by field measurements before being enclosed, and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where cabinets are indicated to fit to other construction, establish dimensions for areas where cabinets are to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that cabinets can be supported and installed as indicated.

PART 2 - PRODUCTS

2.1 ARCHITECTURAL CABINET FABRICATORS

- A. Fabricators: Subject to compliance with requirements, available fabricators offering products that may be incorporated into the Work include AWI member firms that comply with AWI quality standards and certification procedures.

2.2 PLASTIC-LAMINATE-FACED ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of architectural plastic-laminate cabinets indicated for construction, finishes, installation, and other requirements.
 1. Provide labels and certificates from AWI certification program indicating that woodwork, including installation, complies with requirements of grades specified.
 2. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.
- B. Grade: Custom.
- C. Type of Construction: Frameless.
- D. Cabinet, Door, and Drawer Front Interface Style: Flush overlay.
- E. Reveal Dimension: As indicated.

- F. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by woodwork quality standard.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation.
 - b. Panolam Industries International, Inc.
 - c. Wilsonart International; Div. of Premark International, Inc.
- G. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade VGS.
 - 3. Edges: PVC edge banding, .5 mm thick, matching laminate in color, pattern, and finish.
 - 4. Pattern Direction: As indicated on architectural elevations.
- H. Dust Panels: 1/4-inch plywood or tempered hardboard above compartments and drawers unless located directly under tops.
- I. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- J. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- K. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. See Architects Color Schedule

2.3 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 8 to 13 percent.
 - 2. Refer to 064023 - INTERIOR ARCHITECTURAL WOODWORK for solid wood trim material and finish.

2.4 CABINET HARDWARE AND ACCESSORIES

- A. General: Provide cabinet hardware and accessory materials associated with architectural cabinets except for items specified in Section 087111 "Door Hardware (Descriptive Specification)."
- B. Frameless Concealed Hinges (European Type): BHMA A156.9, B01602, 170 degrees of opening, self-closing.
- C. Back-Mounted Pulls: BHMA A156.9, B02011.
- D. Wire Pulls: Back mounted, solid metal, 4 inches long, 5/16 inch in diameter, Stainless Steel #4 Satin finish
- E. Catches: Magnetic catches, BHMA A156.9, B03141.
- F. Shelf Rests: BHMA A156.9, B04013; metal.
- G. Drawer Slides: BHMA A156.9.
 - 1. Grade 1HD-100 and Grade 1HD-200: Side mounted; full-extension type; zinc-plated-steel ball-bearing slides.
 - 2. For box drawers not more than 3 inches high and not more than 24 inches wide, provide Grade 1.
 - 3. For file drawers more than 6 inches high but and not more than 24 inches wide, provide Grade 1HD-100.
 - 4. For drawers more than 6 inches high or more than 24 inches wide, provide Grade 1HD-100.
- H. Door Locks: BHMA A156.11, E07121. Provide 1 lock for each cabinet door. Some locks may need to be keyed alike. Coordinate with the Owner.
- I. Drawer Locks: BHMA A156.11, E07041. Provide 1 lock for each cabinet drawer. Some locks may need to be keyed alike. Coordinate with the Owner.
- J. Door and Drawer Silencers: BHMA A156.16, L03011.
- K. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with BHMA A156.18 for BHMA finish number indicated.
 - 1. Satin Stainless Steel: BHMA 630.
- L. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in BHMA A156.9.
- M. TV Mounting Brackets: For 32" TV sets, use AEON-50201 Recessed In Wall Full Motion TV Wall Mount. For 42" TV sets, use AEON-50101 In Wall TV Mount.

- N. Elbow Catch to Secure Sink Cabinet Doors: EPCO 1018-N Heavy Duty Elbow Catch.
- O. Countertop Support Brackets: Rakks EH-Surface Mount Counter Support Bracket, prime painted from factory; field paint to match wall
- P. MISCELLANEOUS MATERIALS
- Q. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln dried to less than 15 percent moisture content.
- R. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
- S. Adhesive for Bonding Plastic Laminate: Contact cement.
 - 1. Adhesive for Bonding Edges: Manufacturers standard non urea formaldehyde containing product.

2.5 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Fabricate cabinets to dimensions, profiles, and details indicated.
- C. Complete fabrication, including assembly 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.
 - 1. Notify Architect seven days in advance of the dates and times woodwork fabrication will be complete.
 - 2. Trial fit assemblies at fabrication shop that cannot be shipped completely assembled. Install dowels, screws, bolted connectors, and other fastening devices that can be removed after trial fitting. Verify that various parts fit as intended and check measurements of assemblies against field measurements before disassembling for shipment.
- D. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to average prevailing humidity conditions in installation areas.
- B. Before installing cabinets, examine shop-fabricated work for completion and complete work as required.

3.2 INSTALLATION

- A. Grade: Install cabinets to comply with same grade as item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.
- C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
- D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
- E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
 - 1. Use filler matching finish of items being installed.
- 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, and at ends not more than 16 inches o.c. with No. 10 wafer-head sheet metal screws through metal backing or metal framing behind wall finish.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, 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 cabinets on exposed and semiexposed surfaces.

END OF SECTION 064116

SECTION 064219 - PLASTIC-LAMINATE-FACED WOOD PANELING

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. Plastic-laminate-faced wood paneling (decorative laminate surfacing) with solid wood corners and trim; Class B fire rating for use in I-2 Occupancy public spaces.
 - 2. Wood furring, blocking, shims, and hanging strips for installing plastic-laminate-faced wood paneling unless concealed within other construction before paneling installation.

- B. Related Requirements:

- 1. Section 061000 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling and that are concealed within other construction before paneling installation.
 - 2. Section 064023 for solid hardwood edge and corner trim.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product, including panel products high-pressure decorative laminate adhesives and fire-retardant-treated materials.
 - 1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

- B. Shop Drawings: Show location of paneling, large-scale details, attachment devices, and other components. Include dimensioned plans and elevations.
 - 1. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
 - 2. Apply AWI Certified Compliance Program label to first page of Shop Drawings.
- C. Samples for verification for plastic laminates, 12 by 12 inches, for each type, color, pattern, and surface finish, with one sample applied to core material and specified edge material applied to one edge.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Fabricator.
- B. Product Certificates: For each type of product.
- C. Woodwork Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.
- D. Evaluation Reports: For fire-retardant-treated materials and fire-retardant-treated paneling, from ICC-ES.

1.6 QUALITY ASSURANCE

- A. Fabricator Qualifications: 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. Shop is a certified participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Certified participant in AWI's Quality Certification Program.
- C. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant-treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- D. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockups of typical paneling as shown on Drawings.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver paneling until painting and similar operations that could damage paneling have been completed in installation areas. If paneling must be stored in other than installation areas, store only in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install paneling until building is enclosed, wet work is complete, and HVAC system is operating and will maintain temperature between 60 and 90 deg F and relative humidity between 43 and 70 percent during the remainder of the construction period.
- B. Field Measurements: Where paneling 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. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed and indicate measurements on Shop Drawings.
- C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

PART 2 - PRODUCTS

2.1 PANELING FABRICATORS

- 1. Fabricators: Subject to compliance with requirements, available fabricators that are members of the AWI certification program.

2.2 PANELING, GENERAL

- A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of plastic-laminate-faced wood paneling (decorative laminate surfacing) indicated for construction, finishes, installation, and other requirements.
 - 1. The Contract Documents contain selections chosen from options in the quality standard and additional requirements beyond those of the quality standard. Comply with those selections and requirements in addition to the quality standard.

2.3 PLASTIC-LAMINATE-FACED WOOD PANELING

- A. Grade: Custom.
- B. Plastic Laminate: High-pressure decorative laminate complying with NEMA LD 3 and the following requirements:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Formica Corporation.
 - b. Panolam Industries International Incorporated.
 - c. Wilsonart International.
 - 2. Faces: Grade VGS
 - 3. Backs: Grade BKV.
 - 4. Exposed Edges: Same as faces.
- C. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed surfaces complying with the following requirements:
 - 1. See Architects Interior Color Schedule.
 - 2. Grain Direction: As shown on Architectural Elevations.
- D. Panel Core: Fire-retardant medium-density fiberboard.
 - 1. Thickness: As indicated.
- E. Exposed Panel Edges: Plastic-laminate matching faces. Use .50mm edge banding to match face panel pattern.
- F. Panel Reveals: See Architectural Details.
- G. Adhesives for Bonding Plastic Laminate: Contact cement.

1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.
- H. Fire-Retardant-Treated Paneling: Panels shall consist of plastic laminate and fire-retardant medium-density fiberboard. Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E 84 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.
- I. Assemble panels by gluing and concealed fastening.

2.4 MATERIALS

- A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.
- B. Wood Moisture Content: 8 to 13 percent.
- C. Refer to 064023 – Interior Architectural Woodwork for solid wood trim material and finish.
- D. Adhesives: Do not use adhesives that contain added urea formaldehyde resins.
 1. Use Wilsonart 800/801 Contact Adhesive or approved equal, spray applied, solvent-based contact adhesive for rapid high-strength postforming or flatwork application bonds. 418 g/L VOC/liter of material, minimum bond strength 100 psi tested and documented with project laminate on project FR MDF substrate.

2.5 FIRE-RETARDANT-TREATED MATERIALS

- A. Fire-Retardant-Treated Materials, 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.
 1. Use treated materials that comply with requirements of referenced woodworking standard. Do not use materials that are warped, discolored, or otherwise defective.
 2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finish appearance and adhesion. Do not use colorants to distinguish treated materials from untreated materials.
 3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

- B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E 84, 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 beyond the centerline of the burners at any time during the test.
 - 1. Kiln dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
 - 2. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
 - 3. Mill lumber before treatment and implement special procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of treated woodwork.
- C. Fire-Retardant Fiberboard: Medium-density fiberboard panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E 84.

2.6 INSTALLATION MATERIALS

- A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood 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 metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.

2.7 FABRICATION

- A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.
- B. Complete fabrication, including assembly, 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.
 - 1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.

- C. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.
- D. Comply with all substrate, laminate, and adhesive manufacturer recommendations, including but not limited to material acclimation, application temperature and humidity, spray equipment, application rate, open time, and laminating method/pressure/time during application and through curing.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition paneling to average prevailing humidity conditions in installation areas.
- B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

- A. Grade: Install paneling to comply with same grade as paneling to be installed.
- B. Install paneling level, plumb, true, and straight with no distortions. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.
 - 1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch.
- C. Anchor paneling to supporting substrate with concealed panel-hanger clips. Do not use face fastening unless covered by trim.
- D. Pin nails shall not be used for permanent fastening. Always follow fastener manufacturer recommendations, panel product manufacturer recommendations, and industry standards for permanent fastening.
- E. Dark color PLAM edges shall be covered by color-matched edge trim or oriented toward reveals to be less conspicuous.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective paneling, where possible, to eliminate defects; where not possible to repair, replace paneling. Adjust for uniform appearance.
- B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 064219

SECTION 066400 - PLASTIC PANELING

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. Plastic sheet paneling in janitor closets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For plastic paneling and trim accessories, in manufacturer's standard sizes.

1.4 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain plastic paneling and trim accessories from single manufacturer.

2.2 PLASTIC SHEET PANELING

- A. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D 5319.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide Nudo Fiberlite or comparable product by one of the following:
 - a. Glasteel
 3. Surface-Burning Characteristics: As follows when tested by a qualified testing agency according to ASTM E 84. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 4. Nominal Thickness: Not less than 0.075 inch.
 5. Surface Finish: Smooth.
 6. Color: Almond

2.3 ACCESSORIES

- A. Trim Accessories: Manufacturer's standard one-piece vinyl extrusions designed to retain and cover edges of panels. Provide division bars, inside corners and caps as needed to conceal edges.
1. Color: Match Panels.
- B. Adhesive: As recommended by plastic paneling manufacturer and with a VOC content of 50 g/L or less.
- C. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
1. Sealant shall have a VOC content of 250 g/L or less.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, 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. Remove materials that might interfere with adhesive bond.
- B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.
- C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.
- D. Condition panels by unpacking and placing in installation space before installation according to manufacturer's written recommendations.
- E. Lay out paneling before installing. Locate panel joints so that trimmed panels at corners are not less than 12 inches wide.
 - 1. Mark plumb lines on substrate at panel joint locations for accurate installation.
 - 2. Locate panel joints to allow clearance at panel edges according to manufacturer's written instructions.

3.3 INSTALLATION

- A. Install plastic paneling full height according to manufacturer's written instructions.
- B. Install panels in a full spread of adhesive.
- C. Install trim accessories with adhesive. Do not fasten through panels.
- D. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.
- E. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

- F. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.
- G. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION 066400

SECTION 078413 - PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes through-penetration firestop systems for penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items.
- B. Related Sections include the following:
 - 1. Division 07 Section "Fire-Resistive Joint Systems."
 - 2. Division 21 Sections specifying fire-suppression piping penetrations.
 - 3. Division 22 and 23 Sections specifying duct and piping penetrations.
 - 4. Division 26, 27, and 28 Sections specifying cable and conduit penetrations.

1.3 PERFORMANCE REQUIREMENTS

- A. General: For penetrations through fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.
- B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per ASTM E 814:
 - 1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
 - 2. T-Rated Systems: For the following conditions, provide through-penetration firestop systems with T-ratings indicated, as well as F-ratings, where systems protect penetrating items exposed to potential contact with adjacent materials in occupiable floor areas:

- a. Penetrations located outside wall cavities.
 - b. Penetrations located outside fire-resistance-rated shaft enclosures.
 - c. Where firestop systems protect penetration located in construction containing doors required to have a temperature-rise rating.
 - d. Where firestop systems protect penetrating items larger than a 4-inch-diameter nominal pipe or 16 sq. in. in overall cross-sectional area.
- C. For through-penetration firestop systems exposed to view, traffic, moisture, and physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.
 - 1. For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.
 - 2. For floor penetrations with annular spaces exceeding 4 inches in width and exposed to possible loading and traffic, provide firestop systems capable of supporting floor loads involved, either by installing floor plates or by other means.
 - 3. For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.
- D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84. Provide finish escutcheons on exposed piping penetrations.
- E. Fire-Resistive Joint Sealants: Provide joint sealants with fire-resistance ratings indicated, as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
 - 1. Certification by firestopping manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOCs) and are nontoxic to building occupants.
 - 2. Reproduction of the UL tested assembly or other testing agency accepted by the authority having jurisdiction for each proposed assembly.
- B. Engineering Judgments
 - 1. Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular through-penetration firestop condition, submit illustration, with modifications marked, approved by through-penetration firestop system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

- a. Engineering judgments shall not be used where tested assemblies are available.
- C. Through-Penetration Firestop System Schedule: Indicate type of each through-penetration firestop system.
 - 1. Complete the schedule at the end of Part 3.
- D. Qualification Data: For Installer.
- E. Product Test Reports: From a qualified testing agency indicating through-penetration firestop system complies with requirements, based on comprehensive testing of current products.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FMG according to FMG 4991, "Approval of Firestop Contractors."
- B. Installation Responsibility: Assign installation of through-penetration firestop systems in Project to qualified installers.
- C. Source Limitations: Owner's proprietary source is 3M Fire Protection Products for through-penetration firestop systems, for each kind of penetration and construction condition indicated.
 - 1. It shall be the Contractor's responsibility to assign the Firestopping Manufacturer to each installer performing the work.
- D. Fire-Test-Response Characteristics: Provide through-penetration firestop systems that comply with the following requirements and those specified in Part 1 "Performance Requirements" Article:
 - 1. Firestopping tests are performed by a qualified testing and inspecting agency. A qualified testing and inspecting agency is UL, Warnock Hersey, OPL, ITS, or another agency performing testing and follow-up inspection services for firestop systems acceptable to authorities having jurisdiction.
 - 2. Through-penetration firestop systems are identical to those tested per testing standard referenced in "Part 1 Performance Requirements" Article. Provide rated systems complying with the following requirements:
 - a. Through-penetration firestop system products bear classification marking of qualified testing and inspecting agency.
 - b. Through-penetration firestop systems correspond to those indicated by reference to through-penetration firestop system designations listed by the following:

1) UL in its "Fire Resistance Directory."

- E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."
- F. Provide Firestopping products containing no detectable asbestos as determined by the method specified in 40 CFR Part 763, Subpart F, Appendix A, Section 1, "Polarized Light Microscopy."
- G. Mockups: Construct mockups of each common type of Firestopping Assembly to verify materials, comply with tested assembly requirements and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Coordinate location and size of mockup assemblies readily accessible to the contractors and regulatory officials.
 - 2. Approved mockups shall NOT become part of the completed Work. They are for quality purposes only.
 - 3. Mockups shall be removed after firestopping has been installed and inspected.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver through-penetration firestop system products to Project site in original, unopened containers or packages with intact and legible manufacturers' labels identifying product and manufacturer, date of manufacture, lot number, shelf life if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multicomponent materials.
- B. Store and handle materials for through-penetration firestop systems to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install through-penetration firestop systems when ambient or substrate temperatures are outside limits permitted by through-penetration firestop system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Ventilate through-penetration firestop systems per manufacturer's written instructions by natural means or, where this is inadequate, forced-air circulation.

1.8 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to specified requirements.
- B. Provide Firestopping requirements for construction requiring phased access and sequenced installation for items which may be cut off from access during construction. Participate in coordination drawings and note special access and sequence requirements on coordination drawings.
- C. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration firestop systems.
- D. Notify Owner's inspecting agency at least seven days in advance of through-penetration firestop system installations; confirm dates and times on days preceding each series of installations.
- E. Do not cover up through-penetration firestop system installations that will become concealed behind other construction until each installation has been examined by Owner's special inspector.
 - 1. Verify local building inspector requirements for Firestopping inspection prior to covering completed work and comply with requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Through-penetration firestop systems indicated for each application produced by:
 - 1. 3M; Fire Protection Products Division.
- B. UL Assemblies on Drawings: The drawings reference products of Specified Technologies Inc. This does not limit the use of other assemblies which achieve the same appropriate criteria as required by the rating of the penetrating item and the required F, T or L value. However, the specification requires that all of the Firestopping assemblies be from a single manufacturer unless the specificity of the condition requires a different application. Actual tested assemblies shall be provided as field mockups and documented in the submission requirements noted for the schedule at the end of Section 3.

2.2 FIRESTOPPING, GENERAL

- A. Compatibility: Provide through-penetration firestop systems that are compatible with one another; with the substrates forming openings; and with the items, if any, penetrating through-penetration firestop systems, under conditions of service and application, as demonstrated by through-penetration firestop system manufacturer based on testing and field experience.
- B. Accessories: Provide components for each through-penetration firestop system that are needed to install fill materials and to comply with Part 1 "Performance Requirements" Article. Use only components specified by through-penetration firestop system manufacturer and approved by qualified testing and inspecting agency for firestop systems indicated. Accessories include, but are not limited to, the following items:
 - 1. Permanent forming/damming/backing materials, including the following:
 - a. Slag-/rock-wool-fiber insulation.
 - b. Sealants used in combination with other forming/damming/backing materials to prevent leakage of fill materials in liquid state.
 - c. Fire-rated form board.
 - d. Fillers for sealants.
 - 2. Temporary forming materials.
 - 3. Substrate primers.
 - 4. Collars.
 - 5. Steel sleeves.

2.3 FILL MATERIALS

- A. General: As part of the required submission of the firestop system schedule, the Contractor shall provide through-penetration firestop systems containing the types of fill materials included. Reference the types of materials described in this Article. Fill materials are those referred to in directories of referenced testing and inspecting agencies as "fill," "void," or "cavity" materials.
- B. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer metallic sleeve lined with an intumescent strip, a radial extended flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- C. Latex Sealants: Single-component latex formulations that after cure do not re-emulsify during exposure to moisture.
- D. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.

- E. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced elastomeric sheet bonded to galvanized steel sheet.
- F. Intumescent Putties: Nonhardening dielectric, water-resistant putties containing no solvents, inorganic fibers, or silicone compounds.
- G. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- H. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers, and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- I. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives.
- J. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- K. 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, and nonsag formulation for openings in vertical and other surfaces requiring a nonslumping, gunnable sealant, unless indicated firestop system limits use to nonsag grade for both opening conditions.

2.4 MIXING

- A. For those products requiring mixing before application, comply with through-penetration firestop system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of work.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Clean out openings immediately before installing through-penetration firestop systems to comply with firestop system manufacturer's written instructions and with the following requirements:
 1. Remove from surfaces of opening substrates and from penetrating items foreign materials that could interfere with adhesion of through-penetration firestop systems.
 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with through-penetration firestop systems. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Priming: Prime substrates where recommended in writing by through-penetration firestop system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.
- C. Masking Tape: Use masking tape to prevent through-penetration firestop systems from contacting adjoining surfaces that will remain exposed on completion of Work and that would otherwise be permanently stained or damaged by such contact or by cleaning methods used to remove smears from firestop system materials. Remove tape as soon as possible without disturbing firestop system's seal with substrates.

3.3 THROUGH-PENETRATION FIRESTOP SYSTEM INSTALLATION

- A. General: Install through-penetration firestop systems to comply with Part 1 "Performance Requirements" Article and with firestop system manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming/damming/backing materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- C. Install fill materials for firestop systems by proven techniques to produce the following results:

1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items as required to achieve fire-resistance ratings indicated.
2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
3. For fill materials that will remain exposed after completing Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Identify through-penetration firestop systems with preprinted metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of edge of the firestop systems so that labels will be visible to anyone seeking to remove penetrating items or firestop systems. Use mechanical fasteners for metal labels. For plastic labels, use self-adhering type with adhesives capable of permanently bonding labels to surfaces on which labels are placed and, in combination with label material, will result in partial destruction of label if removal is attempted. Include the following information on labels:
 1. The words "Warning - Through-Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Through-penetration firestop system designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Through-penetration firestop system manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified, independent inspecting agency to inspect through-penetration firestopping. Independent inspecting agency shall comply with ASTM E 2174 requirements including those related to qualifications, conducting inspections, and preparing test reports.
- B. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.
- C. Proceed with enclosing through-penetration firestop systems with other construction only after inspection reports are issued and firestop installations comply with requirements.

3.6 CLEANING AND PROTECTING

- A. Clean off excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.7 THROUGH-PENETRATION FIRESTOP SYSTEM SCHEDULE

- A. The following schedules shall be completed by the Contractor and reviewed prior to submission to the Architect by the manufacturer and submitted according to the provisions of Paragraph 1.4 "Submittals" within this specification section. Provide the information in a bound volume organized by section.
- B. The untitled table included shall be completed with each of the following categories of penetrating items as applicable to the construction.
 - 1. Single uninsulated metallic piping and conduit.
 - 2. Multiple uninsulated metallic piping and conduit.
 - 3. Uninsulated plastic piping and conduit.
 - 5. Insulated metallic piping.
 - 6. Insulated high temperature flues and exhaust pipes (boiler flues, generator exhausts insulated with calcium silicate or other non-combustible insulation).
 - 7. Cable tray.
 - 8. Electrical/telephone cable.
 - 9. Bus duct.
 - 10. Ductwork
 - 11. Miscellaneous penetrations.
- C. Complete the additional tables for the following using the format provided.
 - 1. Blanks, voids, holes.
 - 2. Engineering judgments.
 - 3. Ductwork engineering judgments.

PENETRATING ITEM: _____

Manufacturer/Product _____

Name: _____

Color: _____

Accessories: _____

Wall/FI. Const.	Item Size/Description	Sleeve	F Rating	T Rating	Annular Space	Firestop Thickness	Tested Ass'y No.

FIRE RATED JOINTS

Manufacturer/Product

Name:

Color:

Accessories:

Wall/FI. Const.	Item Size/Description	Sleeve	F Rating	T Rating	Annular Space	Firestop Thickness	Tested Ass'y No.

BLANKS, VOIDS, HOLES

Manufacturer/Product

Name:

Color:

Accessories:

Wall/FI. Const.	Item Size/Description	F Rating	T Ratin g	Annular Space	Firestop Thicknes s	Tested Ass'y No.

ENGINEERING JUDGMENTS (Submit Actual Installation Drawing and Letter of Certification)

Manufacturer/Product _____

Name: _____

Color: _____

Accessories: _____

Wall/FI. Const.	Item Size/Descripton	F	T	Annular Space	Firestop Thicknes s	Fill Type and Thickness

DUCTWORK ENGINEERING JUDGMENTS
(Submit Actual Installation Drawing and Letter of Certification)

Manufacturer/Product _____ Name: _____

Color: _____

Accessories: _____

Wall/FI. Const.	Item Size/Description	Fire Damper	F	T	Annular Space Range	Firestop Thickness	Fill Type and Thickness

END OF SECTION 078413

SECTION 078443 - JOINT FIRESTOPPING

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. Joints in or between fire-resistance-rated constructions.
 - 2. Joints at exterior curtain-wall/floor intersections.
 - 3. Joints in smoke barriers.
- B. Related Requirements:
 - 1. Section 078413 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers.
 - 2. Section 092216 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.3 PREINSTALLATION MEETINGS

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: A firm that has been approved by FM Approvals according to FM Approvals 4991, "Approval of Firestop Contractors," or been evaluated by UL and found to comply with UL's "Qualified Firestop Contractor Program Requirements."

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.9 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

- 1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. 3M Fire Protection Products.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtain-Wall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. 3M Fire Protection Products.
 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inch wg (74.7 Pa).
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. 3M Fire Protection Products.
 2. L-Rating: Not exceeding 5.0 cfm/ft. (0.00775 cu. m/s x m) of joint at both ambient and elevated temperatures.
- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.

1. Verify sealant has a VOC content of 250 g/L or less.
- F. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.

1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches (150 mm) of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections according to ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 078443

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior standard hollow metal doors and frames.

1.2 SUBMITTALS

- A. Shop Drawings: Include elevations, frame profiles, metal thicknesses, preparations for hardware, and other details.
- B. Schedule: Prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- 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. Ceco Door Products; an Assa Abloy Group company.
 2. Curries Company; an Assa Abloy Group company.
 3. Pioneer Industries, Inc.
 4. Steelcraft; an Ingersoll-Rand company.

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, CS, Type B; suitable for exposed applications.
- B. Frame Anchors: ASTM A 591/A 591M, Commercial Steel (CS), 40Z coating designation; mill phosphatized.
- C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.

- D. Mineral-Fiber Insulation: ASTM C 665, Type I.
- E. Bituminous Coating: Cold-applied asphalt mastic, SSPC-Paint 12, compounded for 15-mil dry film thickness per coat.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

- A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Standard-Duty Doors and Frames: SDI A250.8, Level 1; SDI A250.4, Level C. At locations indicated in the Door and Frame Schedule.
 - 1. Doors:
 - a. Type: As indicated in the Door and Frame Schedule.
 - b. Thickness: 1-3/4 inches.
 - c. Face: Uncoated steel sheet, minimum thickness of 0.032 inch.
 - d. Edge Construction: Model 2, Seamless.
 - e. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated doors.
 - 2. Frames:
 - a. Materials: Uncoated steel sheet, minimum thickness of 0.042 inch.
 - b. Construction: Full profile welded.

2.4 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
 - 2. Postinstalled Expansion Anchor: Minimum 3/8-inch-diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.
- B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
- C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.
- D. Material: ASTM A 879/A 879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M; hot-dip galvanized according to ASTM A 153/A 153M, Class B.

2.5 FABRICATION

- A. Tolerances: Fabricate hollow metal work to tolerances indicated in SDI 117.
- B. Hollow Metal Frames: Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
 1. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
 3. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
 4. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Stud-Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Four anchors per jamb from 60 to 90 inches high.
 - 2) Two anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
- C. Hardware Preparation: Factory prepare hollow metal work to receive templated mortised hardware according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
 1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive nontemplated, mortised and surface-mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 electrical Sections.

2.6 STEEL FINISHES

- A. Prime Finish: Apply manufacturer's standard primer immediately after cleaning and pretreating.

1. Shop Primer: ANSI/SDI A250.10.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hollow Metal Frames: Comply with ANSI/SDI A250.11.

1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
 - a. At fire-protection-rated openings, install frames according to NFPA 80.
 - b. Remove temporary braces necessary for installation only after frames have been properly set and secured.
 - c. Check plumbness, squareness, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
 - a. Floor anchors may be set with powder-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation behind frames.
4. Ceiling Struts: Extend struts vertically from top of frame at each jamb to overhead structural supports or substrates above frame unless frame is anchored to masonry or to other structural support at each jamb. Bend top of struts to provide flush contact for securing to supporting construction. Provide adjustable wedged or bolted anchorage to frame jamb members.
5. Installation Tolerances: Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
 - a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
 - b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
 - c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
 - d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

- #### B. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
2. Smoke-Control Doors: Install doors according to NFPA 105.

3.2 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 081113

SECTION 081416 - FLUSH WOOD DOORS

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. Solid-core doors and transom panels with wood-veneer faces.
 - 2. Fire rated 20 minute solid-core doors with factory fabricated applied wood veneered faces to create reveals.
 - 3. Mineral-core wood doors with wood-veneer faces.
 - 4. Fire rated 45 minute mineral-core doors with factory fabricated applied wood veneered faces to create reveals.
 - 5. Shop priming and Factory finishing flush wood doors.
 - 6. Factory fitting flush wood doors to frames and factory machining for hardware.
- B. Related Requirements:
 - 1. Section 088000 "Glazing" for glass view panels in flush wood doors.
 - 2. Section 088170 "Fire Rated Glass" for fire rated view panels in flush wood doors.
 - 3. Section 099123 "Interior Painting"
 - 4. Section 099300 "Staining and Transparent Finishing".
 - 5. Section 064216 Flush Wood Paneling

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of door. Include details of core and edge construction and trim for openings.
- B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; and the following:

1. Dimensions and locations of blocking.
2. Dimensions and locations of mortises and holes for hardware.
3. Dimensions and locations of cutouts.
4. Undercuts.
5. Requirements for veneer matching.
6. Doors to be factory finished and finish requirements.
7. Fire-protection ratings for fire-rated doors.

C. Samples for Initial Selection: For factory-finished doors. 12x12 samples for initial material and finish selection and comparison to wood panel selection.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three Samples showing typical range of color and grain to be expected in finished Work.
 - a. Provide 1 full finished leaf door for comparison to be installed in the field mock up. Finished leaf shall be reviewed in field and adjusted until approved under the base contract.
 - b. Provide one 12" x 12" sample door section indicating the reveal construction.
2. Corner sections of doors, approximately 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide Samples for each species of veneer and solid lumber required.
 - b. Finish veneer-faced door Samples with same materials proposed for factory-finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.5 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For special warranty.
- B. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: A qualified manufacturer that is a certified participant in AWI's Quality Certification Program.

- B. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package doors individually in plastic bags or cardboard cartons.
- C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during remainder of construction period.

1.9 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.
 - 2. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.
 - 3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Algoma Hardwoods, Inc.

2. Eggers Industries.
3. Oshkosh Door Company.
4. Door America, a division of American Builders Supply

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2 FLUSH WOOD DOORS, GENERAL

- A. Quality Standard: In addition to requirements specified, comply with AWI's, AWMAC's, and WI's "Architectural Woodwork Standards."
1. Provide AWI Quality Certification Labels indicating that doors comply with requirements of grades specified.
 2. Contract Documents contain selections chosen from options in quality standard and additional requirements beyond those of quality standard. Comply with those selections and requirements in addition to quality standard.
- B. Low-Emitting Materials: Fabricate doors with adhesives and composite wood products that do not contain urea formaldehyde.
- C. WDMA I.S.1-A Performance Grade: Heavy Duty.
- D. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL 10C.
1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
 2. Cores: Provide core specified or mineral core as needed to provide fire-protection rating indicated.
 3. Edge Construction: Provide edge construction with Category A intumescent seals concealed by outer stile. Comply with specified requirements for exposed edges.
 4. Pairs: Provide fire-retardant stiles that are listed and labeled for applications indicated without formed-steel edges and astragals. Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 5. Pairs: Provide formed-steel edges and astragals with intumescent seals only where required by hardware configuration.
 - a. Finish exposed steel edges and astragals with veneer to match door.
- E. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control, based on testing according to UL 1784.

F. Particleboard-Core Doors:

1. Particleboard: ANSI A208.1, Grade LD-2.
2. Blocking: Provide wood blocking in particleboard-core doors as needed to eliminate through-bolting hardware.

G. Mineral-Core Doors:

1. Core: Noncombustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire-protection rating indicated.
2. Blocking: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated as needed to eliminate through-bolting hardware.
3. Edge Construction: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.
 - a. Screw-Holding Capability: 475 lbf per WDMA T.M.-10.

2.3 VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Solid-Core Doors:

1. Grade: Premium, with Grade AA faces. See exception for veneer matching.
2. Species: Select white maple.
3. Cut: Quarter sliced.
4. Match between Veneer Leaves: Slip match.
5. Assembly of Veneer Leaves on Door Faces: Balance match.
6. Pair and Set Match: Provide for doors hung in same opening.
7. Transom Match: Continuous match.
8. Exposed Vertical Edges: Same species as faces or a compatible species - edge Type A.
9. Core: Particleboard.
10. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.
11. Visible Barber Poling on natural finish wood doors shall be considered a defect and cause for rejection.

2.4 DOORS FOR OPAQUE FINISH

A. Interior Solid-Core Doors:

1. Grade: Custom.

2. Faces: MDO.
 - a. Apply MDO to standard-thickness, closed-grain, hardwood face veneers.
3. Exposed Vertical Edges: Any closed-grain hardwood.
4. Core: Particleboard.
5. Fire Rating: As noted on Architects Door Schedule
6. Construction: Five plies. Stiles and rails are bonded to core, then entire unit is abrasive planed before veneering.

2.5 DOORS WITH FACTORY APPLIED PANELING WITH REVEALS

- A. Unrated, 20 minute solid core, and 45 minute mineral core rated doors
 1. Rated doors shall bear UL label.
 2. Provide solid core doors complying with section 2.3A or 2.4A with 1/2" thick finish panels on each side of the door as indicated on the architectural door schedule.
 3. Panels shall have the same construction as the doors listed above.
 4. Panel wood species, cut, grain, stain, and finish shall match Architect's sample and project millwork.
 5. Edges of panels shall be banded to match the panel faces.
 6. Side of reveals shall match the panel face. Bottom of reveals shall match the face panels. Where Maple and Cherry panels are next to each other the bottom of the reveal shall be Maple.
 7. Overall door thickness shall be 2-3/4". Contractor to coordinate with hardware supplier for proper hardware operation and adjacent construction clearance. Extra long spindles, screws, strikes, and other hardware provisions will be needed.

2.6 LIGHT FRAMES

- A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.
 1. Wood Species: Same species as door faces.
 2. Profile: Flush rectangular beads.
 3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and concealed metal glazing clips approved for such use.
- B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.7 FABRICATION

- A. Factory fit doors to suit frame-opening sizes indicated. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
 - 1. Comply with NFPA 80 requirements for fire-rated doors.
- B. Factory machine doors for hardware that is not surface applied. Locate hardware to comply with DHI-WDHS-3. Comply with final hardware schedules, door frame Shop Drawings, BHMA-156.115-W, and hardware templates. Note that certain doors shall require alternate hardware locations for the lever or exit device hardware based on the presence of reveal construction and light frame location.
 - 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 - 2. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors. Metal Astragals shall be covered with wood veneer of same species and grain as wood door.
- C. Transom Panels: If indicated, fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
 - 1. Fabricate door and transom panels with full-width, solid-lumber, rabbeted,] meeting rails. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.
- D. Openings: Factory cut and trim openings through doors.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 088000 "Glazing" or 088170 "Fire-rated Glass" as indicated by the door rating.

2.8 SHOP PRIMING

- A. Doors for Opaque Finish: Shop prime faces, all four edges, edges of cutouts, and mortises with one coat of wood primer specified in Section 099123" Interior Painting."

2.9 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.

1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.
- B. Factory finish all doors unless specifically indicated to receive a painted finish. .
- C. Transparent Finish:
 1. Grade: Premium.
 2. Finish: AWI's, AWMAC's, and WI's "Architectural Woodwork Standards" System 11, catalyzed polyurethane.
 3. Staining: Match Architect's sample. See Interior color schedule. Doors with reveals have different stains for each wood species.
 4. Sheen: Satin or Semigloss to be selected from project sample and mockup.
 5. Actual finish of factory finished doors shall be selected by comparison to the approved finish of the architectural wood panels selected under section 064216 Architectural Wood Paneling.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames, with Installer present, before hanging doors.
 1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 2. Reject doors with defects.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Section 087100 "Door Hardware."
- B. Installation Instructions: Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.
 1. Install fire-rated doors according to NFPA 80.
 2. Install smoke- and draft-control doors according to NFPA 105.
- C. Factory-Fitted Doors: Align in frames for uniform clearance at each edge. Provide the contractor a template for reveal locations to permit installation of matching reveals in gypsum wall board installation.

- D. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 ADJUSTING

- A. Operation: Rehang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 083113 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Access doors and frames for walls and ceilings.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
- C. Samples: For each door face material.
- D. Coordinate access door locations and sizes with the production of coordination drawings noted in the Division 1 Specification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Units complying with NFPA 80 tested according to the following test method:
 1. NFPA 252 or UL 10B for fire-rated access door assemblies installed vertically.
 2. NFPA 288 for fire-rated access door assemblies installed horizontally.

2.2 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

- A. Manufacturers: Basis of Design shall be Acudor BP 58 for use in public corridors and patient rooms. Use Acudor UF 5000 in support areas.
- B. Subject to compliance with requirements, provide equal products by one of the following:

1. Babcock-Davis.
 2. J. L. Industries, Inc.; Div. of Activar Construction Products Group.
 3. Karp Associates, Inc.
 4. Larsen's Manufacturing Company.
 5. Milcor Inc.
- C. Source Limitations: Obtain each type of access door and frame from single source from single manufacturer.
- D. Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling in Support Areas
 3. Door Size: As required.
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material and thickness as door.
 6. Hinges: concealed.
 7. Hardware: Camlock
- E. Recessed Access Doors:
1. Assembly Description: Fabricate door in the form of a pan recessed 1/2 inch with gypsum board infill. Provide frame with gypsum board bead for concealed flange no bead for acoustical tile installation.
 2. Locations: Wall and ceiling in Public Corridors and Patient Rooms
 3. Door Size: As required
 4. Uncoated Steel Sheet for Door: Nominal 0.060 inch, 16 gage.
 - a. Finish: Factory prime.
 5. Frame Material: Same material and thickness as door.
 6. Hinges: Manufacturer's standard.
 7. Hardware: Lock.
 8. Provide mineral wool panel sound attenuation at locations indicated.
- F. Fire-Rated, Flush Access Doors with Concealed Flanges:
1. Assembly Description: Fabricate door to fit flush to frame, with a core of mineral-fiber insulation enclosed in sheet metal. Provide self-latching door with automatic closer and interior latch release. Provide frame with gypsum board beads for concealed flange installation.
 2. Locations: Wall and ceiling.
 3. Fire-Resistance Rating: Not less than that of adjacent construction.

4. Uncoated Steel Sheet for Door: Nominal 0.036 inch, 20 gage.
 - a. Finish: Factory prime.
5. Frame Material: Same material, thickness, and finish as door.
6. Hinges: Manufacturer's standard.

2.3 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A 879/A 879M, with cold-rolled steel sheet substrate complying with ASTM A 1008/A 1008M, Commercial Steel (CS), exposed.
- C. Frame Anchors: Same type as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A 153/A 153M or ASTM F 2329.

2.4 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish attachment devices and fasteners of type required to secure access doors to types of supports indicated.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling.
- E. Latching Mechanisms: Furnish number required to hold doors in flush, smooth plane when closed.
 1. For recessed panel doors, provide access sleeves for each locking device. Furnish plastic grommets and install in holes cut through finish.

2.5 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- D. Steel and Metallic-Coated-Steel Finishes:
 - 1. Factory Prime: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.
- B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.
- C. Provide access doors as required to provide service to ceiling and wall systems. Review architectural, mechanical, electrical and plumbing drawings to determine actual quantities required.

3.2 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.
- B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION 083113

SECTION 087100 - DOOR HARDWARE

PART 1 -

PART 2 - GENERAL

2.1 RELATED DOCUMENTS

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

2.2 SUMMARY

- A. Section includes:

- 1. Mechanical door hardware for the following:
 - a. Swinging doors.
 - b. Sliding doors.
- 2. Cylinders for door hardware specified in other Sections.
- 3. Electrified door hardware.

- B. Related Sections:

- 1. Section 081113 "Hollow Metal Doors and Frames".
- 2. Section 081416 "Flush Wood Doors
- 3. Section 084243 "Intensive Care Unit/Critical Care Unit (ICU/CCU) Entrances" for entrance door hardware, except cylinders.
- 4. Section 281300 "Access Control" for access control devices installed at door openings and provided as part of a security system.
- 5. Section 283111 "Digital, Addressable Fire-Alarm System" for connections to building fire-alarm system.

2.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.

- B. Shop Drawings: Details of electrified door hardware, indicating the following:
1. Wiring Diagrams: For power, signal, and control wiring and including the following:
 - a. Details of interface of electrified door hardware and building safety and security systems.
 - b. Schematic diagram of systems that interface with electrified door hardware.
 - c. Point-to-point wiring.
 - d. Risers.
 - e. Elevations doors controlled by electrified door hardware.
 2. Operation Narrative: Describe the operation of doors controlled by electrified door hardware.
- C. Samples for Verification: For exposed door hardware of each type required, in each finish specified, prepared on Samples of size indicated below. Tag Samples with full description for coordination with the door hardware schedule. Submit Samples before, or concurrent with, submission of door hardware schedule.
1. Sample Size: Full-size units or minimum 2-by-4-inch Samples for sheet and 4-inch long Samples for other products.
 - a. Full-size Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.
- D. Other Action Submittals:
1. Door Hardware Schedule: Prepared by or under the supervision of a Consultant member, A.H.C., in good standing, of the Door and Hardware Institute; detailing fabrication and assembly of door hardware, as well as installation procedures and diagrams. Coordinate final door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 - a. Submittal Sequence: Submit door hardware schedule after submissions of Product Data, Samples, and Shop Drawings. Coordinate submission of door hardware schedule with scheduling requirements of other work to facilitate the fabrication of other work that is critical in Project construction schedule.
 - b. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page.
 - c. Format: Use same scheduling sequence and format and use same door numbers as in the Contract Documents.

d. Content: Include the following information:

- 1) Identification number, location, hand, fire rating, size, and material of each door and frame.
- 2) Locations of each door hardware set, cross-referenced to Drawings on floor plans and to door and frame schedule.
- 3) Complete designations, including name and manufacturer, type, style, function, size, quantity, function, and finish of each door hardware product.
- 4) Description of electrified door hardware sequences of operation and interfaces with other building control systems.
- 5) Fastenings and other pertinent information.
- 6) Explanation of abbreviations, symbols, and codes contained in schedule.
- 7) Mounting locations for door hardware.
- 8) List of related door devices specified in other Sections for each door and frame.

2. Keying Schedule: Prepared by or under the supervision of Hardware Supplier's A.H.C., detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations that are coordinated with the Contract Documents.

2.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and Architectural Hardware Consultant.
- B. Product Certificates: For electrified door hardware, from the manufacturer.
 1. Certify that door hardware approved for use on types and sizes of labeled fire-rated doors complies with listed fire-rated door assemblies.
- C. Product Test Reports: For compliance with accessibility requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for door hardware on doors located in accessible routes.
- D. Warranty: Special warranty specified in this Section.

2.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.

2.6 QUALITY ASSURANCE

- A. Supplier Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and an Architectural Hardware Consultant who is available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.
 - 1. Warehousing Facilities: In Project's vicinity.
 - 2. Scheduling Responsibility: Preparation of door hardware and keying schedules.
 - 3. Engineering Responsibility: Preparation of data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.
- B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as follows:
 - 1. For door hardware, an Architectural Hardware Consultant (AHC).
- C. Source Limitations: Obtain each type of door hardware from a single manufacturer.
 - 1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that perform electrical modifications and that are listed by a testing and inspecting agency acceptable to authorities having jurisdiction are acceptable.
- D. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated, provide door hardware rated for use in assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C, unless otherwise indicated.
- E. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
 - 1. Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. at the tested pressure differential of 0.3-inch wg of water.
- F. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.
- G. Means of Egress Doors: Latches do not require more than 15 lbf to release the latch. Locks do not require use of a key, tool, or special knowledge for operation.

- H. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
1. Provide operating devices that do not require tight grasping, pinching, or twisting of the wrist and that operate with a force of not more than 5 lbf.
 2. Comply with the following maximum opening-force requirements:
 - a. Interior, Non-Fire-Rated Hinged Doors: 5 lbf applied perpendicular to door.
 - b. Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
 - c. Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
 3. Bevel raised thresholds with a slope of not more than 1:2. Provide thresholds not more than 1/2 inch high.
 4. Adjust door closer sweep periods so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- I. Keying Conference:
- J. Will be Conducted by the Best Manufactures Key System Specialist Direct with the Owners Representative and Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
- K. Permanent Cores and Keys will be delivered directly to the Owner as determined by;
1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
 2. Preliminary key system schematic diagram.
 3. Requirements for key control system.
 4. Requirements for access control.
 5. Address for delivery of keys.
- L. Pre-installation Conference: Conduct conference at Project site.
1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 2. Inspect and discuss preparatory work performed by other trades.
 3. Inspect and discuss electrical roughing-in for electrified door hardware.
 4. Review sequence of operation for each type of electrified door hardware.
 5. Review required testing, inspecting, and certifying procedures.

2.7 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification coordinated with the final door hardware schedule, and include installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

2.8 COORDINATION

- A. Coordinate layout and installation of floor-recessed door hardware with floor construction. Cast anchoring inserts into concrete.
- B. Installation Templates: Distribute for doors, frames, and other work specified to be factory prepared. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
- C. Security: Coordinate installation of door hardware, keying, and access control with Owner's security consultant.
- D. Electrical System Roughing-In: Coordinate layout and installation of electrified door hardware with connections to power supplies and building safety and security systems.
- E. Existing Openings: Where hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide proper door operation.

2.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including excessive deflection, cracking, or breakage.
 - b. Faulty operation of doors and door hardware.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Three years from date of Substantial Completion, unless otherwise indicated. Each company shall provide a special warranty for the following components. Should the following warranty terms exceed the manufacturer's standard published warranties, they shall clarify the warranty terms as part of their initial proposal for the Owners consideration.
 - a. Electromagnetic and Delayed-Egress Locks: Five years from date of Substantial Completion.
 - b. Exit Devices: Ten (10) years from date of Substantial Completion.
 - c. Manual Closers: Twenty-Five (25) years from date of Substantial Completion.
 - d. Concealed Floor Closers: Twenty-Five (25) years from date of Substantial Completion.
 - e. Locks: Ten (10) years from date of substantial completion
 - f. Continuous Geared Aluminum Hinges: Continuous Warranty with no expiration date.

2.10 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Beginning at Substantial Completion, provide [six] months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door and door hardware operation. Provide parts and supplies that are the same as those used in the manufacture and installation of original products.

PART 3 - PRODUCTS

3.1 SCHEDULED DOOR HARDWARE

- A. Provide door hardware for each door as scheduled in Part 3 "Door Hardware Schedule" Article to comply with requirements in this Section.
 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and named manufacturers' products.
 2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door

Hardware Schedule" Article. Products are identified by using door hardware designations, as follows:

1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Schedule" Article.

3.2 HINGES

- A. Hinges: BHMA A156.1. Provide template-produced hinges for hinges installed on hollow-metal doors and hollow-metal frames.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Hager Companies
 - b. McKinney Products Company; an ASSA ABLOY Group company.
 - c. PBB, Inc.
 - d. Stanley Commercial Hardware
 - e. Bommer Industries, Inc.

3.3 CENTER-HUNG AND OFFSET PIVOTS

- A. Center-Hung and Offset Pivots: BHMA A156.4.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Rixson Specialty Door Controls; An ASSA ABLOY Group Company
 - b. DORMA Architectural Hardware, a division of Dorma+Kaba
 - c. McKinney Products Company; an ASSA ABLOY Group company.

3.4 CONTINUOUS HINGES

- A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
- B. Continuous, Gear-Type Hinges: Extruded-aluminum, pinless, geared hinge leaves joined by a continuous extruded-aluminum channel cap; with concealed, self-lubricating thrust bearings.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. McKinney Products Company; an ASSA ABLOY Group company.
 - b. Bommer Industries, Inc.
 - c. Select Products Limited.

3.5 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: As indicated in door hardware schedule.
- B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
 2. Bored Locks: Minimum 1/2" throw
 3. Deadbolts: Minimum 1.25 inch bolt throw.
- C. Lock Backset: 2-3/4 inches, unless otherwise indicated.
- D. Lock Trim:
 1. Description: DORMA Architectural Hardware, a division of Dorma+Kaba
 2. Levers: Pressure Cast
 - a. Dorma C800 x LCC Design.
 - b. Best 9K.
 3. Escutcheons (Roses): Cast or Wrought to match finish of levers.
 4. Operating Device: Lever with escutcheons (roses).
 5. Dummy Trim: Match lock trim and escutcheons (roses)
- E. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- F. Bored Locks: BHMA A156.2; Grade 1; Series 4000., U.L. Listed for UL 10B/10C and UBC 7.2
 1. Cast stainless steel latch retractor
 2. Stainless steel latch bolt
 3. Lock chassis constructed of steel and stainless steel components

4. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DORMA Architectural Hardware, a division of Dorma+Kaba, C800 Series.

3.6 AUXILIARY LOCKS

- A. Mortise Auxiliary Locks: BHMA A156.5; Grade 1; with strike that suits frame.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DORMA Architectural Hardware, a division of Dorma+Kaba, D900 Series.
 - b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - c. Falcon Lock division of Allegion.
- B. Push-Button Combination Locks: BHMA A156.5; mortise; Grade 1; lock opens by entering a one- to five-digit code by pushing correct buttons in correct sequence; automatically relocks when door is closed; with strike that suits frame.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Kaba Ilco Corp.; a division of Dorma+Kaba.
 - b. Simplex Lock Corporation.
 - c. Alarm Lock
 - d. Salto Systems

3.7 ELECTRIC STRIKES

- A. Electric Strikes: BHMA A156.31; Grade [1]; with faceplate to suit lock and frame.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. HES, Inc.; an ASSA ABLOY Group company.
 - b. Security Door Controls.
 - c. DORMA Architectural Hardware, a division of Dorma+Kaba

3.8 ELECTROMAGNETIC LOCKS

- A. Electromagnetic Locks: BHMA A156.23; electrically powered; with electromagnet attached to frame and armature plate attached to door; full-exterior or full-interior type, as required by application indicated.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Door Controls International, Inc.
 - b. Schlage Commercial Lock Division; an Allegion company.
 - c. DORMA Architectural Hardware, a division of Dorma+Kaba

3.9 EXIT LOCKS AND EXIT ALARMS

- A. Exit Locks and Alarms: BHMA A156.29, Grade 1.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - b. Von Duprin division of Allegion
 - c. DORMA Architectural Hardware, a division of Dorma+Kaba

3.10 MANUAL FLUSH BOLTS

- A. Manual Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Adams Rite Manufacturing Co.; an ASSA ABLOY Group company.
 - b. Door Controls International, Inc.
 - c. IVES Hardware; an Allegion company.
 - d. Rockwood Manufacturing
 - e. Trimco Architectural Hardware.

3.11 AUTOMATIC AND SELF-LATCHING FLUSH BOLTS

- A. Automatic and Self-Latching Flush Bolts: BHMA A156.16; minimum 3/4-inch throw; designed for mortising into door edge.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Door Controls International, Inc.
 - b. IVES Hardware; an Allegion company.
 - c. Rockwood Manufacturing
 - d. Trimco Architectural Hardware.

EXIT DEVICES AND AUXILIARY ITEMS

- B. Exit Devices and Auxiliary Items: BHMA A156.3, Grade 1
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DORMA Architectural Hardware, a division of Dorma+Kaba, 9000 Series

3.12 LOCK CYLINDERS

- A. Lock Cylinders: Tumbler type, constructed from brass or bronze, stainless steel, or nickel silver.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - BEST Architectural Hardware, a division of Dorma+Kaba.
- B. Standard Lock Cylinders: BHMA A156.5; Grade 1; permanent cores that are interchangeable; face finished to match lockset.
 - 1. Number of Pins: 7
 - 2. Mortise, Rim, Bored Lock type
- C. Construction Master Keys: Provide 10 construction master keys.
- D. Construction Cores: Provide temporary construction cores that are replaceable by permanent cores.

3.13 KEYING

- A. Keying System: Furnish all locks and cores keyed to BEST, Factory Key Control System(, Great Great Grand Master Key System as established for McLeod Regional Medical Center.
 - 1. Great-Grand Master Key System: Change keys, a master key, a grand master key, and a great-grand master key operate cylinders.
 - 2. Existing System:
 - a. Master key or grand master key locks to Owner's existing system.
 - b. Re-key Owner's existing master key system into new keying system.

3. Tag all cores and keys to indicate their intended locations and to enable Owner, with a minimum of effort to establish his key control system.
4. Permanently inscribe each core with a visual key control number (VKC)
5. Contact Best KSS (Key System Specialist), to arrange keying meeting with owner and Owner Representative.

B. Keys: Nickel silver.

1. Stamping: Permanently inscribe each key with a visual key control number and include the following notation:
 - a. Notation: "DO NOT DUPLICATE." Include the serialized key control (SKC) symbol on each key.
2. Quantity: Provide the following:
 - a. Cylinder Change Keys: Three per core
 - b. Master Keys: six per master key set
 - c. Grand Master Keys: Six
 - d. Great-Grand Master Keys: Three
 - e. Great Great Grand Master Keys: Three
 - f. Construction Master Keys: Ten
 - g. Construction Control Keys: Two
 - h. Permanent Control Keys: Two
 - i. Specialty Keys, i.e. HKSP, ENG, etc.: Five per type
 - j. Key Blanks – SKC: One Hundred

3.14 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel, unless otherwise indicated.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. IVES Hardware; an Allegion company.
 - c. Rockwood Manufacturing Company.
 - d. Trimco Architectural Hardware.

3.15 ACCESSORIES FOR PAIRS OF DOORS

- A. Coordinators: BHMA A156.3; consisting of active-leaf, hold-open lever and inactive-leaf release trigger; fabricated from steel with nylon-coated strike plates; with built-in, adjustable safety release.

- B. Astragals: BHMA A156.22.

3.16 SURFACE CLOSERS

- A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DORMA Architectural Hardware, a division of Dorma+Kaba, 8916 series.
 - b. Best Stanley Door Closers D4550 SERIES
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company

3.17 CONCEALED CLOSERS

- A. Concealed Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves. Comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. DORMA Architectural Hardware, a division of Dorma+Kaba
 - b. LCN Closers: an Allegion Company.
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

3.18 MECHANICAL STOPS AND HOLDERS

- A. Wall and Floor Mounted Stops: BHMA A156.16.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hager Companies.
 - b. IVES Hardware; an Allegion Company.

- c. Trimco Architectural Hardware.

3.19 ELECTROMAGNETIC STOPS AND HOLDERS

- A. Electromagnetic Door Holders: BHMA A156.15, Grade 1; electromagnetic unit with strike plate attached to swinging door; coordinated with fire detectors and interface with fire alarm system for labeled fire-rated door assemblies. Electromagnetic hold open devices and Power Supplies are provided under the fire alarm specification.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, one of the following products shall be provided under the Digital Addressable Fire Alarm Specification 283111.
 - a. Architectural Builders Hardware Mfg., Inc.
 - b. DORMA Architectural Hardware, a division of Dorma+Kaba
 - c. SARGENT Manufacturing Company; an ASSA ABLOY Group company.

3.20 OVERHEAD STOPS AND HOLDERS

- A. Overhead Stops and Holders: BHMA A156.8.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - 2.
 - a. ABH Manufacturing Company.
 - b. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - c. DORMA Architectural Hardware, a division of Dorma+Kaba

3.21 DOOR GASKETING

- A. Door Gasketing: BHMA A156.22; air leakage not to exceed 0.50 cfm per foot (0.000774 cu. m/s per m) of crack length for gasketing other than for smoke control, as tested according to ASTM E 283; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. National Guard Products.
 - c. Pemko Manufacturing Co
 - d. Reese Enterprises, Inc.
 - e. Zero International.

3.22 THRESHOLDS

- A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. National Guard Products.
 - c. Pemko Manufacturing Co
 - d. Reese Enterprises, Inc.
 - e. Zero International.

3.23 SLIDING DOOR HARDWARE

- A. Sliding Door Hardware: BHMA A156.14; consisting of complete sets including rails, hangers, supports, bumpers, floor guides, and accessories indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Hager Companies.
 - b. Henderson, PC Inc.
 - c. Johnson, L. E., Products, Inc.
 - d. Stanley Commercial Hardware; Div. of The Stanley Works.

3.24 AUXILIARY DOOR HARDWARE

- A. Auxiliary Hardware: BHMA A156.16.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. Baldwin Hardware Corporation.
 - b. Hager Companies.
 - c. Rockwood Manufacturing Company.
 - d. Stanley Commercial Hardware; Div. of The Stanley Works.
 - e. Trimco Architectural Hardware.

3.25 AUXILIARY ELECTRIFIED DOOR HARDWARE

A. Auxiliary Electrified Door Hardware:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on schedule or comparable product by one of the following:
 - a. SARGENT Manufacturing Company; an ASSA ABLOY Group company.
 - b. Security Door Controls.
 - c. DORMA Architectural Hardware, a division of Dorma+Kaba

3.26 FABRICATION

- A. Base Metals: Produce door hardware units of base metal indicated, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18.
- B. Fasteners: Provide door hardware manufactured to comply with published templates prepared for machine, wood, and sheet metal screws. Provide screws that comply with commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
 2. Fire-Rated Applications:
 - a. Wood or Machine Screws: For the following:
 - 1) Hinges mortised to doors or frames.
 - 2) Strike plates to frames.
 - 3) Closers to doors and frames.
 - b. Steel Through Bolts: For the following unless door blocking is provided:
 - 1) Surface hinges to doors.
 - 2) Closers to doors and frames.
 - 3) Surface-mounted exit devices.
 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

4. Fasteners for Wood Doors: Comply with requirements in DHI WDHS.2, "Recommended Fasteners for Wood Doors."
5. Gasketing Fasteners: Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.

3.27 FINISHES

- A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 4 - EXECUTION

4.1 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire-rated door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

4.2 PREPARATION

- A. Steel Doors and Frames: For surface applied door hardware, drill and tap doors and frames according to ANSI/SDI A250.6.
- B. Wood Doors: Comply with DHI WDHS.5 "Recommended Hardware Reinforcement Locations for Mineral Core Wood Flush Doors."

4.3 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
 - 1. Standard Steel Doors and Frames: ANSI/SDI A250.8.
 - 2. Wood Doors: DHI WDHS.3, "Recommended Locations for Architectural Hardware for Wood Flush Doors."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing. Do not install surface-mounted items until finishes have been completed on substrates involved.
 - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
 - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Hinges: Install types and in quantities indicated in door hardware schedule but not fewer than the number recommended by manufacturer for application indicated or one hinge for every 30 inches of door height, whichever is more stringent, unless other equivalent means of support for door, such as spring hinges or pivots, are provided.
- D. Intermediate Offset Pivots: Where offset pivots are indicated, provide intermediate offset pivots in quantities indicated in door hardware schedule but not fewer than one intermediate offset pivot per door and one additional intermediate offset pivot for every 30 inches of door height greater than 90 inches.
- E. Lock Cylinders: Install construction cores to secure building and areas during construction period.
 - 1. Replace construction cores with permanent cores as directed by Owner.
- F. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings. Locations above hung ceilings or enclosed spaces shall be hard wired in junction boxes. Verify location with Architect.
 - 1. Configuration: Provide one power supply for each door opening with electrified door hardware.
- G. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 079200 "Joint Sealants."
- H. Stops: Provide floor stops for doors unless wall or other type stops are indicated in door hardware schedule. Do not mount floor stops where they will impede traffic.

- I. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- J. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
- K. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

4.4 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
 - 1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

4.5 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
 - 1. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
 - 2. Door Closers: Adjust sweep period to comply with accessibility requirements and requirements of authorities having jurisdiction.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust each item of door hardware, including adjusting operating forces, as necessary to ensure function of doors, door hardware, and electrified door hardware.

4.6 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

4.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes. Refer to Section 017900 "Demonstration and Training."

4.8 DOOR HARDWARE SCHEDULE

Hardware #GL-02 Glass Doors

Doors: 4524A

Each to have:

NOTE: ALL HARDWARE FURNISHED BY SECTION 08 41 26

Hardware #02 Dictation

Doors: 4564A, 4564B, 4581A, 4581B

Each to have:

3	Hinges	FBB191-HT- 4.5 X 4.5	630	STA
1	Passage Set	C810 LCC	626	DORMA
1	Wall Stop	1270WV	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #03 Therapy

Doors: 4568A, 4568B

Each to have:

3	Hinges	FBB191-HT- 5 X 4.5	630	STA
1	Classroom Set	C870 LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X AF89 X SNB	689	DORMA
1	Edge Guards	KE33-2 x 42"	630	Trimco
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Wall Stop	1270WV	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #06 Patient Rooms

Doors:

4514A, 4515A, 4516A, 4517A, 4518A, 4519A, 4520A, 4521A, 4525A, 4526A, 4527A, 4528A, 4529A, 4530A, 4531A, 4532A, 4533A, 4534A, 4535A, 4536A, 4537A, 4538A, 4539A, 4540A, 4542A, 4543A, 4544A, 4545A, 4546A, 4547A, 4548A, 4549A, 4550A, 4551A, 4541A

Each to have:

3	Hinges Swing Clear	STSCB278 - 5	630	STA
1	Hospital Latch	6800Q-2A	630	ABH
1	OH Stop	1025	630	ABH
1	Edge Guards	KE33-2 x 42"	630	Trimco
1	Set Smoke Seal	5050C	C	NGP
1	Auto Door Bottom	225N	A	NGP

Hardware #07 Isolation Patient Rooms

Doors: 4522A, 4523A

Each to have:

3	Hinges Swing Clear	STSCB278 - 5	630	STA
1	Hospital Latch	6800Q-2A	630	ABH
1	Closer	8916 x DA x AF89 x SNB	689	DORMA
1	OH Stop	1025	630	ABH
1	Edge Guards	KE33-2 x 42"	630	Trimco
1	Kick Plate	K0050 10" x 45 1/2" x B4E x CS	630	Trimco
1	Set Smoke Seal	5050C	C	NGP
1	Auto Door Bottom	225N	A	NGP

Hardware #08 Patient Toilets

Doors:

4514T-A, 4515T-A, 4516T-A, 4517T-A, 4518T-A, 4519T-A, 4520T-A, 4521T-A, 4522T-A, 4523T-A, 4525T-A, 4526T-A, 4527T-A, 4528T-A, 4529T-A, 4530T-A, 4531A-T, 4532T-A, 4533T-A, 4534T-A, 4535T-A, 4536T-A, 4537T-A, 4538T-A, 4539T-A, 4540T-A, 4542T-A, 4543T-A, 4544T-A, 4545T-A, 4546T-A, 4547T-A, 4548T-A, 4549T-A, 4550T-A, 4551T-A, 4541T-A

Each to have:

3	Hinges	FBB191-HT- 4.5 X 4.5	630	STA
1	Privacy Set	CL840 LCC	626	DORMA
1	OH Stop	4023	630	ABH
3	Silencers	1229A	Grey	Trimco

Hardware #09 Staff Toilets

Doors: 4585A, 4560A

Each to have:

3	Hinges	FBF191-HT- 4.5 X 4.5	630	STA
1	Privacy set	C840 LCC	626	DORMA
1	Closer	8916 X AF89 X SNB	689	DORMA
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Mop Plate	KM050 6" x 1" LDW x B4E x CS	630	Trimco
1	Wall Stop	1270WV	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #10 Public Toilets

Doors: 4569A, 4575A

Each to have:

3	Hinges	FBF191-HT- 4.5 X 4.5	630	STA
1	Privacy Set	C840 LCC	626	DORMA
1	Closer	8916 X AF89 X SNB	689	DORMA
1	Wall Stop	1270WV	630	Trimco
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Mop Plate	KM050 6" x 1" LDW x B4E x CS	630	Trimco
1	Smoke Seal	5050C		NGP

Hardware #11 Electrical/Equipment/Tel./Storage

Doors: 4572A, 4573A

Each to have:

3	Hinges	FBF191-HT- 4.5 X 4.5	630	STA
1	Storeroom Lock	C880T LCC (Abrasive Outside 4573A)	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X AF89 X SNB	689	DORMA
1	Kick Plates	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Wall Stop	1270WV	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Note: Install closer to allow 180-degree swing on outswing corridor doors.

Hardware #12 Equipment

Doors: 4577A, 4577B

Each to have:

3	Hinges Swing Clear	STSCB278 – 5	630	STA
1	Storeroom Lock	C880T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X DA X IS X SNB	689	DORMA
1	Kick Plates	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Edge Guards	KE33-2 x 38"	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #14 Soiled Utility

Doors: 4562A, 4562B, 4583A, 4583B

Each to have:

3	Hinges	FBB191-HT- 4.5 X 4.5	630	STA
1	Classroom Lock	C870T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X DA X IS X SNB	689	DORMA
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #16 Janitor

Doors: 4561A, 4584A

Each to have:

3	Hinges	FBB191-HT- 4.5 X 4.5	630	STA
1	Storeroom Lock	C880T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X AF89 X SNB	689	DORMA
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Wall Stop	1270WV	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #17 Clean Linen/Utility/Corr./Work/Med and Nourishment

Doors: 4566A, 4566B, 4579A, 4579B

Each to have:

3	Hinges	FBF191-HT- 4.5 X 4.5	630	STA
1	Classroom Lock	C870T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X DA X IS X SNB	689	DORMA
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #17A Clean Linen/Utility/Corr./Work/Med and Nourishment

Doors: 4567A, 4567B, 4578A, 4578B

Each to have:

3	Hinges	FBF191-HT- 5 X 4.5	630	STA
1	Classroom Lock	C870T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer	8916 X DA X IS X SNB	689	DORMA
1	Kick Plate	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #23 Break/Family Wait

Doors: 4571A, 4574A

Each to have:

3	Hinges	FBF191 4.5 X 4.5	630	STA
1	Classroom Lock	C870T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Closer/Stop	8916 X S-IS X SNB	689	DORMA
1	Kick Plates	K0050 10" x 2" LDW x B4E x CS	630	Trimco
1	Set Smoke Seal	5050C	C	NGP

Hardware #27 Offices

Doors: 4563A, 4570A, 4576A, 4582A

Each to have:

3	Hinges	FBB191 4.5 X 4.5	630	STA
1	Office Lock	C853T LCC	626	DORMA
1	Permanent Core	Cormax	626	BEST
1	Wall Stop	1270WV	630	Trimco
3	Smoke Seal	5050C		NGP

Hardware #28 Pocket Cross Corridor

Doors: 4503A, 4505A

Each to have:

8	Sets Pocket Pivots	75523 (Special Offset Template)	652	DORMA
2	Exit Devices	F9400-LB x No Trim	630	DORMA
2	Pocket Closers 90°	TS93 PTK 90	689	DORMA
2	Wall Mag. Holder	EM504-24120	689	DORMA
1	Set Smoke Seal	5050C	C	NGP
2.	Kick Plates	K0050 10" x 2" LDW x B4E x CS	630	Trimco

Note: Provide shims or spaces as required for wall magnetic holder and recess pocket
Door/Frame Assembly

END OF SECTION 087100

SECTION 088170 – FIRE-RATED GLASS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-rated glazing materials installed as vision lights in fire-rated doors.

B. Related Sections include the following:

1. Section 081416 “Flush Wood Doors”

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM E2074-00: Standard Test Method for Fire Tests of Door Assemblies, Including Positive Pressure Testing of Side-Hinged and Pivoted Swinging Door Assemblies.
2. ASTM E2010-01: Standard Test Method for Positive Pressure Fire Tests of Window Assemblies.

B. American National Standards Institute (ANSI):

1. ANSI Z97.1: Standard for Safety Glazing Materials Used in Buildings

C. Consumer Product Safety Commission (CPSC):

1. CPSC 16 CFR 1201: Safety Standard for Architectural Glazing Materials

D. Glass Association of North America (GANA):

1. GANA – Glazing Manual.
2. FGMA – Sealant Manual.

E. National Fire Protection Association (NFPA):

1. NFPA 80: Fire Doors and Windows.
2. NFPA 252 – Fire Tests of Door Assemblies.
3. NFPA 257 – Fire Tests of Window Assemblies.

F. 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.

1.3 PERFORMANCE REQUIREMENTS

- A. Fire-rated clear ceramic and wireless glazing material for use in impact safety-rated locations such as doors, transoms and borrowed lites with fire rating requirements ranging from 20 minutes to 3 hours with hose stream test.
- B. Passes positive pressure test standards UL10C, UBC 7-2 and UBC 7-4.

1.4 SUBMITTALS

- A. Product data: Submit manufacturer's technical data for each glazing material required, including installation and maintenance instructions.
- B. Product certificates: Signed by glass and glazing materials manufacturers attesting that glass and glazing materials furnished for project comply with requirements.
- C. Product Test Listings: From UL indicating fire-rated glass complies with requirements, based on comprehensive testing of current product.
- D. Samples: Submit, for verification purposes, approx. 8-inch by 10-inch sample for each type of glass indicated. Provide glazed samples with 3M Film for color selection comparison to laminated glass with Arctic Snow Innerlayer.
- E. Glazing Schedule: Use same designations indicated on Vision Glass Schedule for glazed openings in preparing a schedule listing glass types and thicknesses for each size opening and location.

1.5 QUALITY ASSURANCE

- A. Glazing Standards: FGMA Glazing Manual and Sealant Manual.
- B. Fire Protective Rated Glass: Each lite shall bear permanent, nonremovable label of UL certifying it for use in tested and rated fire protective assemblies.
- C. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per ASTM E 152, labeled and listed by UL or WHI or other certification agency acceptable to authorities having jurisdiction.

- D. Installer Qualifications: An experienced installer who has completed glazing similar in material, design, and extent to that indicated for this Project; whose work has resulted in glass installations with a record of successful in-service performance.
- E. Source Limitations for Glazing Accessories: Obtain glazing accessories through one source from a single manufacturer for each product and installation method indicated.
- F. Glass Product Testing: Obtain glass test results for product test reports in "Submittals" Article from a qualified testing agency based on testing glass products.
 - 1. Glass Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.
- G. Glazing for Fire-Rated Door Assemblies: Glazing for assemblies that comply with NFPA 80 and that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.
- H. Safety Glazing Products: Comply with testing requirements in 16 CFR 1201.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to specified destination in manufacturer's or distributor's packaging, undamaged, complete with installation instructions.
- B. Store off ground, under cover, protected from weather and construction activities.
- C. Protect glazing materials according to manufacturer's written instructions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- D. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.7 WARRANTY

- A. Provide manufacturer's limited warranty.
- B. Warranty Period: Three years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LAMINATED CERAMIC GLAZING MATERIAL

- A. Manufacturer: FireLite®Plus as manufactured by Nippon Electric Glass Company, Ltd., and distributed by Technical Glass Products, Kirkland, Washington or approved equal
1. Properties:
 - a. Thickness: 5/16 inch overall.
 - b. Weight: 4 lbs./sq. ft.
 - c. Approximate Visible Transmission: 85 percent.
 - d. Approximate Visible Reflection: 9 percent.
 - e. Fire-rating: 20 minutes to 3 hours for doors;
 - f. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - g. Surface Finish: Standard
 - h. Positive Pressure Test: UL 10C, UBC 7-2 and 7-4; passes.
 2. Labeling: Permanently label each piece of fire rated glass with manufacturer's logo, UL logo and fire.
 3. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with NPFA 252 and NFPA 257.
 4. Applied Film: Provide 3M Fasara film of color to be selected to match laminated glass on doors noted on door schedule.
- B. Manufacturer: Fireglass20® as manufactured by J.R. Four Ltd., and distributed by Technical Glass Products, 8107 Bracken Place SE, Snoqualmie, WA 98065,
1. Properties:
 - a. Thickness: 1/4 inch.
 - b. Weight: 3.0 lbs./sq. ft.
 - c. Approximate Visible Transmission: 89 percent.
 - d. Approximate Visible Reflection: 8 percent.
 - e. Fire-rating: 20 minutes (WITHOUT HOSE STREAM TEST).
 - f. Impact Safety Resistance: ANSI Z97.1 and CPSC 16CFR1201 (Cat. I and II).
 - C. Labeling: Permanently label each piece of fireglass 20™ with the fireglass 20™ logo, UL logo and fire rating in sizes up to 6,396 sq. in.
 - D. Fire Rating: Fire rating listed and labeled by UL for fire rating scheduled at opening locations on drawings, when tested in accordance with ASTM E2074-00 and UL 9, UL 10B and UL10C.

2.2 GLAZING COMPOUND FOR FIRE-RATED GLAZING MATERIALS

- A. Glazing Tape: Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides, maximum water absorption by volume of 2 percent. Glass

panels that exceed 1,393 sq. inches for 90-minute ratings must be glazed with fire-rated glazing tape supplied by manufacturer.

- B. Silicone Sealant: One-part neutral curing silicone, medium modulus sealant, Type S; Grade NS; Class 25 with additional movement capability of 50 percent in both extension and compression (total 100 percent); Use (Exposure) NT; Uses (Substrates) G, A, and O as applicable. Available Products:
 - 1. Dow Corning 795 - Dow Corning Corp.
 - 2. Silglaze-II 2800 - General Electric Co.
 - 3. Spectrem 2 - Tremco Inc.
- C. Setting Blocks: Neoprene, EPDM, or silicone; tested for compatibility with glazing compound; of 70 to 90 Shore A hardness.
- D. Cleaners, Primers, and Sealers: Type recommended by manufacturer of glass and gaskets.
- E. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range.

2.3 FABRICATION

- A. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine glass framing, with glazier present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Observable edge damage or face imperfections.
- B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings that are not firmly bonded to substrates.

3.3 INSTALLATION (GLAZING)

- A. Comply with referenced FGMA standards and instructions of manufacturers of glass, glazing sealants, and glazing compounds.
- B. Provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerance as required by manufacturer for fire rating. Adjust as required by Project conditions during installation.
- C. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- D. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- E. Cut glazing tape to length and set against permanent stops, flush with sight lines to fit openings exactly, with stretch allowance during installation.
- F. Install in vision panels in fire-rated doors to requirements of NFPA 80.
- G. Install so that appropriate UL markings remain permanently visible.

3.4 PROTECTION AND CLEANING

- A. Protect glass from contact with contaminating substances resulting from construction operations. Remove any such substances by method approved by glass manufacturer.
- B. Wash glass on both faces not more than four days prior to date scheduled for inspections intended to establish date of substantial completion. Wash glass by method recommended by glass manufacturer.

END OF SECTION 088170

SECTION 090512 - MISCELLANEOUS DEVICE COLOR SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes administrative and procedural requirements for DEVICE COLORS

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Coordinate Device colors with manufactured system as listed below. Colors listed below shall take precedence over other color references which may be listed in other sections of the project specification.

MISCELLANEOUS DEVICE COLOR SCHEDULE			
<u>RESPONSIBILITY*</u>	<u>DEVICE</u>	<u>COLOR</u>	<u>REMARKS</u>
A	Magnetic Hold Open	Brushed Stainless	
A	Touchless Handwave sensor	White	
A	Proximity Door swing sensor	White	
E	F.A Pull Station	RED	
E	F.A. Strobe	WHITE	
E	Exit Light	RED Letters, Clear Housing, White Accessory box.	
E	Receptacles and switches	WHITE	Unless required to be red or orange by regulation.
E	Switchplates	WHITE	
M	Differential Pressure	WHITE	

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	Sensors		
M	Thermostat / Temp Sensor	WHITE	
M	Grilles / Diffusers	WHITE	
P	Med Gas Outlets	COLOR CODED	Plate surrounding outlet shall be smallest available. Color shall be white or grey as selected by architect. Provide per NFPA 99C
P	Zone Valve Boxes	WHITE	CABINET FRAME
P	Med Gas Alarms	WHITE	CABINET FRAME
P	Area Alarms	WHITE	CABINET FRAME
P	Master Alarms	WHITE	CABINET FRAME
FP	Sprinkler Heads - Concealed	WHITE	COVER PLATES
FP	Sprinkler Heads -Concealed in Wood Ceiling	Factory painted to match Limber Maple	
O	N.C. Dome Light	WHITE	
O	N.C. Stations	WHITE	
O	Telemetry Antennae	WHITE	
O	Proximity Door Sensor	WHITE	
O	Data and Telephone Outlets	WHITE	
O	Sound System Speakers	WHITE	
O	Volume Switch	WHITE	
O	Intercom	WHITE	
	Cameras	WHITE CASING	

***A=ARCHITECTURE, E=ELECTRICAL, M=MECHANICAL, P=PLUMBING, FP=FIRE PROTECTION, O=OWNER**

END OF SECTION 090512

SECTION 092216 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Non-load-bearing steel framing systems for interior gypsum board assemblies.
2. Suspension systems for interior gypsum ceilings and soffits.
3. Wall systems for curved walls and fascias

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics: Provide materials and construction identical to those tested according to ASTM E 119.
- B. 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.

2.2 FRAMING SYSTEMS

- A. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: As indicated on Drawings.
- B. Slip-Type Head Joints: Where indicated, provide one of the following in thickness not less than indicated for studs and in width to accommodate depth of studs:
 - 1. Single Long-Leg Runner System: ASTM C 645 top runner with 2-inch- deep flanges, installed with studs friction fit into top runner and with continuous bridging located within 12 inches of the top of studs to provide lateral bracing.
 - 2. Double-Runner System: ASTM C 645 top runners, inside runner with 2-inch-deep flanges and fastened to studs, and outer runner sized to friction fit inside runner.
 - 3. Deflection Track: Steel sheet top runner manufactured to prevent cracking of finishes due to deflection of structure above.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - 1) Steel Network Inc. (The); VertiClip SLD Series.
 - 2) Superior Metal Trim; Superior Flex Track System (SFT).
- C. Firestop Tracks: Manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; 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.
- E. Cold-Rolled Channel Bridging: Steel, 0.053-inch minimum base-metal thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch- thick, galvanized steel.
- F. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Minimum Base-Metal Thickness: 0.033 inch.
 - 2. Depth: As indicated on Drawings.
- G. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Z shaped.
- H. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.
 - 1. Depth: 3/4 inch.
 - 2. Furring Brackets: Adjustable, corrugated-edge type of steel sheet with minimum uncoated-steel thickness of 0.033 inch.
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.
- I. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-metal thickness of 0.018 inch, and depth required to fit insulation thickness indicated.

2.3 HAND FORMABLE METAL FRAMING

A. Manufacturer: Basis of Design:

1. Radius Track Corporation: 9320 Evergreen Blvd. N.W., Suite G, Minneapolis, MN 55433; Telephone: (888) 872-3487, (763) 795-8885; Fax: (763) 795-8884; E-mail: info@radiustrack.com; website: www.radiustrack.com or approved equal.

B. Hand Formable Framing: As specified for Non-structural metal framing studs and tracks.

1. Minimum Metal Thickness: 0.033 inch.
2. Coating: G60.

C. Hand-Formable Track:

1. Basis of Design Product: Hand-Formable Ready-Track by Radius Track Corporation.
2. Web Depth: As indicated on Drawings.
3. Flange Height: 1-1/4 inches.

D. Hand-Formable Angle:

1. Basis of Design Product: Hand-Formable Ready-Angle by Radius Track Corporation.
2. Angle Size: 1-1/2 x 1-1/2 inches.

2.4 FABRICATION - CURVED COLD-FORMED METAL FRAMING

A. Fabricators: Furnish curved cold-formed metal framing fabricated by one of the following:

1. Radius Track Corporation: 9320 Evergreen Blvd. N.W., Suite G, Minneapolis, MN 55433; Telephone: (888) 872-3487, (763) 795-8885; Fax: (763) 795-8884; E-mail: info@radiustrack.com; website: www.radiustrack.com.

B. Custom form components by computer controlled bending, crimping, or rolling of metal framing and track to produce uniform curves indicated on Drawings using uninterrupted, continuous metal profiles with structural capacity to meet performance requirements.

1. Fabricator to determine curve type to meet design intent.

C. Factory assemble the following custom curved framing assemblies to greatest extent possible:

D. Fabrication Tolerances:

1. Radius: Plus or minus 1/8 inch in 16 feet.
2. Radius Uniformity: Plus or minus 1/16 in 32 inches.
3. Arc Length: Plus or minus 1/8 inch.
4. Plane: Plus or minus 1/4 inch.
5. Tangent Points: 1/16 within 16 inches.

2.5 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 1. Anchors: Capable of sustaining a load equal to 5 times that imposed as determined by ASTM E 488.
 - a. Type: Postinstalled, expansion anchor.
 2. Powder-Actuated Fasteners: Capable of sustaining, a load equal to 10 times that imposed as determined by ASTM E 1190.
- C. Wire Hangers: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, in size indicated on Drawings.
- E. Carrying Channels: Cold-rolled, commercial-steel sheet with a base-metal thickness of 0.053 inch and minimum 1/2-inch-wide flanges.
 1. Depth: As indicated on Drawings.
- F. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges, 3/4 inch deep.
 2. Steel Studs and Runners: ASTM C 645. Use either steel studs and runners or dimpled steel studs and runners of equivalent minimum base-metal thickness.
 - a. Minimum Base-Metal Thickness: 0.033 inch.
 - b. Depth: As indicated on Drawings.
 3. Hat-Shaped, Rigid Furring Channels: ASTM C 645, 7/8 inch deep.
 - a. Minimum Base-Metal Thickness: As indicated on Drawings.

4. Resilient Furring Channels: 1/2-inch- deep members designed to reduce sound transmission.
 - a. Configuration: Z shaped.

2.6 AUXILIARY MATERIALS

- A. 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 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754.
 1. 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.

3.2 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacing indicated, but not greater than spacing required by referenced installation standards for assembly types.
- B. Install studs so flanges within framing system point in same direction.
- C. 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 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:
- D. Curved Walls:
1. Install top and bottom track, in position and alignment required to produce completed framing configuration indicated on Drawings. Anchor track to substrate at maximum 24 inches on center.
 2. Position studs in tracks, spaced maximum 12 inches or 16 inches on center as required by radius for a smooth curve appearance.
 3. Locate studs maximum 2 inches from door frames and abutting construction.
 4. Fasten stud framing to both flanges of top and bottom tracks. Do not fasten stud framing to single deflection track.
 5. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 6. 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 o.c.
- E. Hand-Formable Track: Field-bend tracks to indicated radius and install at curved shapes in ceilings.
- F. Hand-Formable Angle: Field-bend tracks to indicated radius and install at top and bottom of curved walls.

- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 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.
- 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, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - 3. Do not attach hangers to steel roof deck.
 - 4. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 5. 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. Refer to drawings.
- F. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 092216

SECTION 092900 - GYPSUM BOARD

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 gypsum board.
 - 2. Tile backing panels.
 - 3. Reveals
 - 4. Glazing Tracks
- B. Related Requirements:
 - 1. Section 092216 "Non-Structural Metal Framing" for non-structural framing and suspension systems that support gypsum board panels.
 - 2. Section 092116.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch- long length for each trim accessory indicated.

1.4 QUALITY ASSURANCE

- A. Mockups: Before beginning gypsum board installation, install mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Install mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations including reveals and intersections to various building wall components.
2. Apply or install final Painting on exposed surfaces for review of mockups.
3. Simulate finished lighting conditions for review of mockups.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.6 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, 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.

- C. Sulphur Free Composition: Provide materials that are sulphur free in product composition.
- D. Manufacturer's Plant Location: Products shall be manufactured in the United States of America. No foreign manufactured products will be accepted.

2.2 GYPSUM BOARD, GENERAL

- A. Provide manufacturer's certification of sulphur free product composition and manufacturer's plant location.
- B. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. American Gypsum.
 - 2. CertainTeed Corp.
 - 3. Georgia-Pacific Gypsum LLC.
 - 4. National Gypsum Company.
 - 5. USG Corporation.
- B. Moisture- and Mold-Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold-resistant core and paper surfaces.
 - 1. Core: 5/8 inch, Type X.
 - 2. Long Edges: Tapered.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- C. Flexible Gypsum Board Type X: ASTM C 1396/C 1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 - 1. Thickness: 1/4 inch.
 - 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C 1396/C 1396M. Sag Resistant
 - 1. Thickness: 1/2 inch.
 - 2. Long Edges: Tapered.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C 1396/C 1396M. Manufactured to have increased fire-resistive capability.
- B. Use Type C board where required for increased fire resistance to permit thinner construction, and as listed on UL design assemblies.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. American Gypsum; Firebloc Type C.
 - b. CertainTeed Corp.; ProRoc Type C.
 - c. Georgia-Pacific Gypsum LLC; Fireguard C.
 - d. National Gypsum Company; Gold Bond Fire-Shield C.
 - e. USG Corporation; Firecode C Core.
 - 2. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 - 3. Long Edges: Tapered.

2.5 TILE BACKING PANELS

- A. Cement Tile Backing Board: ASTM C1325
 - 1. Products: Basis of design:
 - a. United States Gypsum Company; Durock Cement Board.
 - 2. Core: 5/8 inch, Type X.
 - 3. Mold Resistance: ASTM D 3273, score of 10 as rated according to ASTM D 3274.
- B. Water-Resistant Gypsum Backing Board: ASTM C 1396/C 1396M, with manufacturer's standard edges. Install on all toilet rooms that do not contain showers and on all walls in rooms containing plumbing fixtures.
 - 1. Specifically provided in janitors closets and in soiled utility rooms and in mechanical rooms containing water and water processing equipment.
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Gypsum.
 - b. CertainTeed Corp.
 - c. Georgia-Pacific Gypsum LLC.
 - d. Lafarge North America Inc.
 - e. USG Corporation.

3. Core: 5/8 inch, Type X or Type C as required by fire-resistance-rated assembly indicated on Drawings.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
 1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
- B. Reveals: Trim-Tex AS5110 vinyl reveal beads and matching 1 piece special beads to provide for cross, tee and L configurations
- C. Drywall Reveal Protection in Fire Rated Walls: "FSB" (Flat Strap Backer) as manufactured by BlazeFrame Industries, (425) 869-2811, <http://www.blazeframe.com>.
- D. Ceiling Glazing Channels: Fry Reglet Model DRM- 150-75
- E. Low Partition Glazing Sill assembly: Fry Reglet Sill DMG 4875. Confirm width with partition construction.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
 1. Interior Gypsum Board: Paper.
 2. Tile Backing Panels: As recommended by panel manufacturer.
- C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
 1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use sandable setting-type taping compound.

2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use sandable setting-type taping compound.
 - a. Use sandable setting-type compound for installing paper-faced metal trim accessories.
3. Fill Coat: For second coat, use drying-type, sandable topping compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use drying-type, all-purpose compound.
 - a. Use of high-build interior coating product designed for application by airless sprayer to be used instead of skim coat to produce Level 5 finish is not permitted.
6. Final finished product shall be of uniform texture. Variances in texture created by use of setting type and drying type compounds are not acceptable. Aff final exposed finish shall be drying type compound.

D. Joint Compound for Tile Backing Panels:

1. Glass-Mat, Water-Resistant Backing Panel: As recommended by backing panel manufacturer.
2. Cementitious Backer Units: As recommended by backer unit manufacturer.
3. Water-Resistant Gypsum Backing Board: Use setting-type taping compound and setting-type, sandable topping compound.

E. Joint Compound for Mold Resistant Gypsum Board:

1. Use manufacturers recommended product. ,

2.8 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
- B. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
 1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
 2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- C. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- D. Acoustical Joint Sealant: Manufacturer's standard nonsag, paintable, nonstaining latex sealant complying with ASTM C 834. 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.
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Accumetric LLC; BOSS 824 Acoustical Sound Sealant.
 - b. Grabber Construction Products; Acoustical Sealant GSC.
 - c. Pecora Corporation; AC-20 FTR.
 - d. Specified Technologies, Inc.; Smoke N Sound Acoustical Sealant.
 - e. USG Corporation; SHEETROCK Acoustical Sealant.
 2. Acoustical joint 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. Thermal Insulation: As specified in Section 072100 "Thermal Insulation."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and framing, with Installer present, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C 919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:

1. Type X: Use at all Vertical surfaces unless otherwise indicated.
2. Flexible Type: Apply in double layer at curved assemblies as required for small radius curvature.
3. Ceiling Type: Ceiling surfaces.
4. Moisture- and Mold-Resistant Type X: Use for interior walls. Use at all exterior wall finishing.
5. Type C: Where required for specific fire-resistance-rated assembly indicated.
6. Cement Tile Backing Board: At ceramic tile installations in wet areas.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels as recommended by manufacturer based on stud spacing and board type. Hold panels 1/4" minimum off floor construction and attach to metal stud construction. Apply appropriate sealant and bond break between floor and gypsum board to provide a water resistant seal.
3. On Z-furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws as recommended by manufacturer and as required by fire tested assembly.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers as recommended by manufacturer with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-furring members, apply base layer as recommended by manufacturer and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.

D. 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. 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.

3.4 APPLYING TILE BACKING PANELS

- A. Cement Tile Backing Board: Comply with manufacturer's written installation instructions and install at showers and where indicated to receive tile. Install with 1/4-inch gap where panels abut other construction or penetrations.
- B. Water-Resistant Backing Board: Install where indicated with 1/4-inch gap where panels abut other construction or penetrations.

3.5 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control joints according to ASTM C 840 and in specific locations approved by Architect for visual effect. Locate joints in long horizontal runs above door frames
- C. Interior Trim: Install in the following locations:
 1. Cornerbead: Use at outside corners unless otherwise indicated.
 2. LC-Bead: Use at exposed panel edges.
 3. Curved-Edge Cornerbead: Use at curved openings.
- D. Aluminum Trim: Install in wet locations in rooms containing showers.
- E. Reveals: In all fire rated walls, install Drywall Reveal Protection to provide tested and verified code compliant continuous fire rating behind reveals. Attach directly to framing, carefully coordinating placement and drywall installation to match tested assembly.
- F. Reveals: Install reveals straight and true with no apparent distortion or waviness. But reveals tight at joints maintaining a continuous appearance. Coordinate location of reveals in walls with those in Wood Doors. Reveals shall match height and appear continuous on walls with recessed pocket doors etc. This may require the reveals to be installed after installation of wood door construction.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:
 - 1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 - 2. Level 2: Panels that are substrate for tile.
 - 3. Level 3: Not Applicable.
 - 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."
 - 5. Level 5: Corridor walls, all walls beneath wall washing light fixtures, all walls containing reveals, all curved walls and where indicated on Drawings.
 - 6. Sprayed on level 5 finisher is not acceptable for project.
 - a. Primer and its application to surfaces are specified in Section 099123 "Interior Painting."

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 092900

SECTION 093000 - TILING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceramic tile.

B. Related Sections

1. Section 092900 "Gypsum Board" for tile backing panels.
2. Section 123661 "Simulated Stone Countertops and Thresholds" for Patient Toilet door thresholds.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples:

1. Each type and composition of tile and for each color and finish required.
2. Assembled samples, with grouted joints, for each type and composition of tile and for each color and finish required.
3. Stone thresholds in 6-inch lengths.

1.3 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Build mockup of each type of floor tile installation.
2. Build mockup of each type of wall tile installation.
3. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 EXTRA MATERIALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering and identified with labels describing contents.
 - 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.

PART 2 - PRODUCTS

2.1 TILE PRODUCTS

- A. ANSI Ceramic Tile Standard: Provide Standard grade tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
- B. Tile Type CTF6: Unglazed paver tile.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Dal-Tile Unity, Color Body Porcelain Unpolished.
 - 2. Composition: Porcelain through body.
 - 3. Face Size: 12" x 12".
 - 4. Thickness: 3/8".
 - 5. Face: Smooth.
 - 6. Finish: Unpolished
 - 7. Tile Color and Pattern: As indicated on drawings.
 - 8. Grout Color: As indicated on Drawings
- C. Tile Type CTW 1,2,3: Glazed Wall Tile. Factory-mounted flat tile as follows:
 - 1. Basis of Design: Subject to compliance with requirements, provide Dal-Tile "Semi Gloss"
 - 2. Surface: Gloss
 - 3. Module Size: 4 1/4inches by 4 1/4inches
 - 4. Nominal Thickness: 5/16 inch.
 - 5. Factory Joint Spacing: 1/16"
 - 6. Grout Color: As indicated on Drawings
 - 7. Finish: Bright Opaque Glaze
 - 8. Face: Plain, with cushion edges.
 - 9. Tile and Color Pattern: As indicated on Drawings
- D. Tile Type CTW 5: Decorative wall tile.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide Dal-Tile Unity Color body Porcelain Polished.

2. Module Size: 12" x 12".
3. Thickness: 3/8 inch.
4. Face: Smooth.
5. Finish: Semimat, clear glaze.
6. Tile Color and Pattern: As indicated on drawings.
7. Grout Color: As selected by Architect from manufacturer's full range.
8. Mounting: Factory, back mounted.
9. Mounting: PregROUTED sheets of tiles factory assembled and grouted with manufacturer's standard white silicone rubber.
10. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as follows, selected from manufacturer's standard shapes:
 - a. Base: Straight, module size 6" x 12", Dal-Tile Unity S-36C9T Unpolished.
 - b. External Corners for Thin-Set Mortar Installations: Bullnose shape, same size as adjoining flat tile.
 - c. Internal Corners: For coved base and cap use angle pieces designed to fit with stretcher shapes.

2.2 THRESHOLDS

- A. General: Marble thresholds fabricated to sizes and profiles indicated or required to provide transition between adjacent floor finishes.
 1. Bevel edges at 1:2 slope, with lower edge of bevel aligned with or up to 1/16 inch above adjacent floor surface. Finish bevel to match top surface of threshold. Limit height of threshold to 1/2 inch or less above adjacent floor surface.

2.3 SETTING MATERIALS

- A. Latex-Portland Cement Mortar (Thin Set): ANSI A118.4.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Custom Building Products.
 - c. Laticrete International, Inc.
 - d. MAPEI Corporation.
 - e. TEC; a subsidiary of H. B. Fuller Company.
 2. Prepackaged, dry-mortar mix combined with liquid-latex additive.
 3. For wall applications, provide nonsagging mortar.

2.4 GROUT MATERIALS

A. Water-Cleanable Epoxy Grout: ANSI A118.3.

1. Manufacturers: Subject to compliance with requirements, provide Laticrete Epoxy Spectralock or products by one of the following:
 - a. Bonsal American; an Oldcastle company.
 - b. Custom Building Products.
 - c. MAPEI Corporation.
 - d. Southern Grouts & Mortars, Inc.
 - e. Summitville Tiles, Inc.
 - f. TEC; a subsidiary of H. B. Fuller Company.

2.5 ELASTOMERIC SEALANTS

A. General: Provide sealants, primers, backer rods, and other sealant accessories that comply with the following requirements and with the applicable requirements in Division 07 Section "Joint Sealants."

1. Use sealants that have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. One-Part, Mildew-Resistant Silicone Sealant: ASTM C 920; Type S; Grade NS; Class 25; Uses NT, G, A, and, as applicable to nonporous joint substrates indicated, O; formulated with fungicide, intended for sealing interior ceramic tile joints and other nonporous substrates that are subject to in-service exposures of high humidity and extreme temperatures.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. DAP Inc.
 - b. Dow Corning Corporation; Dow Corning 786.
 - c. GE Silicones, a division of GE Specialty Materials; Sanitary 1700.
 - d. Laticrete International, Inc.; Latasil Tile & Stone Sealant.
 - e. Pecora Corporation; Pecora 898 Sanitary Silicone Sealant.
 - f. Tremco Incorporated; Tremsil 600 White.

2.6 MISCELLANEOUS MATERIALS

A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.

- B. Grout Sealer: Manufacturer's standard silicone product for sealing grout joints and that does not change color or appearance of grout.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bonsal American, an Oldcastle company; Grout Sealer.
 - b. Bostik, Inc.; CeramaSeal Grout & Tile Sealer.
 - c. C-Cure; Penetrating Sealer 978.
 - d. Custom Building Products; Grout and Tile Grout Sealer.
 - e. Jamo Inc.; Matte Finish Sealer.
 - f. TEC, a subsidiary of H. B. Fuller Company; TA-256 Penetrating Silicone Grout Sealer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
 - 1. Verify that substrates for setting tile are firm, dry, clean, free of coatings that are incompatible with tile-setting materials including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.

3.2 PREPARATION

- A. Fill cracks, holes, and depressions in concrete substrates for tile floors installed with thin-set mortar with trowelable leveling and patching compound specifically recommended by tile-setting material manufacturer.
- B. Where indicated, prepare substrates to receive waterproofing by applying a reinforced mortar bed that complies with ANSI A108.1A and is sloped 1/4 inch per foot toward drains.
- C. Blending: For tile exhibiting color variations, use factory blended tile or blend tiles at Project site before installing.

3.3 INSTALLATION

- A. Comply with TCA's "Handbook for Ceramic Tile Installation" for TCA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 Series "Specifications for Installation of Ceramic Tile" that are referenced in TCA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
 - 1. For the following installations, follow procedures in the ANSI A108 Series of tile installation standards for providing 95 percent mortar coverage:
 - a. Tile floors in wet areas.
 - b. Tile floors composed of tiles 8 by 8 inches or larger.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Jointing Pattern: Lay tile in grid pattern unless otherwise indicated. Lay out tile work and center tile fields in both directions in each space or on each wall area. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.
- E. Joint Widths: Unless otherwise indicated, install tile with the following joint widths:
 - 1. Paver Tile: 1/8 inch.
 - 2. Decorative Wall Tile: 1/8 inch.
 - 3. Glazed Wall Tile: 1/16 inch.
- F. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
 - 1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.
 - 2. Prepare joints and apply sealants to comply with requirements in Division 07 Section "Joint Sealants."
- G. Stone Thresholds: Install stone thresholds in same type of setting bed as adjacent floor unless otherwise indicated.

- H. Grout Sealer: Apply grout sealer to cementitious grout joints in tile floors according to grout-sealer manufacturer's written instructions. As soon as grout sealer has penetrated grout joints, remove excess sealer and sealer from tile faces by wiping with soft cloth.
- I. Install waterproofing to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness and bonded securely to substrate.

3.4 INTERIOR TILE INSTALLATION SCHEDULE

- A. Interior Floor Installations, Concrete Subfloor:
 - 1. Tile Installation F115: Thin-set mortar; epoxy grout; TCA F115.
- B. Interior Wall Installations, Metal Studs or Furring:
 - 1. Tile Installation TCA W245: Thin set Mortar on coated glass matt water resistant cementitious backer board.
 - a. Bond Coat / thin set Mortar : Latex Polymer portland cement mortar
 - b. Grout: Water cleanable epoxy grout.

END OF SECTION 093000

SECTION 095113 - ACOUSTICAL PANEL CEILINGS

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 acoustical panels and exposed suspension systems for ceilings.
- B. Glazing Tracks for recessed glazing
- C. Related Requirements:
- D. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For each exposed product and for each color and texture specified, 6 inches in size.
- C. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of size indicated below.
 - 1. Acoustical Panel: Set of 6-inch- square Samples of each type, color, pattern, and texture.
 - 2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Product Test Reports: For each acoustical panel ceiling, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Evaluation Reports: For each acoustical panel ceiling suspension system, from ICC-ES.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For finishes to include in 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. Acoustical Ceiling Panels: Full-size panels equal to 2 percent of quantity installed.
 - 2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to NVLAP for testing indicated.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Build mockup of typical ceiling area as shown on Drawings.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver acoustical panels, suspension-system components, and accessories to Project site in original, unopened packages and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

- B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.
- C. Handle acoustical panels carefully to avoid chipping edges or damaging units in any way.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Acoustical ceiling shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 - 1. Site Class D.
 - 2. Seismic Design Category D
 - 3. Seismic Use Group IV
- B. 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-Spread Index: Comply with ASTM E 1264 for Class A materials.
 - 2. Smoke-Developed Index: 50 or less.

2.2 ACOUSTICAL PANELS, GENERAL

- A. Source Limitations:
 - 1. Acoustical Ceiling Panel: Obtain each type from single source from single manufacturer.
 - 2. Suspension System: Obtain each type from single source from single manufacturer.
- B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer.

- C. Glass-Fiber-Based Panels: Made with binder containing no urea formaldehyde.
- D. Acoustical Panel Standard: Provide manufacturer's standard panels of configuration indicated that comply with ASTM E 1264 classifications as designated by types, patterns, acoustical ratings, and light reflectances unless otherwise indicated.
 - 1. Mounting Method for Measuring NRC: Type E-400; plenum mounting in which face of test specimen is 15-3/4 inches away from test surface according to ASTM E 795.
- E. Acoustical Panel Colors and Patterns: Match appearance characteristics indicated for each product type.
 - 1. Where appearance characteristics of acoustical panels are indicated by referencing pattern designations in ASTM E 1264 and not manufacturers' proprietary product designations, provide products selected by Architect from each manufacturer's full range that comply with requirements indicated for type, pattern, color, light reflectance, acoustical performance, edge detail, and size.

2.3 ACOUSTICAL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Edge/Joint Detail: Flush reveal sized to fit flange of exposed suspension-system members.
- C. Thickness: 3/4 inch.

2.4 Modular Size: 24 by 24 inches. 24" by 48" tiles cut down as shown on the arch plans.

2.5 ACOUSTICAL PANEL (AP-1)

- A. Basis-of-Design Product: Subject to compliance with requirements, provide United States Gypsum Company Frost Tegal Tile per McLeod Standards.
 - 1. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type III, mineral base with painted finish; Form 1, nodular.
 - 2. Pattern: EI (lightly textured).
- C. Color: White.

- D. LR: Not less than 0.85.
- E. NRC: Not less than 0.70
- F. CAC: Not less than 35
- G. Edge/Joint Detail: reveal sized to fit flange of 9/16" heavy duty grid member.
- H. Thickness: 3/4 inch.
- I. Use with Suspended Metal Grid AG-1.

2.6 Modular Size: 24 by 24 inches. 24" by 48" tiles cut down as shown on the arch plans.

2.7 ACOUSTICAL PANEL AP-2

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries Inc. Ultima or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type IV, mineral base with scrubbable and water-repellent painted finish; Form 1 2, nodular.
 - 2. Pattern: E (lightly textured).
- C. Color: White.
- D. LR: Not less than 0.86.
- E. NRC: Not less than 0.70
- F. CAC: Not less than 35
- G. Edge/Joint Detail: beveled tegular edge to lay flush in Armstrong Silhouette Grid.
- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 24 inches.

- J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21
- K. Use with Suspended Metal Grid AG-1.

2.8 ACOUSTICAL PANEL AP-3

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries Inc Clean Room VL or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type IV, mineral fiber, wet formed, with scrubbable, washable, and water-repellent vinyl-faced membrane; Form 2.
 - 2. Pattern: None.
- C. Color: White.
- D. LR: Not less than 0.80.
- E. NRC: N/A
- F. CAC: Not less than 40
- G. Edge/Joint Detail: Square.
- H. Thickness: 5/8 inch.
- I. Modular Size: 24 by 24 inches.
- J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21
- K. Use with Suspended Metal Grid AG-2.

2.9 ACOUSTICAL PANEL AP-4

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries Inc. Utima Health Zone or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Type IV, mineral fiber, wet formed, with scrubbable, washable, and water-repellent; Form 2.
 - 2. Pattern: E.
- C. Color: White.
- D. LR: Not less than 0.86.
- E. NRC: 0.70.
- F. CAC: Not less than 38
- G. Edge/Joint Detail: Beveled Tegral.
- H. Thickness: 3/4 inch.
- I. Modular Size: 24 by 24 inches.
- J. Broad Spectrum Antimicrobial Fungicide and Bactericide Treatment: Provide acoustical panels treated with manufacturer's standard antimicrobial formulation that inhibits fungus, mold, mildew, and gram-positive and gram-negative bacteria and showing no mold, mildew, or bacterial growth when tested according to ASTM D 3273 and evaluated according to ASTM D 3274 or ASTM G 21
- K. Use with Suspended Metal Grid AG-1

2.10 ACOUSTICAL PANEL AP-5

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries Optima Radial or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.

- B. Classification: Provide panels complying with ASTM E 1264 for type, form, and pattern as follows:
 - 1. Type and Form: Fiberglass with acoustically transparent membrane, washable, scratch resistant, impact resistant, soil resistant.
- C. Color: White.
- D. NRC: 0.70.
- E. CAC: Not less than 38
- F. Edge/Joint Detail: Beveled Tegral.
- G. Thickness: 3/4 inch.
- H. Size and shape as indicated.

2.11 METAL SUSPENSION SYSTEMS, GENERAL

- A. Metal Suspension-System Standard: Provide manufacturer's standard direct-hung metal suspension systems of types, structural classifications, and finishes indicated that comply with applicable requirements in ASTM C 635/C 635M.
- B. Attachment Devices: Size for five times the design load indicated in ASTM C 635/C 635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.
 - 1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing according to ASTM E 488 or ASTM E 1512 as applicable, conducted by a qualified testing and inspecting agency.
 - a. Corrosion Protection: Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (0.005 mm) for Class SC 1 service condition.
 - 2. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing according to ASTM E 1190, conducted by a qualified testing and inspecting agency.

- C. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
 - 1. Zinc-Coated, Carbon-Steel Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper.
 - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635/C 635M, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch- diameter wire or as required by the Authorities Having Jurisdiction.
- D. Seismic Stabilizer Bars: Manufacturer's standard perimeter stabilizers designed to accommodate seismic forces.
- E. Seismic Struts: Manufacturer's standard compression struts designed to accommodate seismic forces.
- F. Seismic Clips: Manufacturer's standard seismic clips designed and spaced to secure acoustical panels in place. Seismic Clips shall limit width of perimeter angles to 3/4" maximum.

2.12 METAL SUSPENSION SYSTEM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

2.13 SUSPENDED METAL GRID AG-1

- A. Basis-of-Design Product : Subject to compliance with requirements, provide Armstrong World Industries Heavy Duty "Suprafine XL HRC" 9/16" exposed Tee Systems Grid or comparable product by one of the following:
 - 1. Chicago Metallic Corporation.
 - 2. USG Interiors, Inc.; Subsidiary of USG Corporation

2.14 SUSPENDED METAL GRID AG-2

- A. Basis-of-Design Product : Subject to compliance with requirements, provide Armstrong World Industries Heavy Duty 1-1/2" C-Extruded Clean Room Exposed Tee Systems, Grid, with gaskets and hold-down clips, or comparable product by one of the following:
 - 1. Chicago Metallic Corporation.
 - 2. USG Interiors, Inc.; Subsidiary of USG Corporation

2.15 METAL EDGE MOLDINGS AND TRIM

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Armstrong World Industries or comparable product by one of the following:
 - 1. CertainTeed Corp.
 - 2. Chicago Metallic Corporation.
 - 3. USG Interiors, Inc.; Subsidiary of USG Corporation.
- C. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.
 - 1. Provide manufacturer's standard edge moldings that fit acoustical panel edge details and suspension systems indicated and that match width and configuration of exposed runners unless otherwise indicated. Provide Armstrong Berc-2 clips or comparable system by other manufacturers for seismic edge conditions in lieu of the generic 2" angle.
 - 2. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
- D. Ceiling Glazing Track: Fry Reglet Model ARM-150-75

2.16 ACOUSTICAL SEALANT

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Acoustical Sealant for Exposed and Concealed Joints:
 - a. Pecora Corporation; AC-20 FTR Acoustical and Insulation Sealant.
 - b. USG Corporation; SHEETROCK Acoustical Sealant.
- B. Acoustical Sealant: Manufacturer's standard sealant complying with ASTM C 834 and effective in reducing airborne sound transmission through perimeter joints and openings in building construction as demonstrated by testing representative assemblies according to ASTM E 90.
 - 1. Exposed and Concealed Joints: Nonsag, paintable, nonstaining latex sealant.
 - 2. Concealed Joints: Nondrying, non hardening, non skinning, non staining, gunnable, synthetic-rubber sealant.
 - 3. Acoustical sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.
- B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders, and comply with layout shown on reflected ceiling plans.

3.3 INSTALLATION

- A. General: Install acoustical panel ceilings to comply with ASTM C 636/C 636M and seismic design requirements indicated, according to manufacturer's written instructions and CISCA's "Ceiling Systems Handbook."
- B. Suspend ceiling hangers from building's structural members and as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
 - 2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
 - 3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
 - 4. Secure flat, angle, channel, and rod hangers to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices that are secure and appropriate for both the structure to which hangers are attached and the type of hanger involved if traditional wire hangers are not adequate to support unusual or obstructed building components and bridging to structure is required..

- Install hangers in a manner that will not cause them to deteriorate or fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, post-installed mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.
 6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
 7. Do not attach hangers to steel deck tabs.
 8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
 9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
 10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
- C. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.
1. Apply acoustical sealant in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.
 2. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends, leveling with ceiling suspension system to a tolerance of 1/8 inch in 12 feet. Miter corners accurately and connect securely.
 3. Do not use exposed fasteners, including pop rivets, on moldings and trim.
- D. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.
- E. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
1. Arrange directionally patterned acoustical panels as follows:
 - a. As indicated on reflected ceiling plans.
 - b. Install panels with pattern running in one direction parallel to short axis of space.
 - c. Install panels in a basket-weave pattern.
 2. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
 3. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.

4. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
5. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.

3.4 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 1. Compliance of seismic design.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections and prepare test reports.
- C. Perform the following tests and inspections of completed installations of acoustical panel ceiling hangers and anchors and fasteners in successive stages. Do not proceed with installations of acoustical panel ceiling hangers for the next area until test results for previously completed installations show compliance with requirements.
 1. Extent of Each Test Area: When installation of ceiling suspension systems on each floor has reached 20 percent completion but no panels have been installed.
 - a. Within each test area, testing agency will select one of every 10 power-actuated fasteners and post-installed anchors used to attach hangers to concrete and will test them for 200 lbf of tension; it will also select one of every two post-installed anchors used to attach bracing wires to concrete and will test them for 440 lbf of tension.
 - b. When testing discovers fasteners and anchors that do not comply with requirements, testing agency will test those anchors not previously tested until 20 pass consecutively and then will resume initial testing frequency.
- D. Acoustical panel ceiling hangers and anchors and fasteners will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 CLEANING

- A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage. Remove and replace ceiling

components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 095113

SECTION 096513 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Resilient base.
2. Resilient molding accessories.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For each type of product indicated, in manufacturer's standard-size Samples but not less than 12 inches long, of each resilient product color, texture, and pattern required.

1.3 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. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive resilient products.

- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 RESILIENT BASE – RB1, 2, 3, 4, 5, 6

- A. Resilient Base:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Johnsonite
- B. Resilient Base Standard: ASTM F 1861.
 - 1. Material Requirement: Type TS (rubber, vulcanized thermoset).
 - 2. Manufacturing Method: Group I (solid, homogeneous).
 - 3. Style: Cove (base with toe). Refer to Finish Schedule for location
 - 4. Straight: Refer to Finish Schedule for location
- C. Minimum Thickness: 0.080 inch.
- D. Height: 6 inch straight and coved. Refer to Finish Schedule for locations.
4 inch coved: Refer to Finish Schedule for locations.
- E. Lengths: Coils in manufacturer's standard length.
- F. Outside Corners: Preformed.
- G. Inside Corners: Preformed.
- H. Finish: As selected by Architect from manufacturer's full range.
- I. Colors and Patterns: As selected by Architect from full range of industry colors, including special order custom colors. 700 Series.

2.2 RESILIENT MOLDING ACCESSORY

- A. Resilient Molding Accessory:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

- a. Johnsonite

- B. Description: Cap for cove resilient floor covering Carpet edge for glue-down applications. Reducer strip for resilient floor covering. Joiner for tile and carpet Transition strips.
 - C. Material: Rubber.
 - D. Profile and Dimensions: As indicated.
 - E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit resilient products and substrate conditions indicated.
 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. Cove Base Adhesives: Not more than 50 g/L.
 - b. Rubber Floor Adhesives: Not more than 60 g/L.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Treads and Accessories: Prepare according to ASTM F 710.
 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.

2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.
4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until they are same temperature as the space where they are to be installed.
 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.

3.3 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.

- B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of carpet and resilient floor covering that would otherwise be exposed.

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of resilient products.
- B. Cover resilient products until Substantial Completion.

END OF SECTION 096513

SECTION 096516 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Vinyl sheet floor covering, without backing.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
- C. Samples: In manufacturer's standard size, but not less than 6-by-9-inch sections of each different color and pattern of floor covering required.
- D. Maintenance data.

1.3 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. Resilient Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every 500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.
 - 1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor coverings.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 48 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL SHEET FLOOR COVERING – HWSV1, HWSV2, HWSV3, HWSV4, HWSV6

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Armstrong World Industries, Inc.; Medintone & Medintech Homogeneous.
- B. Unbacked Vinyl Sheet Floor Covering: ASTM F 1913, 0.080 inch thick.
- C. Wearing Surface: Smooth.
- D. Sheet Width: As standard with manufacturer.
- E. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 VINYL SHEET FLOOR COVERING – HWSV5

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Toli International; Mature Wood
- B. Unbacked Vinyl Sheet Floor Covering: ASTM F 1913, 0.080 inch thick.
- C. Wearing Surface: Smooth.
- D. Sheet Width: As standard with manufacturer.
- E. Colors and Patterns: As selected by Architect from full range of industry colors

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
 - 1. Adhesives: CBC America Ecospray of variety recommended by manufacturer for specific type of flooring.
- B. Integral-Flash-Cove-Base Accessories:
 - 1. Cove Strip: 1-inch radius provided or approved by manufacturer.
 - 2. Cap Strip: Square vinyl, or Tapered vinyl cap provided or approved by manufacturer.
- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.
- D. Seamless Installation Accessories:
 - 1. Heat – Welding Rod: Manufacturer's solid and patterned strand projects for heat welding seams.
 - a. Color: Match sheet floor covering. Submit weld rod layout at all patterned intersections for Architect's approval prior to intersection.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

- a. Perform Relative Humidity Tests using in situ probes, ASTM F 2170. Proceed with installation only after substrates have achieved a level compatible with the following specified product adhesives as follows:
 - 1) Armstrong S543 Adhesive - 90%RH
 - 2) Toli Ecospray Adhesive – 85%RH. (Note that Toli has indicated that there ecospray adhesive may be available for 90%RH application within 4 months)
 - 3) It shall be the resilient sheet flooring installer's responsibility to determine the proper adhesive to be used which meets the project schedule requirements. A copy of the concrete mix design for the elevated lightweight concrete slabs is included for reference.
 - C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
 - D. Do not install floor coverings until they are same temperature as space where they are to be installed.
 - 1. Move floor coverings and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
 - E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.
- 3.2 FLOOR COVERING INSTALLATION
- A. Comply with manufacturer's written instructions for installing floor coverings.
 - B. Unroll floor coverings and allow them to stabilize before cutting and fitting.
 - C. Lay out floor coverings as follows:
 - 1. Maintain uniformity of floor covering direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 - 3. Match edges of floor coverings for color shading at seams.
 - 4. Avoid cross seams.
 - D. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, and door frames.
 - E. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.

- F. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on substrates. Use chalk or other nonpermanent marking device.
- G. Adhere floor coverings to substrates according to manufacturers recommendations for spray adhesive coverage.
- H. Integral-Flash-Cove Base: Cove floor coverings 6 inches up vertical surfaces. Support floor coverings at horizontal and vertical junction by cove strip. Butt at top against cap strip.
- I. Heat Welded Seams: Comply with ASTM F 1516. Rout joints and use welding bead to permanently fuse sections into a seamless floor covering. Prepare, weld, and finish seams to produce surfaces flush with adjoining floor covering surfaces, and free from voids, recesses and raised areas.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor covering.
- B. Cover floor coverings until Substantial Completion.

END OF SECTION 096516

SECTION 096516.13 - LINOLEUM FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Linoleum sheet flooring.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: For each type of floor covering. Include floor covering layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.

C. Samples: In manufacturer's standard size, but not less than 6-by-9 inch sections of each color and pattern of floor covering required.

1. Heat Welding Bead: Include manufacturer's standard-size samples, but not less than 9 inches long of each color required.

D. Maintenance data.

1.3 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. Sheet Flooring: Furnish not less than 10 linear feet (3 linear m) for every [500 linear feet (150 linear m) or fraction thereof, in roll form and in full roll width for each type, color, and pattern of sheet flooring installed

1.4 QUALITY ASSURANCE

A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor coverings.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Close spaces to traffic during floor covering installation.
- D. Close spaces to traffic for 72 hours after floor covering installation.
- E. Install floor coverings after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide the following:
 - 1. Armstrong World Industries, Inc.; Marmorette.
 - 2. Forbo Flooring, Inc.; Real.

2.2 LINOLEUM FLOOR COVERING - LIN-1, LIN-2, LIN-3, LIN-4, LIN-5

- A. Sheet Flooring: ASTM F 2034, Type I, linoleum sheet with backing.
 - 1. Roll Size: In manufacturer's standard length by not less than 78 inches wide.
- B. Thickness: 0.10 inch.
- C. Colors and Patterns: As selected by Architect from full range of industry colors.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, Portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit products and substrate conditions indicated.
 - 1. Use adhesives that have a VOC content of not more than 50 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of floor coverings.
- B. Concrete Substrates: Prepare according to ASTM F 710.
1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 2. Remove substrate coatings and other substances that are incompatible with floor covering adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacture. Proceed with installation only after substrates pass testing.
 4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor coverings until they are same temperature as space where they are to be installed.
1. Move floor coverings and installation materials into spaces where they will be installed at least 72 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by floor coverings immediately before installation.

3.2 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions for installing floor coverings.
- B. Scribe and cut floor coverings to butt neatly and tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.
- C. Extend floor coverings into toe spaces, door reveals, closets, and similar openings.
- D. Maintain reference markers, holes, or openings that are in place or marked for future cutting by repeating on floor coverings as marked on subfloor. Use chalk or other nonpermanent marking device.
- E. Adhere floor coverings to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.3 LINOLEUM SHEET FLOORING INSTALLATION

- A. Unroll sheet floorings and allow them to stabilize before cutting and fitting.
- B. Lay out sheet floorings as follows:
 - 1. Maintain uniformity of floor covering direction.
 - 2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in floor covering substrates.
 - 3. Match edges of floor coverings for color shading at seams.
 - 4. Avoid cross seams.
 - 5. Eliminate deformations that result from hanging method used during drying process (stove bar marks).

3.4 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor coverings.
 - 1. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor
- B. After allowing drying room film (yellow film caused by linseed oil oxidation) to disappear, cover floor coverings until Substantial Completion.

END OF SECTION 096516

SECTION 096519 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Vinyl composition floor tile.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each type of floor tile. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
- C. Samples: Full-size units of each color and pattern of floor tile required.
- D. Maintenance data.

1.3 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. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.4 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: As determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

1.5 PROJECT CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer in spaces to receive floor tile.
- B. Until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer.
- C. Close spaces to traffic during floor tile installation.
- D. Close spaces to traffic for 48 hours after floor tile installation.
- E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL COMPOSITION FLOOR TILE

- A. Products: See Color Finish Schedule.
- B. Tile Standard: ASTM F 1066, Class 2, through-pattern tile.
- C. Wearing Surface: Smooth.
- D. Thickness: 0.125 inch.
- E. Size: 12 by 12 inches.
- F. Colors and Patterns: As selected by Architect from full range of industry colors.

2.2 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland cement based or blended hydraulic-cement-based formulation provided or approved by manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by manufacturer to suit floor tile and substrate conditions indicated.
 - 1. Use adhesives that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
 - a. VCT and Asphalt Tile Adhesives: Not more than 50 g/L.

- C. Floor Polish: Provide protective liquid floor polish products as recommended by manufacturer.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates: Prepare according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
 - 4. Moisture Testing: Perform tests recommended by floor covering manufacturer and as follows. Proceed with installation only after substrates pass testing.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Perform relative humidity test using in situ probes, ASTM F 2170. Proceed with installation only after substrates have a maximum 75% relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound and remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install floor tiles until they are same temperature as space where they are to be installed.
 - 1. Move resilient products and installation materials into spaces where they will be installed at least 48 hours in advance of installation.
- E. Sweep and vacuum clean substrates to be covered by resilient products immediately before installation.

3.2 FLOOR TILE INSTALLATION

- A. Comply with manufacturer's written instructions for installing floor tile.
- B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.
 - 1. Lay tiles square with room axis or in pattern indicated.
- C. Match floor tiles for color and pattern by selecting tiles from cartons in the same sequence as manufactured and packaged, if so numbered. Discard broken, cracked, chipped, or deformed tiles.
 - 1. Lay tiles with grain running in one direction.
- D. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.
- E. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.
- F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent, nonstaining marking device.
- G. Adhere floor tiles to flooring substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.
- H. Concrete Substrates: Prepare horizontal surfaces according to ASTM F 710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Proceed with installation only after substrates pass testing according to manufacturer's written recommendations, but not less stringent than the following:

5. Perform anhydrous calcium chloride test according to ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
6. Perform relative humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative humidity level.

3.3 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protection of floor tile.
- B. Floor Polish: Remove soil, visible adhesive, and surface blemishes from floor tile surfaces before applying liquid floor polish.
 1. Apply two coat(s).
- C. Cover floor tile until Substantial Completion.

END OF SECTION 096519

SECTION 096723 - RESINOUS FLOORING

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. Decorative resinous flooring and base systems.
- B. Related Sections:
 - 1. Section 079200 "Joint Sealants" for sealants installed at joints in resinous flooring systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include manufacturer's technical data, application instructions, and recommendations for each resinous flooring component required.
- B. Samples for Initial Selection: For each type of exposed finish required. Provide 12 inch square samples of all texture options.
- C. Samples for Verification: For each resinous flooring system selected, 12 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

- A. Installer Certificates: Signed by manufacturer certifying that installers comply with specified requirements.
- B. Material Certificates: For each resinous flooring component, from manufacturer.
- C. Material Test Reports: For each resinous flooring system.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
- C. Preinstallation Conference: Conduct conference at Project site to review installation methods, specifically how to ensure that design floor slopes and drainage will be accomplished, and to also ensure correct connection to drain body to eliminate any possible water path past the waterproof membrane.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.8 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
- B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
- C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Stonhard Stonshield SLT with Stonset Grout to provide indicated slope, Stonproof ME7 waterproofing, and Polyethylene Backer Rod and Stonflex MP7 at area drains per standard Stonhard shower pan detailing. Comparable product by one of the following may be used.
 - 1. Crossfield Products Corp.; Dex-O-Tex.
 - 2. ITW Resin Technologies.
 - 3. Polymerica, Incorporated.
 - 4. Tamms Industries, Inc.; a division of The Euclid Chemical Company.

2.2 MATERIALS

- A. VOC Content of Liquid-Applied Flooring Components: Not more than 100 g/L when calculated according to 40 CFR 59, Subpart D (EPA Method 24):

2.3 DECORATIVE RESINOUS FLOORING[FAEB-1]

- A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, decorative-aggregate-filled, epoxy-resin-based, monolithic floor surfacing designed to produce a seamless floor and integral cove base. System shall perform as a fully waterproof shower pan and finish floor, preventing water entry across the entire floor surface, sealed to the floor drain and door threshold, and turned up to seal against the wall tile edge.
- B. System Characteristics:
 - 1. Color and Pattern: As selected by Architect from manufacturer's full range.
 - 2. Wearing Surface: Textured for slip resistance, Architect to select from samples showing full range of texture that can be produced.
 - 3. Overall System Thickness: 1/8" at the drain. Slope up from drain at 2% within the curtain area. Continue sloping up from curtain area to room walls and door threshold beyond at 1%.
 - 4. If required slope results in total system thickness greater than 7/8", then provide raised underlayment beneath door threshold. Gradually taper underlayment out into adjacent room to make the transition imperceptible.
- C. Body Coats:

1. Resin: Epoxy.
 2. Formulation Description: 100 percent solids.
 3. Aggregates: Colored quartz (ceramic-coated silica).
- D. Topcoat: Sealing or finish coats.
1. Resin: Epoxy.
 2. Formulation Description: 100 percent solids.
 3. Type: Clear.
 4. Finish: Gloss level and texture shall be as selected by the Architect.
 5. Number of Coats: Two.
- E. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested according to test methods indicated:
1. Compressive Strength: 9000psi per ASTM C 579.
 2. Tensile Strength: 1600psi per ASTM C 307.
 3. Flexural Modulus of Elasticity: 1.0×10 to the 6th power per ASTM C 580.
 4. Water Absorption: .1% per ASTM C 413.
 5. Coefficient of Thermal Expansion: 1.8×10 to the 6th power in/in Degree C. per ASTM C 531.
 6. Hardness: 85 - 90 per ASTM D2240 Shore D
 7. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation per MIL-D-3134.
 8. Abrasion Resistance: 0.06gm max weight loss per ASTM D 4060.
 9. Flammability: Self-extinguishing per ASTM D 635.
- F. System Chemical Resistance: Test specimens of cured resinous flooring system are unaffected when tested according to ASTM D 1308 for 50 percent immersion.:

2.4 ACCESSORIES

- A. Primer: Type recommended by manufacturer for substrate and body coats indicated.
1. Formulation Description: 100 percent solids.
- B. Waterproofing Membrane: Type recommended by manufacturer for substrate and primer and body coats indicated.
1. Formulation Description: 100 percent solids.
- C. Reinforcing Membrane: Flexible resin formulation that is recommended by manufacturer for substrate and primer and body coats indicated and that prevents substrate cracks from reflecting through resinous flooring.

1. Formulation Description: 100 percent solids.
- D. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended by manufacturer for application indicated.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General: Prepare and clean substrates according to resinous flooring manufacturer's written instructions for substrate indicated. Provide clean, dry substrate for resinous flooring application.
- B. Provide manufacturers recommended filler to create pitch to drain indicated on the drawing.
- C. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 1. Roughen concrete substrates as follows:
 - a. Comply with ASTM C 811 requirements unless manufacturer's written instructions are more stringent.
 2. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.
 3. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.
 - a. Perform anhydrous calcium chloride test, ASTM F 1869. Proceed with application of resinous flooring only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. of slab area in 24 hours.
 - b. Perform plastic sheet test, ASTM D 4263. Proceed with application only after testing indicates absence of moisture in substrates.
 4. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.
- D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

- E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.
- F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.2 APPLICATION

- A. General: Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
 - 1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 - 2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
 - 3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Do not create floor slope by measuring depth relative to concrete subfloor, because that may not be level. Use calibrated and accurate high resolution level to insure required 2% (inside shower curtain) and 1% (between shower curtain and surrounding walls/doors) slope to drain.
- C. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
- D. Apply waterproofing membrane, where indicated, in manufacturer's recommended thickness.
 - 1. Apply waterproofing membrane to integral cove base substrates.
 - 2. Fully and permanently bond waterproofing membrane to drain assemblies to prevent water under all circumstances from bypassing the waterproof membrane and ending up in the floor below. Block drain weeps if needed to achieve this.
- E. Apply reinforcing membrane to substrate cracks.
- F. Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring. Apply according to manufacturer's written instructions and details including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
 - 1. Integral Cove Base: Height as indicated.
- G. Apply troweled or screeded body coats in thickness indicated for flooring system. Hand or power trowel and grout to fill voids. When cured, remove trowel marks and roughness using method recommended by manufacturer.

- H. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.
- I. Furnish and install sealant between top of epoxy cove base and bottom edge of ceramic wall tile and accessory system to prevent water entry into the walls under all conditions.
- J. If required slope results in total system thickness greater than 7/8", provide raised underlayment beneath solid surface sloped door threshold. Gradually taper underlayment out into adjacent room to make the transition imperceptible. Taper slope shall not exceed 1/16" per foot.
- K. Test drainage over entire floor. There shall be no areas on which water ponds or moves toward drain slowly.

3.3 FIELD QUALITY CONTROL

- A. Core Sampling: At the direction of Owner and at locations designated by Owner, take two core samples of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring and correct deficiencies. Locate cores in unobtrusive locations.
- B. Flood Testing: Test floor pitch to ensure that entire floor drains and that no ponding exists.

3.4 PROTECTION

- A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 096723

SECTION 096813 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes modular, tufted textured loop pile carpet tile.

1.2 PREINSTALLATION MEETINGS

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

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Type of subfloor.
 - 3. Type of installation.
 - 4. Pattern of installation.
 - 5. Pattern type, location, and direction.
 - 6. Pile direction.
 - 7. Type color and location of edge transition and other accessory strips.
 - 8. Transition details to other flooring materials.
- C. Samples: For each of the following products and for each color and texture specified. Label each sample with manufacturer's name, material description, color, pattern and designation indicated on drawings and schedules.
 - 1. Carpet Tile: Full size sample.
 - 2. Exposed Edge, Transition, and other Accessory Stripping: 12 inch long sample.

1.4 INFORMATIONAL SUBMITTALS

- A. Product test reports.
- B. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance data.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Fire-Test-Response Ratings: Where indicated, provide carpet tile identical to those of assemblies tested for fire response according to NFPA 253 by a qualified testing agency.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 - 1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
 - 2. Failures include, but are not limited to, more than 10 percent edge raveling, snags, runs, dimensional stability, excess static discharge, loss of tuft bind strength, loss of face fiber, and delamination.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Products: See Color Finish Schedule.

2.2 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that complies with flammability requirements for installed carpet tile and is recommended by carpet tile manufacturer for releasable installation.
 1. Adhesives shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance. Examine carpet tile for type, color, pattern, and potential defects.
- B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.
- D. Preparation: Comply with CRI 104, Section 6.2, "Site Conditions; Floor Preparation," and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile installation.
- E. Installation: Comply with CRI 104, Section 14, "Carpet Modules," and with carpet tile manufacturer's written installation instructions.

- F. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.
- G. Maintain dye lot integrity. Do not mix dye lots in same area.
- H. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- I. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- J. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on finish flooring as marked on subfloor. Use nonpermanent, nonstaining marking device.
- K. Install pattern parallel to walls and borders.
- L. Perform the following operations immediately after installing carpet tile:
 - 1. Remove excess adhesive, seam sealer, and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 - 2. Remove yarns that protrude from carpet tile surface.
 - 3. Vacuum carpet tile using commercial machine with face-beater element.
- M. Protect installed carpet tile to comply with CRI 104, Section 16, "Protecting Indoor Installations."

END OF SECTION 096813

SECTION 099123 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior substrates. the following interior substrates:
 - 1. Concrete.
 - 2. Concrete masonry units (CMU).
 - 3. Steel
 - 4. Hollow Metal Doors and Frames
 - 5. Galvanized metal.
 - 6. Gypsum board
 - 7. GFRP Column covers
- B. Surfaces which will become finish walls in future fitout work shall not be painted under this contract.
- C. Walls and other listed materials on the first floor which are affected by demolition and patching shall be painted to the natural break point.
- D. The Shell Contract presently under construction does not contain any interior painting. This contract includes the painting of walls, ceilings, stairs, railings and miscellaneous items constructed under the shell contract.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 2: Not more than 10 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 3: 10 to 25 units at 60 degrees and 10 to 35 units at 85 degrees, according to ASTM D 523.
- D. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- E. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.

- F. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- G. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Samples: For each type of paint system and in each color and gloss of topcoat.
- C. Product List: For each product indicated. Include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the proposed product highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Paint: 5 percent, but not less than 1 gal. (3.8L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, available Sherwin Williams products that may be incorporated into the Work include, but are not limited to products listed in other Part 2 articles for the paint category indicated.

1. Other Manufacturers:
 - a. PPG
 - b. Benjamin Moore Paint Company

2.2 PAINT, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."

- B. Material Compatibility:

1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior paints and coatings applied at Project site, the following VOC limits, inclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Dry-Fog Coatings: 400 g/L.
4. Primers, Sealers, and Undercoaters: 200 g/L.
5. Anticorrosive and Antirust Paints Applied to Ferrous Metals: 250 g/L.
6. Zinc-Rich Industrial Maintenance Primers: 340 g/L.
7. Pretreatment Wash Primers: 420 g/L.
8. Floor Coatings: 100 g/L.
9. Shellacs, Clear: 730 g/L.
10. Shellacs, Pigmented: 550 g/L.

- D. Low-Emitting Materials: Interior paints and coatings 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. Colors: As indicated in a color schedule.

2.3 BLOCK FILLERS

- A. Block Filler, Latex, Interior/Exterior: MPI #4.
 - 1. Sherwin Williams; PrepRite Block Filler B25W25

2.4 PRIMERS/SEALERS

- A. Primer Sealer, Latex, Interior: MPI #50.
 - 1. Sherwin Williams; ProMar 200 Latex Primer B28W2600.
- B. Primer, Alkali Resistant, Water Based: MPI #3.
 - 1. Sherwin Williams; Loxon Concrete and Masonry Primer
- C. Primer Sealer, Interior, Institutional Low Odor/VOC: MPI #149.
 - 1. Sherwin Williams; Harmony Interior Latex Primer B11W00900
- D. Primer, Latex, for Interior Wood: MPI #39.
 - 1. Sherwin Williams; MultiPurpose Primer BS1W8020
- E. Primer, Bonding, Water Based: MPI #17
 - 1. Sherwin Williams; Adhesion Primer B51W8050

2.5 METAL PRIMERS

- A. Primer, Rust-Inhibitive, Water Based: MPI #107.
 - 1. Sherwin Williams; Pro-Cryl Universal Primer B66-310.
- B. Primer, Alkyd, Anti-Corrosive, for Metal: MPI #79.
 - 1. Sherwin Williams; Kem Kromik Universal Metal Primer B50NZ6/B50NZ1
- C. Primer, Galvanized, Water Based: MPI #134.

1. Sherwin Williams; DTM Primer/Finish B66W1

2.6 WATER-BASED PAINTS

- A. Latex, Interior, Institutional Low Odor/VOC, Flat (Gloss Level 1): MPI #143 with a min EPR of 4.0.
 1. Sherwin Williams; Harmony Interior Latex Flat B5W951
- B. Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2): MPI #144 with a min EPR of 4.0.
 1. Sherwin Williams; Harmony Interior Latex Eg-Shel B09W00951
- C. Latex, Interior, Institutional Low Odor/VOC, Semi-Gloss (Gloss Level 5): MPI #147 with a min EPR of 5.0.
 1. Sherwin Williams; Harmony Interior Latex Semi-Gloss B10W00951
- D. Light Industrial Coating, Interior, Water Based, Semi-Gloss (Gloss Level 5): MPI #153.
 1. Sherwin Williams; DTM Acrylic Semi-Gloss B66-200 series
- E. Light Industrial Coating, Interior, Water Based, Gloss (Gloss Level 6): MPI #154.
 1. Sherwin Williams; Sher-Cryl HPA Gloss B66W311
- F. Light Industrial Coating, Interior, Single Component Epoxy, Eggshell, (Gloss Level 3)
 1. Sherwin-Williams; Pre-Catalyzed Epoxy Eg-Shel, K45-150 Series
- G. Light Industrial Coating, Interior, Single Component Epoxy, Semi-Gloss (Gloss Level 5)
 1. Sherwin-Williams; Pre-Catalyzed Epoxy Semi-Gloss, K46-150 Series

2.7 SOLVENT-BASED PAINTS

- A. Alkyd, Interior, Semi-gloss: MPI 47 (Gloss Level 5)
 1. Sherwin Williams; B34W200 Series

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 - 1. Concrete: 12 percent.
 - 2. Masonry (CMU): 12 percent.
 - 3. Gypsum Board: 12 percent.
- C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated including the necessary preparation for the painting of existing substrates that may be soiled.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

3.3 APPLICATION

- A. Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
- B. Apply paint systems to all exposed to view substrates including repainting of existing substrates required to provide an overall match of painted surfaces. Please note that this includes repainting of the existing wall surfaces within the existing kitchen storage areas and other unassigned rooms which are part of the construction area of this contract..
- C. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates, Nontraffic Surfaces:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149
 - b. Intermediate Coat: Latex, interior, institutional low odor/VOC, matching topcoat.
 - c. Topcoat: Latex, interior, institutional low odor/VOC, flat (Gloss Level 1), MPI #143.
- B. CMU Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Block Filler: Block filler, latex, interior/exterior, MPI #4.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.

- c. Topcoat: Light Industrial Coating, Interior, Single Component Epoxy, Semi-Gloss (Gloss Level 5).
- C. Steel Substrates:
 - 1. Water-Based Light Industrial Coating System:
 - a. Prime Coat: Primer, rust-inhibitive, water based, MPI #107.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light Industrial Coating, Interior, Single Component Epoxy, Eggshell, (Gloss Level 3).
- D. Hollow Metal Doors and Frames
 - 1. Alkyd System:
 - a. Prime Coat: Primer, alkyd, anti-corrosive, for metal, MPI #79.
 - b. Intermediate Coat: Alkyd, interior, matching topcoat.
 - c. Topcoat: Alkyd, interior, Match sheen on adjacent wall.
- E. Galvanized-Metal Substrates:
 - 1. Water-Based Light Industrial Coating Over Waterborne Primer System:
 - a. Prime Coat: Primer, galvanized, water based, MPI #134.
 - b. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - c. Topcoat: Light Industrial Coating, Interior, Single Component Epoxy, Eggshell, (Gloss Level 3).
- F. Clinical Areas Gypsum Board and GFRP Column Cover Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.
 - a. Intermediate Coat: Light industrial coating, interior, water based, matching topcoat.
 - b. Topcoat: Light Industrial Coating, Interior, Single Component Epoxy, Eggshell, (Gloss Level 3).
- G. Public Areas Gypsum Board and GFRP Column Cover Substrates:
 - 1. Institutional Low-Odor/VOC Latex System:
 - a. Prime Coat: Primer sealer, interior, institutional low odor/VOC, MPI #149.

- b. Intermediate Coat: Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2), matching topcoat.
- c. Topcoat: Latex, Interior, Institutional Low Odor/VOC, (Gloss Level 2): MPI #144 with a min EPR of 4.0.

END OF SECTION 099123

SECTION 099300 - STAINING AND TRANSPARENT FINISHING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes surface preparation and application of wood finishes

1. Interior Substrates: WS-1, WS-2
 - a. Dressed lumber (finish carpentry).
 - b. Exposed wood panel products.

1.2 DEFINITIONS

- A. Gloss Level 1: Not more than 5 units at 60 degrees and 10 units at 85 degrees, according to ASTM D 523.
- B. Gloss Level 4: 20 to 35 units at 60 degrees and not less than 35 units at 85 degrees, according to ASTM D 523.
- C. Gloss Level 5: 35 to 70 units at 60 degrees, according to ASTM D 523.
- D. Gloss Level 6: 70 to 85 units at 60 degrees, according to ASTM D 523.
- E. Gloss Level 7: More than 85 units at 60 degrees, according to ASTM D 523.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include preparation requirements and application instructions.
- B. Samples: For each type of finish system and in each color and gloss of finish indicated.
- C. Product List: For each product indicated, include printout of current "MPI Approved Products List" for each product category specified in Part 2, with the product proposed for use highlighted.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials from the same product run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Stains and Transparent Finishes: 5 percent, but not less than 1gal. (3.8L) of each material and color applied.

1.5 QUALITY ASSURANCE

- A. Mockups: Apply mockups of each finish system indicated and each color selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each type of finish system and substrate.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of stain color selections will be based on mockups.
 - a. If preliminary stain color selections are not approved, apply additional mockups of additional stain colors selected by Architect at no added cost to Owner.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide products listed in other Part 2 articles for the category indicated.

2.2 MATERIALS, GENERAL

- A. MPI Standards: Provide products that comply with MPI standards indicated and that are listed in its "MPI Approved Products List."
- B. Material Compatibility:

1. Provide materials for use within each finish system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a finish system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
- C. VOC Content: Products shall comply with VOC limits of authorities having jurisdiction and, for interior stains and finishes applied at project site, the following VOC limits, exclusive of colorants added to a tint base, when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
1. Clear Wood Finishes, Varnishes: VOC not more than 350 g/L.
 2. Stains: VOC not more than 250 g/L.
 3. Primers, Sealers, and Undercoaters: 200 g/L.
- D. Low-Emitting Materials: Interior stains and finishes 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. Stain Colors: Match Architect's samples
- 2.3 WOOD FILLERS
- A. Wood Filler Paste: MPI #91.
- 2.4 PRIMERS AND SEALERS
- A. Alkyd, Sanding Sealer, Clear: MPI #102.
- 2.5 STAINS
- A. Stain, Semi-Transparent, for Interior Wood: MPI #90.
1. To match Architect's sample; seal to separate from topcoat.
- 2.6 POLYURETHANE
1. Topcoat: Two coats AWI System TR-6 catalyzed polyurethane

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
- B. Maximum Moisture Content of Exterior Wood Substrates: 15 percent, when measured with an electronic moisture meter.
- C. Maximum Moisture Content of Interior Wood Substrates: 9 percent, when measured with an electronic moisture meter.
- D. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
- E. Proceed with finish application only after unsatisfactory conditions have been corrected.
 - 1. Beginning finish application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and finishing.
 - 1. After completing finishing operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean and prepare surfaces to be finished according to manufacturer's written instructions for each particular substrate condition and as specified.
 - 1. Remove dust, dirt, oil, and grease by washing with a detergent solution; rinse thoroughly with clean water and allow to dry. Remove grade stamps and pencil marks by sanding lightly. Remove loose wood fibers by brushing.
 - 2. Remove mildew by scrubbing with a commercial wash formulated for mildew removal and as recommended by stain manufacturer.

3.3 APPLICATION

- A. Apply finishes according to manufacturer's written instructions and recommendations in "MPI Manual."
- B. Apply finishes to produce surface films without cloudiness, holidays, lap marks, brush marks, runs, ropiness, or other surface imperfections.

3.4 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from finish application. Correct damage by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- B. At completion of construction activities of other trades, touch up and restore damaged or defaced finished wood surfaces.

END OF SECTION 099300

SECTION 101900 – SHOWER CURTAINS

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. Shower curtains.

1.3 PERFORMANCE REQUIREMENTS

- A. Curtains: Provide curtain fabrics with the following characteristics:

- 1. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

- A. Product Data: Include durability, fade resistance, and fire-test response characteristics for each type of curtain fabric indicated.
 - 1. Include data on each type of applied curtain treatment.
- B. Shop Drawings: Show layout, sizes of curtains, and conditions requiring accessories as per shop drawings included. Indicate dimensions taken from field measurements.
 - 1. Include Details on blocking above ceiling and in walls.
- C. Coordination Drawings: Reflected ceiling plans drawn to scale and coordinating penetrations and ceiling-mounted items. Show the following:
 - 1. Method of attaching track hangers to building structure.

- D. Samples for Initial Selection: For each type of shower curtain fabric indicated.
- E. Samples for Verification: Full-size units of each type of the following products:
 - 1. Curtain Fabric: 12-inch- square swatch or larger Sample as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
- F. Shower Curtain Schedule: Use same room designations as indicated on Drawing where other wise indicated.
- G. Product Certificates: Signed by manufacturers shower curtains and tracks certifying that products furnished comply with requirements.
- H. Maintenance Data: For tracks and curtains to include in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
 - 1. Build mockups of typical shower curtains complete with track, as shown on Drawings.
 - 2. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install shower curtains until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where shower curtains are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Shower Curtains: Full-size units equal to 15 percent of amount installed for each size indicated, but not less than 3 units.

PART 2 - PRODUCTS

2.1 SHOWER CURTAINS

- A. Curtain Fabric: Shower Curtain manufacturer's standard, as follows:

1. Fiber Content: 100% flame retardant polyester modified with nano-molecular anti-bacterial and water repellent technologies.
2. Product: Subject to compliance with requirements, provide one of the following:
 - a. Sure-Chek Linen
 - 1) Color: As selected by Architect from full range of industry colors.
 - 2) Width: 72".
 - 3) Source: In Pro Corporation
 - a) Source Address: S80 W18766 Apollo Drive
Muskego, WI 53150
 - b) Source Phone Number: 800-222-5556
 - c) Source Contact: n/a

2.2 SHOWER CURTAIN FABRICATION

- A. Fabricate curtains to comply with the following requirements:
 1. Width: 6" wider than track.
 2. Length: Equal to floor-to-ceiling height minus depth of track and carrier at top, and minus distance above finished floor at bottom as follows:
 - a. Shower Curtains: 2" (50.8 mm).

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect installed recessed track openings with nonresidue adhesive tape to prevent debris from ceiling finishing operations from impeding carrier operation.

END OF SECTION 10190

SECTION 102113.16 - PLASTIC-LAMINATE-CLAD TOILET COMPARTMENTS

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. Plastic-laminate-clad toilet compartments configured as toilet enclosures and urinal screens.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for blocking.
 - 2. Section 102800 "Toilet, Bath, and Laundry Accessories" for toilet tissue dispensers, grab bars, purse shelves, and similar accessories mounted on toilet compartments.

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 toilet compartments.
- B. Shop Drawings: For toilet compartments.
 - 1. Include plans, elevations, sections, details, and attachment details.
 - 2. Show locations of cutouts for compartment-mounted toilet accessories.
 - 3. Show locations of centerlines of toilet fixtures.
 - 4. Show locations of floor drains.
- C. Samples for Initial Selection: For each type of toilet compartment material indicated.
 - 1. Include Samples of hardware and accessories involving material and color selection.

- D. Samples for Verification: For the following products, in manufacturer's standard sizes unless otherwise indicated:
 - 1. Each type of material, color, and finish required for toilet compartments, prepared on 6-inch-square Samples of same thickness and material indicated for Work.
 - 2. Each type of hardware and accessory.
- E. Product Schedule: For toilet compartments, prepared by or under the supervision of supplier, detailing location and selected colors for toilet compartment material.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of toilet compartment.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For toilet compartments to include in maintenance manuals.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of toilet fixtures, walls, columns, ceilings, and other construction contiguous with toilet compartments by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities and ICC A117.1 for toilet compartments designated as accessible.

2.2 PLASTIC-LAMINATE-CLAD TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Accurate Partitions Corp.; ASI Group.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
 4. General Partitions Mfg. Corp.
- B. Toilet-Enclosure Style: Overhead braced Floor anchored.
- C. Entrance-Screen Style: Overhead braced Floor anchored.
- D. Urinal-Screen Style: Wall hung.
- E. Door, Panel, Screen, and Pilaster Construction: One-piece, plastic-laminate facing sheets pressure laminated to core material without splices or joints in facings or cores; with laminate applied to edges before faces to seal edges and prevent laminate from being pried loose. Seal exposed core material at cutouts to protect core from moisture.
1. Core Material: Particleboard.
 2. Doors and Panels: Finished to not less than 1 inch thick.
 3. Pilasters: Provide construction to comply with one of the following:
 - a. Finished to not less than 1-1/4 inches thick and with internal, nominal 0.134-inch-thick, steel-sheet reinforcement.
 - b. Finished to 1-1/4 inches thick and with manufacturer's standard steel-sheet core laminated to both sides of honeycomb of resin-impregnated kraft paper in lieu of particleboard core.
 - c. Finished to not less than 1 inch thick and with internal, nominal 0.120-inch-thick, steel-sheet reinforcement.
- F. Pilaster Shoes and Sleeves (Caps): Formed from stainless-steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- G. Brackets (Fittings):
1. Stirrup Type: Ear or U-brackets, stainless steel.
- H. Plastic-Laminate Finish: One color and pattern in each room.
1. Color and Pattern: As selected by Architect from plastic laminate used for project millwork.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's standard operating hardware and accessories.
 - 1. Material: Stainless steel.
 - 2. Hinges: Manufacturer's standard paired, self-closing type that can be adjusted to hold doors open at any angle up to 90 degrees, allowing emergency access by lifting door.
 - 3. Latch and Keeper: Manufacturer's standard surface-mounted latch unit designed for emergency access and with combination rubber-faced door strike and keeper. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
 - 4. Coat Hook: Manufacturer's standard combination hook and rubber-tipped bumper, sized to prevent in-swinging door from hitting compartment-mounted accessories.
 - 5. Door Bumper: Manufacturer's standard rubber-tipped bumper at out-swinging doors and entrance-screen doors.
 - 6. Door Pull: Manufacturer's standard unit at out-swinging doors that complies with regulatory requirements for accessibility. Provide units on both sides of doors at compartments designated as accessible.
- B. Overhead Bracing: Manufacturer's standard continuous, extruded-aluminum head rail with antigrip profile and in manufacturer's standard finish.
- C. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless-steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel anchors compatible with related materials.

2.4 MATERIALS

- A. Particleboard: ANSI A208.1, Grade M-2.
- B. Plastic Laminate: NEMA LD 3, general-purpose HGS grade, 0.048-inch nominal thickness.
- C. Stainless-Steel Sheet: ASTM A 666, Type 304, stretcher-leveled standard of flatness.
- D. Stainless-Steel Castings: ASTM A 743/A 743M.

2.5 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Overhead-Braced Units: Provide manufacturer's standard corrosion-resistant supports, leveling mechanism, and anchors at pilasters to suit floor conditions. Provide shoes at pilasters to conceal supports and leveling mechanism.
- C. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- D. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for fastening, support, alignment, operating clearances, and other conditions affecting performance of the Work.
 - 1. Confirm location and adequacy of blocking and supports required for installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.
 - b. Panels and Walls: 1 inch.
 - 2. Stirrup Brackets: Secure panels to walls and to pilasters with no fewer than three brackets attached at midpoint and near top and bottom of panel.

- a. Locate wall brackets so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.
- B. Overhead-Braced Units: Secure pilasters to floor and level, plumb, and tighten. Set pilasters with anchors penetrating not less than 1-3/4 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Secure continuous head rail to each pilaster with no fewer than two fasteners. Hang doors to align tops of doors with tops of panels, and adjust so tops of doors are parallel with overhead brace when doors are in closed position.
- C. Floor-Anchored Units: Set pilasters with anchors penetrating not less than 2 inches into structural floor unless otherwise indicated in manufacturer's written instructions. Level, plumb, and tighten pilasters. Hang doors and adjust so tops of doors are level with tops of pilasters when doors are in closed position.
- D. Urinal Screens: Attach with anchoring devices to suit supporting structure. Set units level and plumb, rigid, and secured to resist lateral impact.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors and doors in entrance screens to return doors to fully closed position.

END OF SECTION 102113.16

SECTION 102123 – CUBICLE TRACK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Curtain tracks and carriers.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show layout of cubicles, number of carriers, anchorage details, and accessories.
- C. Schedule: Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials described below.
 - 1. Curtain Carriers and Track End Caps: Full-size units equal to 3 percent of amount installed, but no fewer than 10 units.

PART 2 - PRODUCTS

2.1 CURTAIN AND SUPPORT-SYSTEM MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or product by the following:
 - 1. InPro Corporation. Optitrac.

2.2 CURTAIN SUPPORT SYSTEMS

- A. Extruded-Aluminum Curtain Track: Not less than 1-3/8 inches wide by 3/4 inch high; with manufacturer's standard wall thickness.
 - 1. Curved Track: Factory-fabricated, 12-inch- radius bends for standard curves.
 - 2. Custom Radius Curves: Long radius custom curves as indicated.
 - 3. Finish: Baked acrylic enamel finish.
- B. Curtain Track Accessories: Fabricate from same material and with same finish as track.
- C. Curtain Carriers: Two nylon rollers and nylon axle, One-piece nylon glide with chrome-plated steel hook.
- D. Exposed Fasteners: Stainless steel.
- E. Concealed Fasteners: Hot-dip galvanized.
- F. Track mounted below GWB: Use manufacturers standard support and anchor system.
- G. Track mounted below 9/16" grid: Use clips to space track far enough below the grid to prevent interference with tegular edge ceiling tiles.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install tracks level and plumb, according to manufacturer's written instructions.
- B. Up to 20 feet in length, provide track fabricated from single continuous length.
 - 1. Curtain Track Mounting: Surface.
 - 2. IV Track Mounting: Surface.
- C. Surface-Track Mounting: Fasten tracks to ceilings at intervals recommended by manufacturer. Fasten tracks to structure at each splice and tangent point of each corner. Center fasteners in track to ensure unencumbered carrier operation.
- D. Track Accessories: Install splices, end caps, connectors, end stops, coupling and joining sleeves, and other accessories as required for a secure and operational installation.

- E. Curtain Carriers: Provide curtain carriers adequate for 6-inch spacing along full length of curtain plus an additional carrier.

END OF SECTION 102123

SECTION 102124 – CUBICLE CURTAINS

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. Cubicle curtains

1.3 PERFORMANCE REQUIREMENTS

- A. Curtains: Provide curtain fabrics with the following characteristics:
 - 1. Fabrics are launderable to a temperature of not less than 160 deg F.
 - 2. Fabrics are flame resistant and are identical to those that have passed NFPA 701 when tested by a testing and inspecting agency acceptable to authorities having jurisdiction.
 - a. Identify fabrics with appropriate markings of applicable testing and inspecting agency.

1.4 SUBMITTALS

- A. Product Data: Include durability, fade resistance, and fire-test-response characteristics for each type of curtain fabric indicated.
 - 1. Include data on each type of applied curtain treatment.
- B. Shop Drawings: Show layout of typical cubicle panel sizes, number of carriers, anchorage details, splices, and conditions requiring accessories (tiebacks and wands). Indicate dimensions taken from field measurements.
- C. Samples for Initial Selection: For each type of curtain fabric indicated.
- D. Samples for Verification: Full-size units of each type of the following products:

1. Curtain Fabric: 12-inch- square swatch or larger Sample as required to show complete pattern repeat, from dye lot used for the Work, with specified treatments applied. Mark top and face of material.
 2. Mesh Top: Not less than 4 inches square.
 3. Curtain Track: Not less than 4 inches long.
 4. Curtain Carrier: Full-size unit.
 5. Curtain Holdbacks: Full-size unit.
- E. Product Certificates: Signed by manufacturers of curtains certifying that products furnished comply with requirements.
- F. Maintenance Data: For curtains to be included in maintenance manuals specified in Division 1.

1.5 QUALITY ASSURANCE

- A. Mockups: Build mockup to verify selections made under Sample submittals and to demonstrate aesthetic effects and qualities of materials and execution.
1. Build mockup of typical cubicle as shown on Drawings. See Division 1 specification for additional mock up information.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install cubicles until spaces are enclosed and weatherproof, wet work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where cubicles are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

- A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Curtains: (3) Three units per typical configuration and module width.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Maharam Curtain Fabric
2. InPro Corporation – Optitrac

2.2 CURTAINS:

- A. Curtain Fabric: CC – 1, as follows:

1. Fiber Content: 50 percent Trevira CS Bioactive polyester, 50 percent polyester, inherently and permanently flame resistant.
2. Products: Provide the following:
 - a. Manufacturer's Name: Maharam
 - b. Pattern: Increment 511443
 - c. Color: 005 Delight
 - d. Fiber Content: 50% Trevira CS Bioactive polyester, 50% polyester
 - e. Width: 72"
 - f. Fabric Application: Privacy Curtain
 - g. Flammability: NFPA 701
3. Source:
 - a. Source Address: 916 Joseph E. Lowery Blvd NW
Atlanta, Georgia 30318
 - b. Source Phone No: (803) 920-8911/cell
 - c. Source Email: wtuten@maharam.com
 - c. Source Contact: Will Tuten

- B. Mesh Top: No. 50 nylon mesh with 1/2" openings and 20" in height. Color: Snow

- C. Curtain Grommets: Two-piece, rolled-edge, rustproof, nickel-plated brass; spaced not more than 6 inches o.c.; machined into top hem. Locate 1/4" in from edge of twill tape.

1. Curtain holdbacks: Tiebacks to be made of fabric to match cubicle curtain or Lexan holdbacks as decided in mock-up to be installed by vendor.
 - a. Fabricated from C.O.M.; one at each curtain termination. Tiebacks to include two piece, rolled edge, rustproof, nickel plated brass grommets.

Locate 1/2" in from end edge. Dimensions to be 2" wide. Length to be determined. All tiebacks to be wall mounted at 2'-9" A.F.F. per Architect.

CURTAIN FABRICATION

Refer to drawings for curtain height.

2.3

A. Fabricate cubicle curtains to comply with the following requirements and project standards:

1. Panel Widths: Finished panel widths shall be and 10' – 0", 13' – 0", and 15' – 0".

2. Panel Heights:

a. 'L' = Panels at 8' – 0" finished panel height.

b. 'S' = 6' – 8" finished panel height

*All 8'-0" finished panel heights to be used for ceiling heights of 9'-0" and above, and to have 'L' suffix. All 6'-8" finished panel heights to be used for ceiling heights up to 8'-11", and to have 'S' suffix.

3. Top Hem: Not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web, and double lock stitched.

4. Mesh Top: Top hem not less than 1 inch and not more than 1-1/2 inches wide, triple thickness, reinforced with integral web (at top and bottom hem) and double lock stitched. Surge and double lock stitch bottom of mesh directly to 1/2-inch triple thickness, top hem of curtain fabric. Finished mesh shall measure 20 inches (on "L" cubicles)

5. Bottom Hem: Not less than 1 inch and not more than 1-1/2 inches wide, double thickness and single lock stitched.

a. Tags shall be sewn in at the bottom hem and shall give suffix "L" (meaning "long" for lengths of 8' – 0"). Panel width to precede 'L' – Ex: 15L shall refer to a cubicle panel measuring 15'-0" finished width.

b. Tags to be nylon with "Block Style" embroidered numbers and letters. Tags shall indicate "MRMC Seacoast" and size. Submit samples to Architect for approval.

Note: All room locations tags shall be located in the bottom hem at right stack back side. Hang cubicle so the finished face side is toward the Corridor and the hem side faces into the Patient Room.

6. Side Hems: Not less than 1/2 inch and not more than 1-1/4 inches wide, with double turned edges, and single lock stitched.
7. Vertical Seams: Not less than 1/2 inch wide, double turned and double stitched.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding
- C. Complete all finishing operations, before installation.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions and Architect's drawings.
- B. Curtains: Install curtains on carriers. Secure to wall (s) with curtain tieback. Test for smooth operation of curtains

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.
- C. Remove debris, and clean surfaces per manufacturer's instructions, upon completion.

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain safety loading units.
 - 1. Train Owner's maintenance personnel on procedures and schedules for changing curtains and maintaining cubicles.
 - 2. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 10190

SECTION 102600 - WALL AND DOOR PROTECTION

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. Interior Painting Section 099123 for back painting of clear corner guards.

1.2 SUMMARY

- A. Section Includes:
 - 1. Wall guards.
 - 2. Impact-resistant handrails, crash rails, and bumper rails
 - 3. Corner guards.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Provide handrails capable of withstanding the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform load of 50 lb/ft. applied in any direction.
 - 2. Concentrated load of 200 lb/f applied in any direction.
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.

1.4 ACTION SUBMITTALS

- A. Product Data: Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.
- B. Shop Drawings: For each impact-resistant wall protection unit showing locations and extent. Include sections, details, and attachments to other work.

1. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Wall and Corner Guards: 12 inches long. Include examples of joinery, corners, end caps, top caps, and field splices.
 2. Handrails: 12 inches long. Include examples of joinery, corners, and field splices.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Material Certificates: For each impact-resistant plastic material, from manufacturer.
- C. Material Test Reports: For each impact-resistant plastic material.
- D. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For each impact-resistant wall protection unit to include in maintenance manuals.
 1. Include recommended methods and frequency of maintenance for maintaining optimum condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to plastic finishes and performance.

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. Wall-Guard and Handrail Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 8-foot- long units.
 2. Corner-Guard Covers: Full-size plastic covers of maximum length equal to 2 percent of each type, color, and texture of units installed, but no fewer than two, 4-foot- long units.

- B. Include mounting and accessory components. Replacement materials shall be from same production run as installed units.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated. Refer to Section 014000 "Quality Requirements."
- D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.
- E. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.
- F. Preinstallation Conference: Conduct conference at Project site.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
 - 1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 2. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
 - a. Store corner-guard covers in a vertical position.
 - b. Store wall-guard and handrail covers in a horizontal position.

1.10 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install impact-resistant wall protection units until building is enclosed and weatherproof, wet work is complete and dry, and

HVAC system is operating and maintaining temperature at 70 deg F for not less than 72 hours before beginning installation and for the remainder of the construction period.

1.11 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Deterioration of plastic and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

MATERIALS

2.1 Wall Protection

- A. PVC Plastic: ASTM D 1784, Class 1, textured, chemical- and stain-resistant, high-impact-resistant PVC or acrylic-modified vinyl plastic with integral color throughout; extruded and sheet material, thickness as indicated.
 - 1. Impact Resistance: Minimum 25.4 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
 - 2. Chemical and Stain Resistance: Tested according to ASTM D 543.
 - 3. Self-extinguishing when tested according to ASTM D 635.
 - 4. Flame-Spread Index: 25 or less.
 - 5. Smoke-Developed Index: 450 or less.
- B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft-lbf/in. of notch when tested according to ASTM D 256, Test Method A.
- C. Aluminum Extrusions: Alloy and temper recommended by manufacturer for type of use and finish indicated, but with not less than strength and durability properties specified in ASTM B 221 for Alloy 6063-T5.
- D. Solid Wood: Clear hardwood lumber of species indicated, free of appearance defects, and selected for compatible grain and color.

- E. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.
- F. Adhesive: As recommended by impact-resistant plastic wall protection manufacturer and with a VOC content of 70 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.2 WALL PROTECTION SHEET

- A. Wall Protection Sheet shall be 0.075" Acrovyn 4000, Trimless Installation, or approved equal.

2.3 WALL GUARDS

- A. Crash Rail CR-1 (Mounted High) and BR-1(Mounted Low): Heavy-duty assembly consisting of continuous snap-on plastic cover installed over concealed retainer system; designed to withstand impacts.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 2. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties CS Acrovyn SCR-48M or comparable product by one of the following:
 - a. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - b. Pawling Corporation.
 - 3. Cover: Extruded rigid plastic, minimum 0.100-inch wall thickness; in dimensions and profiles indicated on Drawings.
 - a. Profile: Flat.
 - 1) Surface: Uniform.
 - 2) Profile: 6" high by 1" deep rectangular profile.
 - b. Color and Texture: See Architects Color Schedule.
 - 4. Continuous Retainer: Minimum 0.080-inch- thick, one-piece, extruded aluminum.
 - 5. End Caps and Corners: Prefabricated, injection-molded plastic; matching color cover; field adjustable for close alignment with snap-on cover.
 - 6. Accessories: Concealed splices and mounting hardware.
 - 7. Mounting: Surface mounted directly to wall.

2.4 HANDRAILS (HR-1)

- A. Combination Wood-Plastic Bumper Handrail: Assembly consisting of solid-wood handrail mounted above plastic bumper rail, both mounted on common wall bracket with space between wood handrail and plastic bumper.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide Construction Specialties CS Acrovyn P-RWAN or comparable product by one of the following:
 - a. IPC Door and Wall Protection Systems; Division of InPro Corporation.
 - b. Pawling Corporation.
 3. Wood Handrail: 1-1/2 inches in diameter; with matching end caps and corners.
 - a. Wood Species: Maple.
 - b. Finish: Stained Custom.
 - c. Color: See Architects Color Schedule.
 4. Bumper: Extruded rigid plastic, minimum 0.100-inch- wall thickness; as follows:
 - a. Profile: Flat profile, nominal 4 inches high by 1 inch deep.
 - b. Color and Texture: Smooth Texture with Color As shown on architects color schedule .
 - c. End Caps and Corners: Prefabricated, injection-molded plastic; color matching bumper; field adjustable for close alignment with snap-on bumper.
 5. Retainer: Minimum 0.0625-inch- thick, one-piece, extruded aluminum.
 6. Accessories: Concealed splices, cushion(s), and mounting hardware.

2.5 CORNER GUARDS

- A. Surface-Mounted, Transparent-Plastic Corner Guards CG-A: Fabricated from clear polycarbonate plastic sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 2. Basis-of-Design Product: Subject to compliance with requirements, provide Tri Guard or comparable product by one of the following:
 - a. Construction Specialties, Inc.
 - b. IPC Door and Wall Protection Systems; Division of InPro Corporation.

c. Pawling Corporation.

3. Wing Size: Nominal 2-1/2 by 2-1/2 inches.
4. Thickness: Minimum 0.102 inch.
5. Angle: Provide 90 degree units or custom bent units to match obtuse angle wall conditions.
6. Mounting: No predrilled holes. Mount with 5/32"x 1/32" thick double sided foam tape. All corner guards extend from top of base to ceiling surface above in one piece.
7. Corner Guards shall be back painted in the field to match wall color or colors.

2.6 FABRICATION

- A. Fabricate impact-resistant wall protection units to comply with requirements indicated for design, dimensions, and member sizes, including thicknesses of components.
- B. Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.
- C. Fabricate components with tight seams and joints with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.
- D. Provide 1 piece prefabricated corners and ends of wood handrails for returns.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
- B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
 1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
 - 1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.
 - 2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.
 - a. Provide anchoring devices to withstand imposed loads.
 - b. Where splices occur in horizontal runs of more than 20 feet, splice aluminum retainers and plastic covers at different locations along the run, but no closer than 12 inches.
 - c. Adjust end caps as required to ensure tight seams.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.
- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 102600

SECTION 102800 - TOILET, BATH, AND LAUNDRY 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. Public-use washroom accessories.
 - 2. Public-use shower room accessories.
 - 3. Custodial accessories.
 - 4. Personal Protection Equipment Hooks
- B. Furnish and Install Responsibility:
 - 1. Items noted as OFOI on schedule shall be furnished by the Owner and installed by the Owner. The Contractor shall coordinate related construction, such as power and data placement.
 - 2. Items noted as OFCI on schedule shall be furnished by the Owner and installed by the Contractor.
 - 3. Items notes as CFCI on the schedule shall be furnished and installed by the Contractor.
- C. Related Sections:
 - 1. Section 101900 Shower Curtains
 - 2. Section 102123 Cubicle Track
 - 3. Section 102124 Cubicle Curtains.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include the following:
 - 1. Construction details and dimensions.
 - 2. Anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.

3. Material and finish descriptions.
4. Features that will be included for Project.
5. Manufacturer's warranty.

B. Samples: Full size, for each accessory item to verify design, operation, and finish requirements. Deliver to contractor for field review and approval.

1. Approved full-size Samples will be returned and may be used in the Work.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For toilet and bath accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Source Limitations: For products listed together in the same Part 2 articles, obtain products from single source from single manufacturer.

1.7 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.

1.8 WARRANTY

A. Special Mirror Warranty: Manufacturer's standard form in which manufacturer agrees to replace mirrors that develop visible silver spoilage defects and that fail in materials or workmanship within specified warranty period.

1. Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.
- B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.
- C. Fasteners: Screws, bolts, and other devices of same material as accessory unit and tamper-and-theft resistant where exposed, and of galvanized steel where concealed.
- D. Chrome Plating: ASTM B 456, Service Condition Number SC 2 (moderate service).
- E. Mirrors: ASTM C 1503, Mirror Glazing Quality, clear-glass mirrors, nominal 6.0 mm thick.
- F. ABS Plastic: Acrylonitrile-butadiene-styrene resin formulation.

2.2 TOILET ROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following. Products indicated as OFCI are provided by Owner for Contractor Installation
 - 1. American Specialties, Inc.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Bradley Corporation.
- C. Toilet Tissue Dispenser TA-08: (OFCI)
 - 1. Basis-of-Design Product: Georgia Pacific 56797 Compact Translucent White Side-By-Side Double Roll Bathroom Tissue Dispenser.
 - 2. Description: Two-roll unit.
 - 3. Mounting: Surface mounted.
- D. Paper Towel Dispenser TA-09: (OFCI)
 - 1. Basis-of-Design Product: Georgia Pacific 59407 enMotion Translucent White Wall Mount Automated Touchless Towel Dispenser.
 - 2. Mounting: In cabinet or on wall, refer to plans.

- E. Waste Receptacle TA-11: (OFOI)
 - 1. Basis-of-Design Product: Rubbermaid #2806.
 - 2. Mounting: Freestanding.
- F. Liquid Soap and Alcohol Based Hand Cleaner Dispensers TA-07 (OFCI):
 - 1. Basis-of-Design Product: Steris.
 - 2. Description: Designed for dispensing soap in liquid or lotion form.
 - 3. Mounting: Vertically oriented, surface mounted.
- G. Grab Bar TA-01 thru TA-03 (CFCI)
 - 1. Basis-of-Design Product: American Specialties 3800-W Series
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Steel, 0.05 inch thick.
 - a. Finish: White powder coat
 - 4. Outside Diameter: 1-1/2 inches.
 - 5. Configuration and Length: As indicated on Drawings.
- H. Shower Seat TA-17: (CFCI)
 - 1. Basis of Design Product: ASI Model 8203-28
 - 2. Mounting: Surface
 - 3. Material and Finish: White phenolic seat; powder coat factory stainless steel members white.
- I. Sanitary-Napkin Disposal Unit TA-05: (CFCI)
 - 1. Basis-of-Design Product: ASI Model 0473-A.
 - 2. Mounting: Surface mounted.
 - 3. Door or Cover: Self-closing, disposal-opening cover.
 - 4. Receptacle: Removable.
 - 5. Material and Finish: White epoxy powder coat.
- J. Mirror Unit TA-14 with TA-15 Mirror Fasteners: (CFCI)
 - 1. Basis-of-Design Product: ASI Model 8287 (comply with ADA)
 - 2. Frameless: New mirrors.
 - 3. Fasteners: Panel Mount Clips –Gyford SO-APC-100
 - 4. Size: As indicated on Drawings.
- K. Robe Hook TA-10: (CFCI)
 - 1. Basis-of-Design Product: ASI Model 7340W.

2. Description: Single-prong unit.
3. Material and Finish: Steel with white epoxy powder coat.

2.3 SHOWER ROOM ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
- B. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
- C. Shower Curtain Rod: (CFCI)
 1. Basis-of-Design Product: See Specification Section 102123.
 2. Shower Curtain: See Specification Section 101900.
- D. Lavatory Shelf TA-16: (CFCI)
 1. American Specialties 20692, contractor to powder coat white.
- E. Hotel Shelf TA-25: (CFCI)
 1. Basis-of-Design Product: allen+roth Brushed Nickel Zinc Bathroom Shelf – Lowe's Model # 13449;
Brushed nickel finish when purchased; to be powder coated white by contractor.

2.4 CUSTODIAL ACCESSORIES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following Basis-of-Design Products: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 1. American Specialties, Inc.
 2. Bobrick Washroom Equipment, Inc.
 3. Bradley Corporation.
- B. Mop and Broom Holder TA-13: (CFCI)
 1. Basis-of-Design Product: Bobrick Model B-239.
 2. Description: Unit with shelf, hooks and holders.
 3. Length: 34".

4. Hooks: Four.
5. Mop/Broom Holders: Four, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
 - a. Shelf: Not less than nominal 0.05-inch- thick stainless steel.

2.5 FABRICATION

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Plastic anchors into un backed gypsum board are not acceptable. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Grab Bars: Install to withstand a downward load of at least 250 lbf, when tested according to ASTM F 446.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.

END OF SECTION 102800

SECTION 104413 - FIRE EXTINGUISHER CABINETS

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. Fire protection cabinets for the following:
 - a. Portable fire extinguishers.
 - b. Fire hose and valves with fire extinguisher.
- 2. Fire Extinguisher Brackets
- 3. Fire Extinguishers shall be provided by the Owner.

- B. Related Sections:

- 1. Section 211313 Wet-Pipe Fire-Suppression Sprinklers for hose valves.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for fire protection cabinets.
 - 1. Fire Protection 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.
 - 2. Show location of knockouts for hose valves.
- B. Shop Drawings: For fire protection cabinets. Include plans, elevations, sections, details, and attachments to other work.
- C. Samples for Initial Selection: For each type of fire protection cabinet indicated.

- D. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Size: 6 by 6 inches square.

1.4 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For fire protection cabinets to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Fire-Rated, Fire Protection Cabinets: Listed and labeled to comply with requirements in ASTM E 814 for fire-resistance rating of walls where they are installed.
- B. Preinstallation Conference: Conduct conference at Project site.
1. Review methods and procedures related to fire protection cabinets including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.6 COORDINATION

- A. Coordinate size of fire protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated. All cabinets shall be sized to contain a 2-1/2 gallon water type extinguisher
- B. Coordinate size of fire protection cabinets to ensure that type and capacity of fire hoses valves indicated are accommodated.
- C. Coordinate sizes and locations of fire protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.
- B. Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Quality q3, 3 mm thick, Class 1 (clear).

2.2 FIRE PROTECTION CABINET – RECESSED TRIMLESS (FEC-R on Drawings)

- A. Cabinet Type: Suitable for fire extinguisher. Accepts 10# multipurpose dry chemical or 2-1/2 gallon pressurized water extinguishers.
- B. Basis of Design: Larsen's –Architectural Series 2712-RT. Alternate equal products of the following manufacturers shall be considered.
 - a. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - b. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 - c. Potter Roemer LLC.
- C. Cabinet Construction: Nonrated and Fire Rated.
 - 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.
- D. Cabinet Material: Steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- E. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated. Provide appropriate trim for both gypsum board installation and for architectural wood paneling installation.
 - 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Solid Steel Door with Narrow Lite
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide concealed hinge permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.

2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. No Lettering is preferred. Verify requirement with Authorities having Jurisdiction.

K. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
2. Steel: Baked enamel or powder coat. White as selected by architect

2.3 FIRE PROTECTION CABINET – SEMI-RECESSED (FEC-S on Drawings)

- A. Cabinet Type: Suitable for fire extinguisher in walls that are not fire rated and not in a corridor. 4-1/2" trim depth is prohibited in corridors by the Americans with Disabilities Act. Accepts 10# multipurpose dry chemical or 2-1/2 gallon pressurized water extinguishers.
- B. Basis of Design: Larsen's –Architectural Series Model 2712-RM. Alternate equal products of the following manufacturers shall be considered.
 1. J. L. Industries, Inc., a division of Activar Construction Products Group.
 2. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 3. Potter Roemer LLC.
- C. Cabinet Construction: Nonrated and Fire Rated.
 1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.
- D. Cabinet Material: Steel sheet.
 1. Shelf: Same metal and finish as cabinet.
- E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
 1. Rolled-Edge Trim: 4-1/2-inch backbend depth.

- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Vertical framed steel panel with narrow lite
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- J. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. No Lettering is preferred. Verify requirement with Authorities having Jurisdiction.
- K. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
 - 2. Steel: Baked enamel or powder coat.

2.4 FIRE PROTECTION CABINET – SEMI-RECESSED FIRE RATED
(FEC-F on Drawings)

- A. Cabinet Type: Suitable for fire extinguisher. Accepts 10# multipurpose dry chemical extinguishers. Do not use where 2-1/2 gallon pressurized water extinguishers are required.
- B. Basis of Design: Larsen's –Architectural Series Model FS-2409-R4. Alternate equal products of the following manufacturers shall be considered.
 - 1. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - 2. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 - 3. Potter Roemer LLC.
- C. Cabinet Construction: Fire Rated.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.0428-inch- thick, cold-rolled steel sheet lined with minimum 5/8-inch-thick, fire-barrier material. Provide factory-drilled mounting holes.
- D. Cabinet Material: Steel sheet.
1. Shelf: Same metal and finish as cabinet.
- E. Semirecessed Cabinet: Cabinet box partially recessed in walls of sufficient depth to suit style of trim indicated; with one-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend). Provide where walls are of insufficient depth for recessed cabinets but are of sufficient depth to accommodate semirecessed cabinet installation.
1. Rolled-Edge Trim: 4-1/2-inch backbend depth.
- F. Cabinet Trim Material: Steel sheet.
- G. Door Material: Steel sheet.
- H. Door Style: Vertical framed steel panel with narrow lite
- I. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
1. Provide projecting door pull and friction latch.
 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- J. Accessories:
1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. No Lettering is preferred. Verify requirement with Authorities having Jurisdiction.
- K. Finishes:
1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
 2. Steel: Baked enamel or powder coat.

2.5 FIRE PROTECTION CABINET – SURFACE MOUNTED (FEC-SM on Drawings)

- A. Cabinet Type: Suitable for fire extinguisher.
- B. Basis of Design: Larsen's –Architectural Series Model 2712-SM. Alternate equal products of the following manufacturers shall be considered.
 - 1. J. L. Industries, Inc., a division of Activar Construction Products Group.
 - 2. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 - 3. Potter Roemer LLC.
- C. Cabinet Material: Steel sheet.
 - 1. Shelf: Same metal and finish as cabinet.
- D. Surface Mounted Cabinet: Cabinet box surface mounted on wall. Provide where walls are fire rated.
- E. Cabinet Trim Material: Steel sheet.
- F. Door Material: Steel sheet.
- G. Door Style: Solid Steel Door with Narrow Lite
- H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 - 1. Provide projecting door pull and friction latch.
 - 2. Provide manufacturer's standard hinge permitting door to open 180 degrees.
- I. Accessories:
 - 1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
 - 2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. No Lettering is preferred. Verify requirement with Authorities having Jurisdiction.
- J. Finishes:
 - 1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.

2. Steel: Baked enamel or powder coat.
- 2.6 FIRE HOSE AND VALVE CABINET – TRIMLESS RECESSED (With Fire Extinguisher)
(FHVC on Drawings)
- A. Cabinet Type: Suitable for fire hose and bracket, fire department hose valve and fire extinguisher. (10# Chemical provided by owner)
 - B. Basis of Design: Larsen's –Model HCS 3238-RT Alternate equal products of the following manufacturers shall be considered.
 1. J. L. Industries, Inc., a division of Activar Construction Products Group.
 2. Kidde Residential and Commercial Division, Subsidiary of Kidde plc.
 3. Potter Roemer LLC.
 - C. Cabinet Material: Steel sheet
 - D. Recessed Cabinet: Cabinet box recessed in walls of sufficient depth to suit style of trim indicated. Provide appropriate trim for both gypsum board installation and for architectural wood paneling installation.
 1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box to act as drywall bead.
 - E. Cabinet Trim Material: Steel sheet.
 - F. Door Material: Steel sheet.
 - G. Door Style: Solid Sheet with Narrow Lite acrylic glazing
 - H. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
 1. Provide projecting door pull and friction latch.
 2. Provide concealed hinge permitting door to open 180 degrees.
 - I. Accessories:
 1. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. No Lettering is preferred. Verify requirement with Authorities having Jurisdiction.
 2. 100' of fire hose with nozzle and hose bracket.
 3. 2-1/2" Fire Department Hose Valve with cap and chain
 - J. Finishes:

1. Manufacturer's standard baked-enamel paint for the following:
 - a. Exterior of cabinet, door, and trim except for those surfaces indicated to receive another finish.
 - b. Interior of cabinet and door.
2. Steel: Baked enamel or powder coat.

2.7 FIRE EXTINGUISHER BRACKET (FE-B on Drawings)

- A. Manufacturers standard wall mounted fire extinguisher bracket for 10# multipurpose dry chemical type fire extinguisher.

2.8 FABRICATION

- A. Fire Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
 1. Weld joints and grind smooth.
 2. Provide factory-drilled mounting holes.
- B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
 1. Fabricate door frames with tubular stiles and rails and hollow-metal design, minimum 1/2 inch thick.
 2. Miter and weld perimeter door frames.
- C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.9 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.
- C. Finish fire protection cabinets after assembly.
- D. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.10 STEEL FINISHES

- A. Surface Preparation: Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling" Insert surface preparation method.
- B. Factory Prime Finish: Apply manufacturer's standard, fast-curing, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.
- C. Baked-Enamel or Powder-Coat Finish: Immediately after cleaning and pretreating, apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat. Comply with coating manufacturer's written instructions for applying and baking to achieve a minimum dry film thickness of 2 mils.
 - 1. Color and Gloss: Satin White as selected by architect from manufacturers standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for hose valves and cabinets to verify actual locations of piping connections before cabinet installation.
- B. Examine walls and partitions for suitable framing depth and blocking where recessed and semirecessed cabinets will be installed.
- C. Examine walls and partitions for suitable fire rated construction to accept fire rated cabinets in fire rated walls.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare recesses for recessed and semi recessed fire protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION

- A. General: Install fire protection cabinets in locations and at mounting heights indicated
- B. Fire Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire protection cabinets. If wall thickness is not adequate for recessed cabinets, provide semirecessed fire protection cabinets.
2. Fasten mounting brackets to inside surface of fire protection cabinets, square and plumb.
3. Hose-Valve Cabinets:
 - a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
- C. Fire Extinguisher Brackets: Connect Fire Extinguisher Brackets to concealed metal wall reinforcing.
- D. Identification: Apply vinyl lettering at locations indicated as required by the authorities having jurisdiction.

3.4 ADJUSTING AND CLEANING

- A. Remove temporary protective coverings and strippable films, if any, as fire protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.
- B. Adjust fire protection cabinet doors to operate easily without binding.
- C. On completion of fire protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.
- D. Touch up marred finishes, or replace fire protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire protection cabinet and mounting bracket manufacturers.
- E. Replace fire protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 104413

SECTION 105113 - METAL LOCKERS

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. Knock-down metal lockers.

1.3 PREINSTALLATION MEETINGS

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

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of metal locker.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker.
- B. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
- C. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
- D. Product Schedule: For lockers.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.

1.8 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

1.9 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for Knocked-Down Metal Lockers: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 KNOCKED-DOWN CORRIDOR LOCKERS

- A. Products: Subject to compliance with requirements, provide lockers from one of the following one of the following:
1. Lyon Workspace Products, LLC.
 2. Olympus Lockers & Storage Products, Inc.
 3. Penco Products, Inc.
 4. Republic Storage Systems Company.
- B. Basis-of-Design Product: Subject to compliance with requirements, provide Republic Storage Products "Quiet" lockers, configuration as indicated.
- C. Doors: One piece; fabricated from 16 gauge steel sheet; formed into channel shape with double bend at vertical edges and with right-angle single bend at horizontal edges.
1. Reinforcement: Manufacturer's standard reinforcing angles, channels, or stiffeners for doors more than 15 inches wide; welded to inner face of doors.
 2. Stiffeners: Manufacturer's standard full-height stiffener fabricated from 16 gauge steel sheet; welded to inner face of doors.
 3. Sound-Dampening Panels: Manufacturer's standard, designed to stiffen doors and reduce sound levels when doors are closed, of die-formed metal with full perimeter flange and sound-dampening material; welded to inner face of doors.
 4. Door Style: Unperforated panel.
- D. Body: Assembled by riveting or bolting body components together. Fabricate from unperforated steel sheet with thicknesses as follows:
1. Tops, Bottoms, and Intermediate Dividers: 0.024-inch nominal thickness, with single bend at sides.
 2. Backs and Sides: 0.024-inch nominal thickness, with full-height, double-flanged connections.
- E. Frames: Channel formed; fabricated from 0.060-inch nominal-thickness steel sheet; lapped and factory welded at corners; with top and bottom main frames factory welded into vertical main frames. Form continuous, integral, full-height door strikes on vertical main frames.
1. Cross Frames between Tiers: Channel formed and fabricated from same material as main frames; welded to vertical main frames.
- F. Hinges: Welded to door and attached to door frame with no fewer than two factory-installed rivets per hinge that are completely concealed and tamper resistant when door is closed; fabricated to swing 180 degrees.

1. Hinges: Manufacturer's standard, steel, continuous or knuckle type.
- G. Door Handle and Latch for Box Lockers: Stainless-steel strike plate with integral pull; with steel padlock loop that projects through metal locker door.
- H. Locks: Provided by Owner.
- I. Identification Plates: Manufacturer's standard, etched, embossed, or stamped plates, with numbers and letters at least 3/8 inch high.
- J. Continuous Flush Metal Base: Fabricated from manufacturer's standard thickness, but not less than 0.060-inch nominal-thickness steel sheet.
 1. Height: 4".
 2. Flush with locker face, to accept wall base.
- K. Recess Trim: Fabricated from 0.048-inch nominal-thickness steel sheet.
- L. Materials:
 1. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B, suitable for exposed applications.
- M. Finish: Baked enamel or powder coat.
 1. Color: See Architects Color Schedule.

2.2 FABRICATION

- A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.
 1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
 2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.
- B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments. Factory weld frame members of each metal locker together to form a rigid, one-piece assembly.
- C. Knocked-Down Construction: Fabricate metal lockers using nuts, bolts, screws, or rivets for preassembly into sections at plant prior to shipping.

- D. Continuous Base: Formed into channel profile for stiffness, and fabricated in lengths as long as practical to enclose base and base ends of metal lockers; finished to match lockers.
- E. Recess Trim: Fabricated with minimum 2-1/2-inch face width and in lengths as long as practical; finished to match lockers. Trim shall fill gaps between lockers and adjacent GWB construction.

2.3 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine walls, floors, and support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
 - 2. Anchor single rows of metal lockers to walls near top of lockers and to floor.
- B. Knocked-Down Lockers: Assemble with standard fasteners, with no exposed fasteners on door faces or face frames.

- C. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

- 1. Attach recess trim to recessed metal lockers with concealed clips.

3.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding.

3.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 117000 – MEDICAL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes medical equipment and other support equipment as follows:
 - 1. Contractor responsibilities for the installation of owner furnished equipment.
 - 2. Contractor responsibilities for contractor furnished equipment
 - 3. Contractors Final Connections

1.2 QUALITY ASSURANCE

- A. Dimensions, voltages, electrical power requirements, and utility connections are based on the items specified. Contractor is responsible for costs for dimensional adjustments and for providing or arranging for additional electrical or utility services or equipment required as a result of using approved substitute products.
- B. Equipment may be inspected by Owner at manufacturer's plant prior to shipment. Equipment found not in accordance with specifications and approval Drawings may be rejected. Replace rejected equipment at no cost to Owner.
- C. Electric operated and/or heated equipment: Comply with latest standards of National Electrical Manufacturer's Association (NEMA). National Electric Code (NEC) and Underwriters' Laboratories (UL).
- D. Installer qualifications: Manufacturer, or approved in writing.

1.3 SUBMITTALS

- A. Contract closeout information not required for Owner furnished equipment
- B. Contractor furnished equipment:
 - 1. Shop Drawings. To include layout, finishes, electrical/mechanical/structural requirements, dimensions, and component locations.
 - 2. Product data: Manufacturer's installation instruction to include component model numbers.
 - 3. Samples: Not required for Architect review.
 - 4. Contract closeout information:
 - a. Operating and maintenance data.
 - b. Owner instruction report.

c. Warranty.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. CFCI (Contractor furnished, Contractor installed equipment):

1. Contractor store equipment to prevent damage to materials or structure in dry, weather tight, ventilated, and climate control spaces.
2. Deliver to site in manufacturer's original labeled containers. Protect exposed surfaces and edges until work is completed.
3. Repair or remove and replace damaged or rejected work.

B. OFCI (Owner furnished (new equipment), Contractor installed):

1. Owner to receive and store new equipment.
2. Owner to deliver such equipment from Owner's storage location, deliver to site.
3. Contractor is to install. Contractor is to protect exposed surfaces and edges until work is completed.
4. Contractor to provide fasteners, supports, or other miscellaneous items necessary for complete installation, not provided by equipment manufacturer.
5. Owner to provide Contractor with rough-in and installation Drawings of purchased equipment. Please note, the Owner has the right at time of purchase to change the manufacturer and models from what is shown in sections 117300S and 117300S Contractor Supplement.

C. OFOI (Owner furnished, Owner installed):

1. Owner to receive and store new equipment.
2. Owner to deliver such equipment from Owner's storage location, deliver to site.
3. Owner is to install. Contractor is to coordinate final connections and structural support points for equipment requiring final connections by the Owner
4. Owner to provide fasteners, supports, or other miscellaneous items necessary for complete installation, not provided by equipment manufacturer.
5. Owner to provide Contractor with rough-in and installation Drawings of purchased equipment requiring coordination with construction.

D. OFVI (Owner furnished (new equipment), Vendor installed):

1. Vendor to receive and store new equipment.
2. Vendor to deliver such equipment from storage location and deliver to site.
3. Vendor is to install. Contractor is to protect exposed surfaces and edges until work is completed.
4. Contractor to provide management and coordination services described in Section 011000 Summary of Work
5. Vendor to provide Contractor with rough-in and installation Drawings of purchased equipment.
6. Vendor to Provide Owner and Contractor Signed and Sealed Drawings.

- E. Delivery of Owner furnished new equipment for installation by Contractor shall take place at time to be determined by Owner but not necessarily during normal working hours.
- F. *OFCI* (Owner furnished (existing equipment), Contractor installed): Contractor disconnect, remove, store and install such equipment in same manner as new equipment. Replace fasteners, supports, or other miscellaneous items necessary for complete installation. Inspect equipment at existing location prior to bid.
- G. Contractor and Owner mutually inspect existing equipment prior to removal, upon delivery to new location, and after installation to verify installation requirements, physical appearance and working condition.
- H. Owner shall provide a schedule to Contractor of when each piece of existing equipment (that has been identified to be relocated) can be removed from its respective existing location.

1.5 JOB CONDITIONS

- A. Drawings indicate arrangement and location of items of equipment. Field verify dimensions. If it is necessary to vary from arrangement indicated, because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect and at no additional expense to Owner.
- B. Measure recesses and openings at building and provide trim pieces, fillers, closures in sizes required.

1.6 GUARANTEES

- A. Items of equipment furnished by Owner for installation by Contractor shall be excluded from Contractor's one year warranty.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. Acceptable manufacturers:
 - 1. Hospital equipment:
 - a. Base: As noted on attachment "117300S Contractor Supplement".
 - 2. Other manufacturers desiring approval comply with Division 1 Section 016000 Product Requirements and 012500 Substitutions
 - 3. Other approved manufacturers are responsible for adjustments required to fit their products to the work at no additional cost.

4. Provide equipment of each specialty type (as designated by Sections referenced) by one manufacturer, insofar as is possible, and except as otherwise indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install medical equipment according to manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. All wall mounted items shall receive appropriate blocking and backing plates. Contractor shall coordinate the need for metal or fire retardant wood backing for wall mounted items. Plastic anchors into unbacked gypsum board are not acceptable. Install units level, plumb, and firmly anchored in locations and at heights indicated.
- B. Provide for final connections and testing for all contractor installed equipment.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Remove temporary labels and protective coatings.
- C. Clean and polish exposed surfaces according to manufacturer's written recommendations.
- D. The Equipment Schedule directly follows this section.

END OF SECTION 117300

Fund Codes(FC) E=Existing FURN=Furniture IS=IS L=Leased P=Project	Furnish Codes(FRN) INT=Interiors IS=IS OF=Owner CF=Contractor	Install Codes(IC) OI=Owner CI= Contractor VI=Vendor

Room #	4503	Alcove, Charting 2W2C						
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>	
CT	Computer	IT to plan	IS SPECIFY	2	IS	IS	OI	
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI	
WOW000	Workstation on Wheels	OWNER-SPEC'D BY IT		2	IS	IS	OI	
<u>Total Items in Room:</u>				<u>6</u>				

Room #	4504	Alcove, Charting 1C						
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>	
CT	Computer	IT to plan	IS SPECIFY	1	IS	IS	OI	
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	1	P	OF	OI	
<u>Total Items in Room:</u>				<u>2</u>				

Room #	4505	Alcove, Charting 3W2C						
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>	
CT	Computer	IT to plan	IS SPECIFY	2	IS	IS	OI	
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI	
WOW000	Workstation on Wheels	OWNER-SPEC'D BY IT		3	IS	IS	OI	
<u>Total Items in Room:</u>				<u>7</u>				

Room #	4507	Alcove, Charting 2W2C						
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>	
CT	Computer	IT to plan	IS SPECIFY	2	IS	IS	OI	
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI	
WOW000	Workstation on Wheels	OWNER-SPEC'D BY IT		2	IS	IS	OI	
<u>Total Items in Room:</u>				<u>6</u>				

Room #	4508	Alcove, Charting 1C						

<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CT	Computer	IT to plan	IS SPECIFY	1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	1	P	OF	OI
<u>Total Items in Room:</u>				<u>2</u>			

Room # 4509 Alcove, Charting 3W2C

<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CT	Computer	IT to plan	IS SPECIFY	2	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI
WOW000	Workstation on Wheels	OWNER-SPECD BY IT		3	IS	IS	OI
<u>Total Items in Room:</u>				<u>7</u>			

Room # 4512 Nurse Station, Central

<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR027F	Chair, Task, no arms	OWNER-SPECD BY INTERIORS		3	FURN	IN	OI
CT	Computer	IT to plan	IS SPECIFY	3	IS	IS	OI
MON043	Telemetry system	OWNER SPECIFIED	See Vendor Drawings	1	P	OF	VI
PR-LBL	Printer, Label	Zebra Printers	GK420 Healthcare Printer	1	IS	IS	OI
SCAN	Scanner	OWNER-SPECD BY IT	owner specified	1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI
<u>Total Items in Room:</u>				<u>11</u>			

Room # 4513 Workroom CENTRAL

<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR003	Cart, Crash, 5-Drawer	Armstrong Medical Industries	ABLB6++(see quote)	1	P	OF	OI
DEF050	Defibrillator, Lifepak	Physio-Control	LP20E	1	P	OF	OI
DIS048	Scanner, Desktop Pyxis Connect	B-D (was Carefusion/was Pyxis Corporation)	Pyxis Connect Plus	1	L	IS	OI
DSP002	Dispenser, Lotion, Wallmount	SC Johnson Professional	SDS Dispenser System for 1 Liter Bottles	1	V	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
LAB013	Glucometer	UNASSIGNED	Inform II System	1	P	OF	OI
PR-AB/REP	Printer, Armband, multi drawer combo	Lexmark	MS810dn	1	IS	IS	OI

PR-M-C	Printer,Countertop, Multifunction	OWNER-SPEC'D BY IT		1	IS	IS	OI
SHR002	Shred bin	OWNER SPECIFIED	owner specify	1	V	OF	OI
WAS011	Recept, Waste, 23 Gal	Rubbermaid Commercial Products	3540	1	P	OF	OI

Total Items in Room: **10**

Room #	4514	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPEC'D BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPEC'D BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPEC'D BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPEC'D BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPEC'D BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPEC'D BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPEC'D BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4515	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>

AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				18			

Room #	4516	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI

COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4517	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI

TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
<u>Comment</u> WAS028	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4518	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI

WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4519	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4520	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI

CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4521	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI

DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				18			

Room #	4522	Patient Room, Isolation					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI

TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4523	Patient Room, Isolation					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4524	Conference/Workroom						
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC	
CHR021F	Chair, Task, with arms	OWNER-SPECD BY INTERIORS		6	FURN	IN	OI	
CT	Computer	IT to plan	IS SPECIFY	6	IS	IS	OI	
DSK025F	Desk(s), Systems furniture by owner	OWNER-SPECD BY INTERIORS	INTERIORS SPECIFIED	6	FURN	IN	OI	
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI	
FIL000F	File, Lateral, 2 drawer	OWNER-SPECD BY INTERIORS	yet to be determined	2	FURN	IN	OI	
MOU036	Mount, Television 55-65" TILT	Peerless Sales Co	ST650	1	FUTUR E	OF	CI	
PR-M-C	Printer,Countertop, Multifunction	OWNER-SPECD BY IT		1	L	IS	OI	
TEL022	Television, 65" flat panel	LG	65UX340C	1	FUTUR E	IS	CI	
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	6	P	OF	OI	
Total Items in Room:				30				

Room #	4525	Patient Room						
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC	
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI	
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI	
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI	
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI	
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI	
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI	
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI	
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI	
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI	
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI	
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI	
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI	
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI	

TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4526	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI

Total Items in Room:**18**

Room #	4527	Patient Room					
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u>	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED						
VAC000	Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028	Receptacle, Waste, 7.2 gal(28qt) with swing lid	TBD	10030294 (white)	1	P	CF	CI
<u>Comment</u>	;;Vendor is The Container Store						
Total Items in Room:				18			

Room #	4528	Patient Room						
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC	
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI	
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI	
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI	

CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4529	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI

MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4530	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI

THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #		4531 Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #		4532 Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>

AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				18			

Room #	4533	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI

COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4534	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI

TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4535	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI

WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4536	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4537	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI

CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4538	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI

DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				18			

Room #	4539	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI

TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4540	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4541	Patient Room						
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC	
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI	
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI	
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI	
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI	
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI	
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI	
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI	
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI	
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI	
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI	
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI	
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI	
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI	
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI	
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI	
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI	
<u>Comment</u>	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED							
VAC000	Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI	
WAS028	Receptacle, Waste, 7.2 gal(28qt) with swing lid	TBD	10030294 (white)	1	P	CF	CI	
<u>Comment</u>	;;Vendor is The Container Store							
<u>Total Items in Room:</u>				18				

Room #	4542	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI

COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				18			

Room #	4543	Patient Room, Patient of Size					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	OF	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
LIF010	Patient Lift, Ceiling Mounted	Guldmann, Inc.	Stedy	1	P	OF	CI

MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>19</u>			

Room #	4544	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI

THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4545	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4546	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>

AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4547	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI

COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4548	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI

TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
<u>Comment</u> WAS028	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4549	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI

WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4550	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4551	Patient Room					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	1	P	OF	OI
BED003	Bed, Med Surg	Stryker Medical	S3	1	P	OF	OI

CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	1	FURN	IN	OI
CHR039F	Chair, Patient Room, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
COM006F	Communications Board	OWNER-SPECD BY INTERIORS	OWNER DESIGNED	1	P	IN	CI
COU003F	Couch/Sleeper, Patient Room	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	Crimson Brackets	A34	1	P	OF	CI
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPECD BY CLIENT	1	P	OF	OI
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	1	FURN	IN	OI
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	1	FURN	IN	OI
TAB054F	Table, End, Rectangle, Wood	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI
THR005	Thermometer, wallmounted	OWNER-SPECD BY BIOMED	owner to specify	1	P	OF	OI
<u>Comment</u> VAC000	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	1	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid ;;Vendor is The Container Store	TBD	10030294 (white)	1	P	CF	CI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4561	JC					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR007	Cart, Housekeeping	Rubbermaid Commercial Products	9T20 Platinum 619000	1	P	OF	OI
DIS001	Dispenser, Chemical (from Env. Svcs)	Johnson Wax		1	CT	CF	CI
JCE007	Mop Bucket, 8 Gallon Capacity	Geerpres	2220	1	P	OF	OI
JCE008	Mop Rack, 18" long	Rubbermaid Commercial Products	Closet Organizer/Tool Holder/1992	1	CT	CF	CI
<u>Comment</u> WAS011	;;Wall bracing required Recept, Waste, 23 Gal	Rubbermaid Commercial Products	3540	1	P	OF	OI
<u>Total Items in Room:</u>				<u>5</u>			

Room #	4562	Soiled Utility					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>

CAR048	Cart, Food Tray	Lakeside Manufacturing Inc.	832 Premier Series	1	P	OF	OI
COM001	Commode, Portable	Lumex, Inc.	7103	1	P	OF	OI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
REC050	Receptacle, Linen, Dirty	Diversified Plastics, Inc	7001L	1	P	OF	OI
WAS023	Waste, Regular Trash, Large	Rubbermaid Commercial Products	9W22	1	P	OF	OI
WAS024	Waste, Red Bag, Large, 65	Rubbermaid Commercial Products	9W1900 RED 65 GALLON	1	P	OF	OI
WAS026	Receptacle, Waste, Sharps container collection	Schaefer Systems International	96 gallon	1	P	OF	OI
<u>Total Items in Room:</u>				<u>7</u>			

Room #		4563		Office			
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR019F	Chair, Office, Desk	OWNER-SPEC'D BY INTERIORS		1	FURN	IN	OI
CHR020F	Chair, Office, Guest	OWNER-SPEC'D BY INTERIORS		2	FURN	IN	OI
CT	Computer	IT to plan	IS SPECIFY	1	IS	IS	OI
DSK023F	Desk, Office, with return	OWNER-SPEC'D BY INTERIORS	INTERIORS SPECIFIED	1	FURN	IN	OI
PR-LJ-C	Printer, Laser Jet, Countertop	OWNER-SPEC'D BY IT		1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	1	P	OF	OI
<u>Total Items in Room:</u>				<u>7</u>			

Room #		4564		Dr. Dictation			
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR027F	Chair, Task, no arms	OWNER-SPEC'D BY INTERIORS		3	FURN	IN	OI
CT	Computer	IT to plan	IS SPECIFY	3	IS	IS	OI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	P	OF	CI
PR-RX	Printer, Prescription	Lexmark		1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI
<u>Total Items in Room:</u>				<u>10</u>			

Room #		4565		Workroom, Nursing			
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>

CAR073	Cart ,Chart, 2 shelf, locking, mobile	Carstens Health Industries Inc	sku 9283-04-BR	1	P	OF	OI
<u>Comment</u> CHR027F	;;holds 20/24 2" charts Chair, Task, no arms	OWNER-SPEC'D BY INTERIORS		4	P	OF	OI
CT	Computer	IT to plan	IS SPECIFY	4	IS	IS	OI
DSP002	Dispenser, Lotion, Wallmount	SC Johnson Professional	SDS Dispenser System for 1 Liter Bottles	1	V	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
LAB013	Glucometer	UNASSIGNED	Inform II System	1	P	OF	OI
PR-M-C	Printer,Countertop, Multifunction	OWNER-SPEC'D BY IT		1	L	IS	OI
SHR002	Shred bin	OWNER SPECIFIED	owner specify	1	V	OF	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	3	P	OF	OI
<u>Total Items in Room:</u>				<u>17</u>			

Room #	4566	Med/Nourish					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR048	Cart, Food Tray	Lakeside Manufacturing Inc.	832 Premier Series	1	P	OF	OI
COF003	Coffeemaker, single, non plumbed	Bunn	A10	1	P	OF	OI
DIS006	Dispenser, Pyxis Med 6 drawer, Main	B-D (was Carefusion/was Pyxis Corporation)	Medstation 4000 Main	1	L	OF	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI
DIS029	Pyxis remote refrigerator connection	B-D (was Carefusion/was Pyxis Corporation)	SMART remote manager	1	P	OF	CI
DIS049	Dispenser, Med, Pyxis single column auxillary	B-D (was Carefusion/was Pyxis Corporation)	ytbd	1	L	OF	OI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		2	V	OF	CI
ICE006	Icemaker, Counter, 12 pd.	Follett Corporation	12C1425A-S	1	P	CF	CI
OVE004	Microwave, Commercial; 1.4 cu ft 1100 Watt	Frigidaire	FFCE1439LW	1	P	OF	OI
REF028	Refrigerator, full size 20.5 CU FT	Whirlpool	WRT311FZDW	1	P	OF	OI
REF039	Refrigerator,uc, ADA, Med grade	Follett Corporation	REF4P-ADA	1	P	OF	OI
<u>Comment</u> WAS009	;for pyxis; Waste, Pharmaceutical	Pharm Disposal		1	V	OF	OI
WAS012	Recept, Waste, 23 Gal W/Lid	Rubbermaid Commercial Products	3540/2673	1	P	OF	OI

Total Items in Room:**15**

Room #	4567	Clean Supply					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CT-CY	Cybernet computer/scanner pairs with MOU027	OWNER-SPEC'D BY IT	IS SPECIFY	2	IS	IS	CI
<u>Comment</u>	;1 iper room is future						
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		2	V	OF	CI
MOU027	Mount,OMNI CYBERNET monitor scanner	Peerless Sales Co	Smart Mount Universal Flat Wall Mount SF630P	2	IS	IS	OI
<u>Comment</u>	;1 per room is future;						
SHW014	Shelving, Caster, Clean linen 4'w x 2'd, chrome	Logiquip	MB136CH	2	P	OF	OI
SHW050	Shelving, Mobile, 5'wide x 24"deep	Logiquip	M468CH-5	2	P	OF	OI
<u>Comment</u>	;;with locking casters						
WAR016	Cabinet, Warming, 2-comp, 24", glass doors,64"H	Logiquip	DWC2460	1	P	OF	OI
WAS012	Recept, Waste, 23 Gal W/Lid	Rubbermaid Commercial Products	3540/2673	1	P	OF	OI
<u>Total Items in Room:</u>				<u>12</u>			

Room #	4568	Patient Room, Semi Private, Dialysis						
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC	
AIR001	Flowmeter, Air*	Allied Healthcare Products	15004-13	2	P	OF	OI	
BED003	Bed, Med Surg	Stryker Medical	S3	2	P	OF	OI	
CAB016F	Cabinet, Bedside	Nemschoff	Pristo Cabinet Part # PRBT1	2	FURN	IN	OI	
COM006F	Communications Board	OWNER-SPEC'D BY INTERIORS	OWNER DESIGNED	2	P	IN	CI	
DIA001	Dialysis Unit	Fresenius Medical Care	2008T	2	P	OF	OI	
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health-Covidian	31353553/8507MW SHARPS A GATOR	2	P	OF	CI	
DSP030	Dispenser, Gloves	OWNER SPECIFIED		2	P	OF	CI	
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		2	V	OF	CI	
HAM011	Hamper, Chrome w/lid 12x19	Logiquip	CA21	1	P	OF	OI	
MOU048	Mount, TV, Ceiling, for 32"-92" display	Peerless Sales Co	PLCM-UNL-CP	1	P	OF	CI	
OXY004	Oxygen Regulator WITH Ohmeda Connector	PRECISION	SPEC'D BY CLIENT	2	P	OF	OI	
REC036F	Recliner. Patient	Weiland	Cove Sleep Recliner	2	FURN	IN	OI	
TAB050F	Table, overbed	Nemschoff	Oasis Overbed Table Part # OAS123-U-N	2	FURN	IN	OI	
TEL026	Television, 32" flat panel	RCA	J32HE843	1	IS	IS	CI	
THR005	Thermometer, wallmounted	OWNER-SPEC'D BY BIOMED	owner to specify	2	P	OF	OI	
Comment	VERIFY NEED PRIOR TO ORDERING;VERIFY NEED							

VAC000	Regulator, Vacuum, Continuous/Intermittent WITH OH	PRECISION	SPECD BY OWNER	2	P	OF	OI
WAS028 <u>Comment</u>	Receptacle, Waste, 7.2 gal(28qt) with swing lid	TBD	10030294 (white)	2	P	CF	CI
WAT001	;;Vendor is The Container Store RO Water System, Portable	Better Water LLC	PB2	2	P	OF	OI
<u>Total Items in Room:</u>				<u>33</u>			

Room #	4570	Dialysis Cleaning					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
SHW050 <u>Comment</u>	Shelving, Mobile, 5'wide x 24"deep	Logiquip	M468CH-5	3	P	OF	OI
WAS012	;;with locking casters Recept, Waste, 23 Gal W/Lid	Rubbermaid Commercial Products	3540/2673	1	P	OF	OI
<u>Total Items in Room:</u>				<u>5</u>			

Room #	4571	Breakroom					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR022F	Chair, Breakroom, Stackable	OWNER-SPECD BY INTERIORS		8	FURN	IN	OI
COF003	Coffeemaker, single, non plumbed	Bunn	A10	1	P	OF	OI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
ICE006	Icemaker, Counter, 12 pd.	Follett Corporation	12C1425A-S	1	P	CF	CI
MOU064	Mount, Television 13-49""SURFACE MTD	Crimson Brackets	A40	1	P	OF	CI
OVE004	Microwave, Commercial; 1.4 cu ft 1100 Watt	Frigidaire	FFCE1439LW	1	P	OF	OI
REF028	Refrigerator, full size 20.5 CU FT	Whirlpool	WRT311FZDW	1	P	OF	OI
TAB067F	Table, Round, Breakroom, Seats 4	OWNER-SPECD BY INTERIORS		2	FURN	IN	OI
TEL025	Television, 42" flat panel	LG	42LQ640H	1	IS	IS	CI
WAS028F	Waste and Can Recycle Receptacle	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
<u>Total Items in Room:</u>				<u>18</u>			

Room #	4574	Waiting, Family					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR024F	Chair, Waiting Room	OWNER-SPECD BY INTERIORS		7	FURN	IN	OI
COF003	Coffeemaker, single, non plumbed	Bunn	A10	1	P	OF	OI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
MOU064	Mount, Television 13-49""SURFACE MTD	Crimson Brackets	A40	1	P	OF	CI
STO000F	Stool, Cafe, Tall	OWNER-SPECD BY INTERIORS		2	FURN	IN	OI

TAB002F	Table, Coffee, round, Concourse, 30"	OWNER-SPECD BY INTERIORS	1	FURN	IN	OI
TAB006F	Table, End, round, Concourse, 24"	OWNER-SPECD BY INTERIORS	3	FURN	IN	OI
TEL025	Television, 42" flat panel	LG 42LQ640H	1	IS	IS	CI
WAS030F	Receptacle, Waste,Waiting Rooms	OWNER SPECIFIED	2	FURN	IN	OI
<u>Total Items in Room:</u>			<u>19</u>			

Room #		4576 Office, Nurse Manager					
DS ID	Description	Manufacturer	Model #	Qty	FC	FRN	IC
CHR019F	Chair, Office, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
CHR020F	Chair, Office, Guest	OWNER-SPECD BY INTERIORS		2	FURN	IN	OI
CT	Computer	IT to plan	IS SPECIFY	1	IS	IS	OI
DSK023F	Desk, Office, with return	OWNER-SPECD BY INTERIORS	INTERIORS SPECIFIED	1	FURN	IN	OI
FIL000F	File, Lateral, 2 drawer	OWNER-SPECD BY INTERIORS	yet to be determined	1	FURN	IN	OI
PR-LJ-C	Printer, Laser Jet, Countertop	OWNER-SPECD BY IT		1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	1	P	OF	OI
Total Items in Room:				8			

Room #		4577 Storage, Equipment Lg					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR013	Cart, Procedure	Armstrong Medical Industries	ytbd	3	P	OF	OI
<u>Comment</u>	;verify need;						
CAR025	Cart, Isolation	Milcare		1	P	OF	OI
COM001	Commode, Portable	Lumex, Inc.	7103	2	P	OF	OI
<u>Comment</u>	;verify spec;						
DOP006	Doppler, Vascular	OWNER SPECIFIED	Owner to specify	1	P	OF	OI
<u>Comment</u>	;verify need;						
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		2	V	OF	CI
EKG002	EKG MACHINE	OWNER SPECIFIED	yet to be determined	1	P	OF	OI
IVP012	IV Stand,, 4 hook,5 leg, SS	Logiquip	Cat # LQIVH-1004	2	P	OF	OI
<u>Comment</u>	;;Height Range 68"-116"						
LIF013	Patient Lift, Tenor up to 700lbs	Arjo, Huntleigh	Tenor	1	P	OF	OI
<u>Comment</u>	;verify spec;						
MON018	Monitor, portable with EKG and temp, and stand	Phillips Medical (Formerly Hewlett Pack)	8636063/989803147 821/989803144001(Suresign VS4)	2	P	OF	OI
<u>Comment</u>	;verify need;						
MON037	Monitor,Transport, Patient	GE Medical -Formerly Marquette Electron.	Transport PRO	1	P	OF	OI
<u>Comment</u>	;verify need;						

PEG003 <u>Comment</u>	Stainless Steel Pegboard, 5'w x 6'h. Med Surg ;;Wall bracing Req'd	TBD	custom	1	P	CF	CI
PMP002 <u>Comment</u>	Pump, IV,, Double, with pole ;verify need;	OWNER SPECIFIED		1	P	OF	OI
PMP012 <u>Comment</u>	Pump, Syringe ;verify need;	Alaris/Carefusion	8110	1	P	OF	OI
SHW050 <u>Comment</u>	Shelving, Mobile, 5'wide x 24"deep ;;with locking casters	Logiquip	M468CH-5	1	P	OF	OI
STP002 <u>Comment</u>	Stool, Step, with handle ;verify need;	Pedigo	P-1010-A-SS	1	P	OF	OI
STR007	Stretcher, Procedure/Recovery,700lbs	Stryker Medical	1105 Fifth Wheel Wheel Prime Series 30"	1	P	OF	OI
TNK002	Portable O2 tank on holder	TBD		1	P	OF	OI
WAS014	Receptacle, Waste, Step on 18 gal	Rubbermaid Commercial Products	6145	1	P	OF	OI
WHC003	Wheelchair, Standard	Invacare Corporation	Tracer EX	1	P	OF	OI
WHC012	Wheelchair, Bariatric	Owens & Minor (Medichoice)	867WCBAR30S	1	P	OF	OI
<u>Total Items in Room:</u>				<u>26</u>			

Room #	4578	Clean Supply					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CT-CY	Cybernet computer/scanner pairs with MOU027	OWNER-SPEC'D BY IT	IS SPECIFY	2	IS	IS	CI
<u>Comment</u> DSP040	1-future Dispenser, Waterless Soap	OWNER SPECIFIED		2	V	OF	CI
MOU027	Mount,OMNI CYBERNET monitor scanner	Peerless Sales Co	Smart Mount Universal Flat Wall Mount SF630P	2	IS	IS	CI
<u>Comment</u> SHW014	;1-future; Shelving, Caster, Clean linen 4'w x 2'd, chrome	Logiquip	MB136CH	2	P	OF	OI
SHW050 <u>Comment</u>	Shelving, Mobile, 5'wide x 24"deep ;;with locking casters	Logiquip	M468CH-5	4	P	OF	OI
WAR016	Cabinet, Warming, 2-comp, 24", glass doors,64"H	Logiquip	DWC2460	1	P	OF	OI
WAS012	Recept, Waste, 23 Gal W/Lid	Rubbermaid Commercial Products	3540/2673	1	P	OF	OI
<u>Total Items in Room:</u>				<u>14</u>			

Room #	4579	Med/Nourish					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR048	Cart, Food Tray	Lakeside Manufacturing Inc.	832 Premier Series	1	P	OF	OI
COF003	Coffeemaker, single, non plumbed	Bunn	A10	1	P	OF	OI
DIS006	Dispenser, Pyxis Med 6 drawer, Main	B-D (was Carefusion/was Pyxis Corporation)	Medstation 4000 Main	1	L	OF	OI
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	Cardinal Health- Covidian	31353553/8507MW SHARPS A GATOR	1	P	OF	CI

DIS029	Pyxis remote refrigerator connection	B-D (was Carefusion/was Pyxis Corporation)	SMART remote manager	1	P	OF	CI
DIS049	Dispenser, Med, Pyxis single column auxillary	B-D (was Carefusion/was Pyxis Corporation)	ytbd	1	L	OF	OI
DSP030	Dispenser, Gloves	OWNER SPECIFIED		1	P	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		2	V	OF	CI
ICE006	Icemaker, Counter, 12 pd.	Follett Corporation	12C1425A-S	1	P	CF	CI
OVE004	Microwave, Commercial; 1.4 cu ft 1100 Watt	Frigidaire	FFCE1439LW	1	P	OF	OI
REF028	Refrigerator, full size 20.5 CU FT	Whirlpool	WRT311FZDW	1	P	OF	OI
REF039	Refrigerator,uc, ADA, Med grade	Follett Corporation	REF4P-ADA	1	P	OF	OI
<u>Comment</u>	;for pyxis;						
WAS009	Waste, Pharmaceutical	Pharm Disposal		1	V	OF	OI
WAS012	Recept, Waste, 23 Gal W/Lid	Rubbermaid Commercial Products	3540/2673	1	P	OF	OI
<u>Total Items in Room:</u>				<u>15</u>			

Room #	4580	Workroom, Nursing					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR073	Cart ,Chart, 2 shelf, locking, mobile	Carstens Health Industries Inc	sku 9283-04-BR	1	P	OF	OI
<u>Comment</u>	;;holds 20/24 2" charts						
CHR027F	Chair, Task, no arms	OWNER-SPEC'D BY INTERIORS		4	P	OF	OI
CT	Computer	IT to plan	IS SPECIFY	4	IS	IS	OI
DSP002	Dispenser, Lotion, Wallmount	SC Johnson Professional	SDS Dispenser System for 1 Liter Bottles	1	V	OF	CI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
LAB013	Glucometer	UNASSIGNED	Inform II System	1	P	OF	OI
PR-M-C	Printer,Countertop, Multifunction	OWNER-SPEC'D BY IT		1	L	IS	OI
SHR002	Shred bin	OWNER SPECIFIED	owner specify	1	V	OF	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	3	P	OF	OI
<u>Total Items in Room:</u>				<u>17</u>			

Room #	4581	Dr. Dictation					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR027F	Chair, Task, no arms	OWNER-SPEC'D BY INTERIORS		3	FURN	IN	OI
CT	Computer	IT to plan	IS SPECIFY	3	IS	IS	OI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	P	OF	CI

PR-RX	Printer, Prescription	Lexmark		1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	2	P	OF	OI
<u>Total Items in Room:</u>				<u>10</u>			

Room #	4582	Office					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CHR019F	Chair, Office, Desk	OWNER-SPECD BY INTERIORS		1	FURN	IN	OI
CHR020F	Chair, Office, Guest	OWNER-SPECD BY INTERIORS		2	FURN	IN	OI
CT	Computer	IT to plan	IS SPECIFY	1	IS	IS	OI
DSK023F	Desk, Office, with return	OWNER-SPECD BY INTERIORS	INTERIORS SPECIFIED	1	FURN	IN	OI
PR-LJ-C	Printer, Laser Jet, Countertop	OWNER-SPECD BY IT		1	IS	IS	OI
WAS013	Receptacle, Waste, Office	Rubbermaid Commercial Products	2957	1	P	OF	OI
<u>Total Items in Room:</u>				<u>7</u>			

Room #	4583	Soiled Utility					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR048	Cart, Food Tray	Lakeside Manufacturing Inc.	832 Premier Series	1	P	OF	OI
COM001	Commode, Portable	Lumex, Inc.	7103	1	P	OF	OI
DSP040	Dispenser, Waterless Soap	OWNER SPECIFIED		1	V	OF	CI
REC050	Receptacle, Linen, Dirty	Diversified Plastics, Inc	7001L	1	P	OF	OI
WAS023	Waste, Regular Trash, Large	Rubbermaid Commercial Products	9W22	1	P	OF	OI
WAS024	Waste, Red Bag, Large, 65	Rubbermaid Commercial Products	9W1900 RED 65 GALLON	1	P	OF	OI
WAS026	Receptacle, Waste, Sharps container collection	Schaefer Systems International	96 gallon	1	P	OF	OI
<u>Total Items in Room:</u>				<u>7</u>			

Room #	4584	JC					
<u>DS ID</u>	<u>Description</u>	<u>Manufacturer</u>	<u>Model #</u>	<u>Qty</u>	<u>FC</u>	<u>FRN</u>	<u>IC</u>
CAR007	Cart, Housekeeping	Rubbermaid Commercial Products	9T20 Platinum 619000	1	P	OF	OI
DIS001	Dispenser, Chemical (from Env. Svcs)	Johnson Wax		1	CT	CF	CI
JCE007	Mop Bucket, 8 Gallon Capacity	Geerpres	2220	1	P	OF	OI

JCE008	Mop Rack, 18" long	Rubbermaid Commercial Products	Closet Organizer/Tool Holder/1992	1	CT	CF	CI
<u>Comment</u> WAS011	;;Wall bracing required Recept, Waste, 23 Gal	Rubbermaid Commercial Products	3540	1	P	OF	OI
<u>Total Items in Room:</u>				<u>5</u>			

Furnish Codes

OF=Owner
CF=Contractor

Installed Codes

OI=Owner CI
= Contractor
VI=Vendor

Manufacturer

B-D (was Carefusion/was Pyxis)

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
DIS029	Pyxis remote refrigerator connection	SMART remote manager	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4566	Med/Nourish	MED SURG NURSING	1	P	OF	CI
4579	Med/Nourish	MED SURG NURSING	1	P	OF	CI
Subtotal:			2			

Manufacturer

Cardinal Health-Covidian

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
DIS010	Dispenser/Receptacle, Sharps, Wall-Mount, 5 quart	31353553/8507MW SHARPS A GATOR	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4514	Patient Room	MED SURG NURSING	1	P	OF	CI
4515	Patient Room	MED SURG NURSING	1	P	OF	CI
4516	Patient Room	MED SURG NURSING	1	P	OF	CI
4517	Patient Room	MED SURG NURSING	1	P	OF	CI
4518	Patient Room	MED SURG NURSING	1	P	OF	CI
4519	Patient Room	MED SURG NURSING	1	P	OF	CI
4520	Patient Room	MED SURG NURSING	1	P	OF	CI
4521	Patient Room	MED SURG NURSING	1	P	OF	CI
4522	Patient Room, Isolation	MED SURG NURSING	1	P	OF	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	P	OF	CI
4525	Patient Room	MED SURG NURSING	1	P	OF	CI
4526	Patient Room	MED SURG NURSING	1	P	OF	CI
4527	Patient Room	MED SURG NURSING	1	P	OF	CI
4528	Patient Room	MED SURG NURSING	1	P	OF	CI
4529	Patient Room	MED SURG NURSING	1	P	OF	CI
4530	Patient Room	MED SURG NURSING	1	P	OF	CI
4531	Patient Room	MED SURG NURSING	1	P	OF	CI
4532	Patient Room	MED SURG NURSING	1	P	OF	CI
4533	Patient Room	MED SURG NURSING	1	P	OF	CI
4534	Patient Room	MED SURG NURSING	1	P	OF	CI
4535	Patient Room	MED SURG NURSING	1	P	OF	CI
4536	Patient Room	MED SURG NURSING	1	P	OF	CI
4537	Patient Room	MED SURG NURSING	1	P	OF	CI
4538	Patient Room	MED SURG NURSING	1	P	OF	CI
4539	Patient Room	MED SURG NURSING	1	P	OF	CI
4540	Patient Room	MED SURG NURSING	1	P	OF	CI

4541	Patient Room	MED SURG NURSING	1	P	OF	CI
4542	Patient Room	MED SURG NURSING	1	P	OF	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	P	OF	CI
4544	Patient Room	MED SURG NURSING	1	P	OF	CI
4545	Patient Room	MED SURG NURSING	1	P	OF	CI
4546	Patient Room	MED SURG NURSING	1	P	OF	CI
4547	Patient Room	MED SURG NURSING	1	P	OF	CI
4548	Patient Room	MED SURG NURSING	1	P	OF	CI
4549	Patient Room	MED SURG NURSING	1	P	OF	CI
4550	Patient Room	MED SURG NURSING	1	P	OF	CI
4551	Patient Room	MED SURG NURSING	1	P	OF	CI
4566	Med/Nourish	MED SURG NURSING	1	P	OF	CI
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	2	P	OF	CI
4579	Med/Nourish	MED SURG NURSING	1	P	OF	CI
Subtotal:			41			

Manufacturer **Crimson Brackets**

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
MOU063	Mount, Television, exam rms 13"- SURFACE MTD	A34	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4514	Patient Room	MED SURG NURSING	1	P	OF	CI
4515	Patient Room	MED SURG NURSING	1	P	OF	CI
4516	Patient Room	MED SURG NURSING	1	P	OF	CI
4517	Patient Room	MED SURG NURSING	1	P	OF	CI
4518	Patient Room	MED SURG NURSING	1	P	OF	CI
4519	Patient Room	MED SURG NURSING	1	P	OF	CI
4520	Patient Room	MED SURG NURSING	1	P	OF	CI
4521	Patient Room	MED SURG NURSING	1	P	OF	CI
4522	Patient Room, Isolation	MED SURG NURSING	1	P	OF	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	P	OF	CI
4525	Patient Room	MED SURG NURSING	1	P	OF	CI
4526	Patient Room	MED SURG NURSING	1	P	OF	CI
4527	Patient Room	MED SURG NURSING	1	P	OF	CI
4528	Patient Room	MED SURG NURSING	1	P	OF	CI
4529	Patient Room	MED SURG NURSING	1	P	OF	CI
4530	Patient Room	MED SURG NURSING	1	P	OF	CI
4531	Patient Room	MED SURG NURSING	1	P	OF	CI
4532	Patient Room	MED SURG NURSING	1	P	OF	CI
4533	Patient Room	MED SURG NURSING	1	P	OF	CI
4534	Patient Room	MED SURG NURSING	1	P	OF	CI
4535	Patient Room	MED SURG NURSING	1	P	OF	CI
4536	Patient Room	MED SURG NURSING	1	P	OF	CI
4537	Patient Room	MED SURG NURSING	1	P	OF	CI
4538	Patient Room	MED SURG NURSING	1	P	OF	CI
4539	Patient Room	MED SURG NURSING	1	P	OF	CI
4540	Patient Room	MED SURG NURSING	1	P	OF	CI
4541	Patient Room	MED SURG NURSING	1	P	OF	CI
4542	Patient Room	MED SURG NURSING	1	P	OF	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	P	OF	CI
4544	Patient Room	MED SURG NURSING	1	P	OF	CI
4545	Patient Room	MED SURG NURSING	1	P	OF	CI
4546	Patient Room	MED SURG NURSING	1	P	OF	CI
4547	Patient Room	MED SURG NURSING	1	P	OF	CI

4548	Patient Room	MED SURG NURSING	1	P	OF	CI
4549	Patient Room	MED SURG NURSING	1	P	OF	CI
4550	Patient Room	MED SURG NURSING	1	P	OF	CI
4551	Patient Room	MED SURG NURSING	1	P	OF	CI
Subtotal:			37			

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
MOU064	Mount, Television 13-49""SURFACE MTD	A40	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4571	Breakroom	MED SURG NURSING	1	P	OF	CI
4574	Waiting, Family	MED SURG NURSING	1	P	OF	CI
Subtotal:			2			

Manufacturer *Follett Corporation*

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
ICE006	Icemaker, Counter, 12 pd.	12C1425A-S	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4566	Med/Nourish	MED SURG NURSING	1	P	CF	CI
4571	Breakroom	MED SURG NURSING	1	P	CF	CI
4579	Med/Nourish	MED SURG NURSING	1	P	CF	CI
Subtotal:			3			

Manufacturer *Guldmann, Inc.*

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
LIF010	Patient Lift, Ceiling Mounted	GH3+ 500 with remote	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4543	Patient Room, Patient of Size	MED SURG NURSING	1	P	OF	CI
Subtotal:			1			

Manufacturer *Johnson Wax*

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
DIS001	Dispenser, Chemical (from Env. Svcs)		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4561	JC	MED SURG NURSING	1	CT	CF	CI
4584	JC	MED SURG NURSING	1	CT	CF	CI
Subtotal:			2			

Manufacturer *LG*

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
TEL022	Television, 65" flat panel	65UX340C	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>

4524	Conference/Workroom	MED SURG NURSING	1	FUTURE	IS	CI
Subtotal:			1			

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
TEL025	Television, 42" flat panel	42LQ640H	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4571	Breakroom	MED SURG NURSING	1	IS	IS	CI
4574	Waiting, Family	MED SURG NURSING	1	IS	IS	CI
Subtotal:			2			

Manufacturer OWNER SPECIFIED

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
DSP030	Dispenser, Gloves		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4514	Patient Room	MED SURG NURSING	1	P	OF	CI
4515	Patient Room	MED SURG NURSING	1	P	OF	CI
4516	Patient Room	MED SURG NURSING	1	P	OF	CI
4517	Patient Room	MED SURG NURSING	1	P	OF	CI
4518	Patient Room	MED SURG NURSING	1	P	OF	CI
4519	Patient Room	MED SURG NURSING	1	P	OF	CI
4520	Patient Room	MED SURG NURSING	1	P	OF	CI
4521	Patient Room	MED SURG NURSING	1	P	OF	CI
4522	Patient Room, Isolation	MED SURG NURSING	1	P	OF	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	P	OF	CI
4525	Patient Room	MED SURG NURSING	1	P	OF	CI
4526	Patient Room	MED SURG NURSING	1	P	OF	CI
4527	Patient Room	MED SURG NURSING	1	P	OF	CI
4528	Patient Room	MED SURG NURSING	1	P	OF	CI
4529	Patient Room	MED SURG NURSING	1	P	OF	CI
4530	Patient Room	MED SURG NURSING	1	P	OF	CI
4531	Patient Room	MED SURG NURSING	1	P	OF	CI
4532	Patient Room	MED SURG NURSING	1	P	OF	CI
4533	Patient Room	MED SURG NURSING	1	P	OF	CI
4534	Patient Room	MED SURG NURSING	1	P	OF	CI
4535	Patient Room	MED SURG NURSING	1	P	OF	CI
4536	Patient Room	MED SURG NURSING	1	P	OF	CI
4537	Patient Room	MED SURG NURSING	1	P	OF	CI
4538	Patient Room	MED SURG NURSING	1	P	OF	CI
4539	Patient Room	MED SURG NURSING	1	P	OF	CI
4540	Patient Room	MED SURG NURSING	1	P	OF	CI
4541	Patient Room	MED SURG NURSING	1	P	OF	CI
4542	Patient Room	MED SURG NURSING	1	P	OF	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	P	OF	CI
4544	Patient Room	MED SURG NURSING	1	P	OF	CI
4545	Patient Room	MED SURG NURSING	1	P	OF	CI
4546	Patient Room	MED SURG NURSING	1	P	OF	CI
4547	Patient Room	MED SURG NURSING	1	P	OF	CI
4548	Patient Room	MED SURG NURSING	1	P	OF	CI
4549	Patient Room	MED SURG NURSING	1	P	OF	CI
4550	Patient Room	MED SURG NURSING	1	P	OF	CI
4551	Patient Room	MED SURG NURSING	1	P	OF	CI

4566	Med/Nourish	MED SURG NURSING	1	P	OF	CI
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	2	P	OF	CI
4579	Med/Nourish	MED SURG NURSING	1	P	OF	CI

Subtotal: 41

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
DSP040	Dispenser, Waterless Soap		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4513	Workroom CENTRAL	MED SURG NURSING	1	V	OF	CI
4514	Patient Room	MED SURG NURSING	1	V	OF	CI
4515	Patient Room	MED SURG NURSING	1	V	OF	CI
4516	Patient Room	MED SURG NURSING	1	V	OF	CI
4517	Patient Room	MED SURG NURSING	1	V	OF	CI
4518	Patient Room	MED SURG NURSING	1	V	OF	CI
4519	Patient Room	MED SURG NURSING	1	V	OF	CI
4520	Patient Room	MED SURG NURSING	1	V	OF	CI
4521	Patient Room	MED SURG NURSING	1	V	OF	CI
4522	Patient Room, Isolation	MED SURG NURSING	1	V	OF	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	V	OF	CI
4524	Conference/Workroom	MED SURG NURSING	1	V	OF	CI
4525	Patient Room	MED SURG NURSING	1	V	OF	CI
4526	Patient Room	MED SURG NURSING	1	V	OF	CI
4527	Patient Room	MED SURG NURSING	1	V	OF	CI
4528	Patient Room	MED SURG NURSING	1	V	OF	CI
4529	Patient Room	MED SURG NURSING	1	V	OF	CI
4530	Patient Room	MED SURG NURSING	1	V	OF	CI
4531	Patient Room	MED SURG NURSING	1	V	OF	CI
4532	Patient Room	MED SURG NURSING	1	V	OF	CI
4533	Patient Room	MED SURG NURSING	1	V	OF	CI
4534	Patient Room	MED SURG NURSING	1	V	OF	CI
4535	Patient Room	MED SURG NURSING	1	V	OF	CI
4536	Patient Room	MED SURG NURSING	1	V	OF	CI
4537	Patient Room	MED SURG NURSING	1	V	OF	CI
4538	Patient Room	MED SURG NURSING	1	V	OF	CI
4539	Patient Room	MED SURG NURSING	1	V	OF	CI
4540	Patient Room	MED SURG NURSING	1	V	OF	CI
4541	Patient Room	MED SURG NURSING	1	V	OF	CI
4542	Patient Room	MED SURG NURSING	1	V	OF	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	V	OF	CI
4544	Patient Room	MED SURG NURSING	1	V	OF	CI
4545	Patient Room	MED SURG NURSING	1	V	OF	CI
4546	Patient Room	MED SURG NURSING	1	V	OF	CI
4547	Patient Room	MED SURG NURSING	1	V	OF	CI
4548	Patient Room	MED SURG NURSING	1	V	OF	CI
4549	Patient Room	MED SURG NURSING	1	V	OF	CI
4550	Patient Room	MED SURG NURSING	1	V	OF	CI
4551	Patient Room	MED SURG NURSING	1	V	OF	CI
4562	Soiled Utility	MED SURG NURSING	1	V	OF	CI
4564	Dr. Dictation	MED SURG NURSING	1	P	OF	CI
4565	Workroom, Nursing	MED SURG NURSING	1	V	OF	CI
4566	Med/Nourish	MED SURG NURSING	2	V	OF	CI
4567	Clean Supply	MED SURG NURSING	2	V	OF	CI
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	2	V	OF	CI
4570	Dialysis Cleaning	MED SURG NURSING	1	V	OF	CI
4571	Breakroom	MED SURG NURSING	1	V	OF	CI

4574	Waiting, Family	MED SURG NURSING	1	V	OF	CI
4577	Storage, Equipment Lg	MED SURG NURSING	2	V	OF	CI
4578	Clean Supply	MED SURG NURSING	2	V	OF	CI
4579	Med/Nourish	MED SURG NURSING	2	V	OF	CI
4580	Workroom, Nursing	MED SURG NURSING	1	V	OF	CI
4581	Dr. Dictation	MED SURG NURSING	1	P	OF	CI
4583	Soiled Utility	MED SURG NURSING	1	V	OF	CI

Subtotal: 60

Manufacturer OWNER-SPECD BY IT

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
CT-CY	Cybernet computer/scanner pairs with MOU027	IS SPECIFY	

Supp. Info: ;1 per room is "future"

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4567	Clean Supply	MED SURG NURSING	2	IS	IS	CI
4578	Clean Supply	MED SURG NURSING	2	IS	IS	CI

Subtotal: 4

Manufacturer OWNER-SPECD BY INTERIORS

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
COM006F	Communications Board	OWNER DESIGNED	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4514	Patient Room	MED SURG NURSING	1	P	IN	CI
4515	Patient Room	MED SURG NURSING	1	P	IN	CI
4516	Patient Room	MED SURG NURSING	1	P	IN	CI
4517	Patient Room	MED SURG NURSING	1	P	IN	CI
4518	Patient Room	MED SURG NURSING	1	P	IN	CI
4519	Patient Room	MED SURG NURSING	1	P	IN	CI
4520	Patient Room	MED SURG NURSING	1	P	IN	CI
4521	Patient Room	MED SURG NURSING	1	P	IN	CI
4522	Patient Room, Isolation	MED SURG NURSING	1	P	IN	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	P	IN	CI
4525	Patient Room	MED SURG NURSING	1	P	IN	CI
4526	Patient Room	MED SURG NURSING	1	P	IN	CI
4527	Patient Room	MED SURG NURSING	1	P	IN	CI
4528	Patient Room	MED SURG NURSING	1	P	IN	CI
4529	Patient Room	MED SURG NURSING	1	P	IN	CI
4530	Patient Room	MED SURG NURSING	1	P	IN	CI
4531	Patient Room	MED SURG NURSING	1	P	IN	CI
4532	Patient Room	MED SURG NURSING	1	P	IN	CI
4533	Patient Room	MED SURG NURSING	1	P	IN	CI
4534	Patient Room	MED SURG NURSING	1	P	IN	CI
4535	Patient Room	MED SURG NURSING	1	P	IN	CI
4536	Patient Room	MED SURG NURSING	1	P	IN	CI
4537	Patient Room	MED SURG NURSING	1	P	IN	CI
4538	Patient Room	MED SURG NURSING	1	P	IN	CI
4539	Patient Room	MED SURG NURSING	1	P	IN	CI
4540	Patient Room	MED SURG NURSING	1	P	IN	CI

4541	Patient Room	MED SURG NURSING	1	P	IN	CI
4542	Patient Room	MED SURG NURSING	1	P	IN	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	P	IN	CI
4544	Patient Room	MED SURG NURSING	1	P	IN	CI
4545	Patient Room	MED SURG NURSING	1	P	IN	CI
4546	Patient Room	MED SURG NURSING	1	P	IN	CI
4547	Patient Room	MED SURG NURSING	1	P	IN	CI
4548	Patient Room	MED SURG NURSING	1	P	IN	CI
4549	Patient Room	MED SURG NURSING	1	P	IN	CI
4550	Patient Room	MED SURG NURSING	1	P	IN	CI
4551	Patient Room	MED SURG NURSING	1	P	IN	CI
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	2	P	IN	CI
			Subtotal:	39		

Manufacturer **Peerless Sales Co**

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
MOU027	Mount,OMNI CYBERNET monitor scanner	Smart Mount Universal Flat Wall Mount SF620D	
<u>Supp. Info:</u>	;1-per room is future;		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4578	Clean Supply	MED SURG NURSING	2	IS	IS	CI
			Subtotal:	2		

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
MOU036	Mount, Television 55-65" TILT	ST650	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4524	Conference/Workroom	MED SURG NURSING	1	FUTURE	OF	CI
			Subtotal:	1		

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
MOU048	Mount, TV, Ceiling, for 32"-92" display	PLCM-UNL-CP	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	1	P	OF	CI
			Subtotal:	1		

Manufacturer **RCA**

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
TEL026	Television, 32" flat panel	J32HE843	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4514	Patient Room	MED SURG NURSING	1	IS	IS	CI
4515	Patient Room	MED SURG NURSING	1	IS	IS	CI
4516	Patient Room	MED SURG NURSING	1	IS	IS	CI
4517	Patient Room	MED SURG NURSING	1	IS	IS	CI
4518	Patient Room	MED SURG NURSING	1	IS	IS	CI
4519	Patient Room	MED SURG NURSING	1	IS	IS	CI
4520	Patient Room	MED SURG NURSING	1	IS	IS	CI
4521	Patient Room	MED SURG NURSING	1	IS	IS	CI

4522	Patient Room, Isolation	MED SURG NURSING	1	IS	IS	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	IS	IS	CI
4525	Patient Room	MED SURG NURSING	1	IS	IS	CI
4526	Patient Room	MED SURG NURSING	1	IS	IS	CI
4527	Patient Room	MED SURG NURSING	1	IS	IS	CI
4528	Patient Room	MED SURG NURSING	1	IS	IS	CI
4529	Patient Room	MED SURG NURSING	1	IS	IS	CI
4530	Patient Room	MED SURG NURSING	1	IS	IS	CI
4531	Patient Room	MED SURG NURSING	1	IS	IS	CI
4532	Patient Room	MED SURG NURSING	1	IS	IS	CI
4533	Patient Room	MED SURG NURSING	1	IS	IS	CI
4534	Patient Room	MED SURG NURSING	1	IS	IS	CI
4535	Patient Room	MED SURG NURSING	1	IS	IS	CI
4536	Patient Room	MED SURG NURSING	1	IS	IS	CI
4537	Patient Room	MED SURG NURSING	1	IS	IS	CI
4538	Patient Room	MED SURG NURSING	1	IS	IS	CI
4539	Patient Room	MED SURG NURSING	1	IS	IS	CI
4540	Patient Room	MED SURG NURSING	1	IS	IS	CI
4541	Patient Room	MED SURG NURSING	1	IS	IS	CI
4542	Patient Room	MED SURG NURSING	1	IS	IS	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	IS	IS	CI
4544	Patient Room	MED SURG NURSING	1	IS	IS	CI
4545	Patient Room	MED SURG NURSING	1	IS	IS	CI
4546	Patient Room	MED SURG NURSING	1	IS	IS	CI
4547	Patient Room	MED SURG NURSING	1	IS	IS	CI
4548	Patient Room	MED SURG NURSING	1	IS	IS	CI
4549	Patient Room	MED SURG NURSING	1	IS	IS	CI
4550	Patient Room	MED SURG NURSING	1	IS	IS	CI
4551	Patient Room	MED SURG NURSING	1	IS	IS	CI
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	1	IS	IS	CI

Subtotal: 38

Manufacturer Rubbermaid Commercial Products

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
JCE008	Mop Rack, 18" long	Closet Organizer/Tool Holder/1000	
<u>Supp. Info:</u>	;;Wall bracing required		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4561	JC	MED SURG NURSING	1	CT	CF	CI
4584	JC	MED SURG NURSING	1	CT	CF	CI

Subtotal: 2

Manufacturer SC Johnson Professional

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
DSP002	Dispenser, Lotion, Wallmount	SDS Dispenser System for 1 Liter Bottle	

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4513	Workroom CENTRAL	MED SURG NURSING	1	V	OF	CI
4565	Workroom, Nursing	MED SURG NURSING	1	V	OF	CI
4580	Workroom, Nursing	MED SURG NURSING	1	V	OF	CI

Subtotal: 3

Manufacturer**TBD**

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
PEG003	Stainless Steel Pegboard, 5'w x 6'h. Med Surg	custom	
<u>Supp. Info:</u>	;;Wall bracing Req'd		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4577	Storage, Equipment Lg	MED SURG NURSING	1	P	CF	CI
Subtotal:			1			

<u>DS ID</u>	<u>Description</u>	<u>Model #</u>	<u>Lead</u>
WAS028	Receptacle, Waste, 7.2 gal(28qt) with swing lid	10030294 (white)	
<u>Supp. Info:</u>	;;Vendor is The Container Store		

<u>Rm #</u>	<u>Room Name</u>	<u>Department</u>	<u>Qty</u>	<u>FD</u>	<u>FR</u>	<u>IC</u>
4514	Patient Room	MED SURG NURSING	1	P	CF	CI
4515	Patient Room	MED SURG NURSING	1	P	CF	CI
4516	Patient Room	MED SURG NURSING	1	P	CF	CI
4517	Patient Room	MED SURG NURSING	1	P	CF	CI
4518	Patient Room	MED SURG NURSING	1	P	CF	CI
4519	Patient Room	MED SURG NURSING	1	P	CF	CI
4520	Patient Room	MED SURG NURSING	1	P	CF	CI
4521	Patient Room	MED SURG NURSING	1	P	CF	CI
4522	Patient Room, Isolation	MED SURG NURSING	1	P	CF	CI
4523	Patient Room, Isolation	MED SURG NURSING	1	P	CF	CI
4525	Patient Room	MED SURG NURSING	1	P	CF	CI
4526	Patient Room	MED SURG NURSING	1	P	CF	CI
4527	Patient Room	MED SURG NURSING	1	P	CF	CI
4528	Patient Room	MED SURG NURSING	1	P	CF	CI
4529	Patient Room	MED SURG NURSING	1	P	CF	CI
4530	Patient Room	MED SURG NURSING	1	P	CF	CI
4531	Patient Room	MED SURG NURSING	1	P	CF	CI
4532	Patient Room	MED SURG NURSING	1	P	CF	CI
4533	Patient Room	MED SURG NURSING	1	P	CF	CI
4534	Patient Room	MED SURG NURSING	1	P	CF	CI
4535	Patient Room	MED SURG NURSING	1	P	CF	CI
4536	Patient Room	MED SURG NURSING	1	P	CF	CI
4537	Patient Room	MED SURG NURSING	1	P	CF	CI
4538	Patient Room	MED SURG NURSING	1	P	CF	CI
4539	Patient Room	MED SURG NURSING	1	P	CF	CI
4540	Patient Room	MED SURG NURSING	1	P	CF	CI
4541	Patient Room	MED SURG NURSING	1	P	CF	CI
4542	Patient Room	MED SURG NURSING	1	P	CF	CI
4543	Patient Room, Patient of Size	MED SURG NURSING	1	P	CF	CI
4544	Patient Room	MED SURG NURSING	1	P	CF	CI
4545	Patient Room	MED SURG NURSING	1	P	CF	CI
4546	Patient Room	MED SURG NURSING	1	P	CF	CI
4547	Patient Room	MED SURG NURSING	1	P	CF	CI
4548	Patient Room	MED SURG NURSING	1	P	CF	CI
4549	Patient Room	MED SURG NURSING	1	P	CF	CI
4550	Patient Room	MED SURG NURSING	1	P	CF	CI

4551	Patient Room	MED SURG NURSING	1	P	CF	CI
4568	Patient Room, Semi Private, Dialysis	MED SURG NURSING	2	P	CF	CI
Subtotal:			39			

SECTION 122413 - ROLLER WINDOW SHADES

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. Manually operated roller shades with single rollers and with double rollers.
- B. Related Requirements:
 - 1. Section 061000 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
 - 2. Section 079200 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.
- B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.
- C. Samples: For each exposed product and for each color and texture specified, 10 inches long.
- D. Samples for Initial Selection: For each type and color of shadeband material.
 - 1. Include Samples of accessories involving color selection.
- E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark inside face of material if applicable.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material, signed by product manufacturer.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For roller shades 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. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.
- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Mechoshade Manual Shade in recessed pocket or comparable product by one of the following:
 - 1. Springs Window Fashions
 - 2. Hunter Douglas Contract.
- B. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 - 1. Bead Chains: Manufacturer's standard.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted.
 - 2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.

- a. Provide for shadebands that weigh more than 10 lbs or for shades as recommended by manufacturer, whichever criteria are more stringent.
 - B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Roller Drive-End Location: Jamb side of shade.
 2. Direction of Shadeband Roll: Regular, from back of roller.
 3. Shadeband-to-Roller Attachment: Manufacturer's standard method.
 - C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
 - D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
 - E. Shadebands:
 1. Shadeband Material: Light-filtering fabric 3%.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: P5273 Oyster/Chestnut. (Note: dark side of shade fabric to exterior.)
 - F. Installation Accessories:
 1. Closure Panel and Wall Clip: Where indicated, removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 2. Installation Accessories Color and Finish: As selected from manufacturer's full range.
- 2.3 MANUALLY OPERATED SHADES WITH DOUBLE ROLLERS MOUNTED IN POCKET. (3% light filtering and light blocking fabric.)
- A. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.
 1. Bead Chains: Manufacturer's standard.

- a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, sill mounted.
2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller-shade weight and lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criteria are more stringent.
- B. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.
 1. Double-Roller Mounting Configuration: Offset, outside roller over and inside roller under.
 2. Inside Roller:
 - a. Drive-End Location: Jamb end of shade roller.
 - b. Direction of Shadeband Roll: Regular, from back of roller.
 3. Outside Roller:
 - a. Drive-End Location: Jamb end of shade roller.
 - b. Direction of Shadeband Roll: Regular, from back of roller.
 4. Shadeband-to-Roller Attachment: Manufacturer's standard method.
- C. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller mounting configuration, roller assemblies, operating mechanisms, installation accessories, and installation locations and conditions indicated.
- D. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- E. Inside Shadebands:
 1. Shadeband Material: Light-blocking fabric.
 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Enclosed in sealed pocket of shadeband material.
 - b. Color and Finish: Sheerweave Avila Twilight, Color: Khaki A0015

F. Outside (Window Side) Shadebands:

1. Shadeband Material: Light-filtering fabric 3% open.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Exposed with endcaps and integral light seal where bottom (sill) channels are indicated.
 - b. Color and Finish: P5273 Oyster/Chestnut. (Note: dark side of shade fabric to exterior.)

G. Installation Accessories:

1. Closure Panel and Wall Clip: Removable aluminum panel designed for installation at bottom of site-constructed ceiling recess or pocket and for snap-in attachment to wall clip without fasteners.
 - a. Closure-Panel Width: Match recess.
2. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.4 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Filtering Fabric 3%: Woven fabric, stain and fade resistant.
 1. Source: Roller-shade manufacturer - Sheerweave – 2703- 3% open.
 2. Color: P5273 Oyster/Chestnut. (Note: dark side of shade to exterior.)
- C. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 1. Source: Roller-shade manufacturer –Sheerweave Avila Twilight blackout shade cloth with opaque acrylic backing.
 2. Color: Khaki A0015

2.5 Shade Schedule:

Room Number	Qty.	Approximate Dimensions of Window Opening	Mount

**McLeod Health
Seacoast Hospital 50-Bed Addition
Little River, SC**

1520	1	56W x 119H	Single
1522	1	54W x 119H	Single
1523	1	70W x 119H	Single
1524	1	128W x 119H	Single
1525	1	70W x 119H	Single
1526	1	55W x 119H	Single
1527	1	128W x 119H	Single
1528	1	128W x 119H	Single
1529	1	128W x 119H	Single
1530	1	240W x 152H	Double
1533	1	160W x 152H	Single
1533	1	240W x 152H	Single
1534	1	114W x 152H	Single
1535	1	114W x 152H	Single
1536	1	114W x 152H	Single
1537	1	114W x 152H	Single
1565	1	54W x 119H	Single
1566	1	70W x 119H	Single
1568	2	52W x 119H	Single
1568	2	128W x 119H	Single
1569	1	70W x 119H	Single
1570	1	128W x 119H	Single
1573	2	128W x 119H	Double

**McLeod Health
Seacoast Hospital 50-Bed Addition
Little River, SC**

1574	1	240W x 152H	Double
2514	1	54W x 88H	Single
2515 - 2521	7	128W x 88H	Single
2522 - 2523	2	108W x 119H	Single
2524	1	120W x 108H	Single
2524	1	48W x 108H	Single
2524	1	96W x 108H	Single
2524	1	216W x 108H	Single
2525 - 2529	5	156W x 88H	Single
2530	1	150W x 88H	Single
2531	1	136W x 88H	Single
2532 - 2533	2	156W x 88H	Single
2534	1	136W x 88H	Single
2535	1	150W x 88H	Single
2536 - 2540	5	156W x 88H	Single
2541	1	120W x 108H	Single
2541	1	48W x 108H	Single
2541	1	96W x 108H	Single
2541	1	216W x 88H	Single
2542-2543	2	128W x 88H	Single
2544 - 2550	7	128W x 88H	Single
2551	1	54W x 88H	Single
3514	1	54W x 88H	Single

3515 - 3521	7	128W x 88H	Single
3522 - 3523	2	108W x 88H	Single
3524	1	120W x 108H	Single
3524	1	48W x 108H	Single
3524	1	96W x 108H	Single
3524	1	216W x 88H	Single
3525 - 3540	16	156W x 88H	Single
3541	1	120W x 108H	Single
3541	1	48W x 108H	Single
3541	1	96W x 108H	Single
3541	1	216W x 88H	Single
3542 - 3543	2	108W x 88H	Single
3544 - 3550	7	128W x 88W	Single
3551	1	58W x 88H	Single

2.6 ROLLER-SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.
- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.

2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible except as follows:
 1. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER-SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller-shade surfaces after installation, according to manufacturer's written instructions.

- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 122413

SECTION 123661 - SIMULATED STONE COUNTERTOPS AND THRESHOLDS

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. Solid-surface-material countertops and backsplashes and integral sinks.
 - 2. Solid surface thresholds
 - 3. Countertop Support Brackets
- B. Related Documents:
 - 1. See Plumbing Fixture Schedule.

1.3 ACTION SUBMITTALS

- A. Product Data: For countertop materials and sinks.
- B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- C. Samples for Verification: For the following products:
 - 1. Countertop material, 6 inches square.
 - 2. One full-size solid-surface-material countertop, with front edge and integral backsplash, 8 by 10 inches, of construction and in configuration specified.

1.4 PROJECT CONDITIONS

- A. Field Measurements: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete.

1.5 COORDINATION

- A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID-SURFACE-MATERIAL COUNTERTOPS

- A. Configuration: Provide countertops with the following front and backsplash style:
 - 1. Front: Straight, slightly eased at top with solid surface or wood edges as shown on drawings.
 - 2. Backsplash: Straight, slightly eased at corner.
 - 3. Endsplash: Matching backsplash.
- B. Countertops: 1/2-inch- thick, solid surface material with solid surface front edge built up with same material as shown on drawings.
- C. Backsplashes and Side Splashes: 1/4-inch- thick, solid surface material. Test thickness for through visibility in field mockup. Back paint and attach with clear sealant if wall construction telegraphs.
- D. Fabrication: Fabricate tops in one piece with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid-surface-material manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 - 1. Fabricate with loose backsplashes for field assembly at countertops without sinks.
 - 2. Install integral sink bowls in countertops in the shop.

2.2 COUNTERTOP MATERIALS

- A. Solid Surface Material: Homogeneous solid sheets of filled plastic resin complying with ANSI SS1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. E. I. du Pont de Nemours and Company.
 - b. Wilsonart International.
 - 2. Type: Provide Standard Type unless Special Purpose Type is indicated.
 - 3. Finish Schedule.

2.3 SOLID-SURFACE HANDICAPPED ACCESSIBLE DOOR THRESHOLDS

- A. Configuration: Form threshold to custom shape indicated.
 - 1. Custom edge thicknesses to match adjacent different flooring materials. Minimum thickness shall be 3/4" as detailed on drawings.

2. Continuous slope across threshold face to comply with handicapped access standards.
 3. Threshold width shall match door frame.
- B. Exposed milled sloped face to be flat and finished to match factory face standards.
- C. Scribe threshold ends to fit tight against door frame profile.

2.4 ACCESSORIES

- A. Grommets for Cable Passage through Countertops: 2-1/2" OD molded plastic grommets and matching plastic caps with slot for wire passage. Color to match countertop. Grommets shall be field located after placement of owner's equipment. Contractor to assume one grommet per 4' of countertop.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install countertops level to a tolerance of 1/8 inch in 8 feet.
- B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Pre-drill holes for screws as recommended by manufacturer. Align adjacent surfaces and, using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
1. Support all countertops on 3/4" plywood
 2. Install backsplashes and endsplashes which are shipped loose to comply with manufacturer's written instructions for adhesives, sealers, fabrication, and finishing.
 3. Seal edges of cutouts in plywood subtops by saturating with varnish.
- C. Install thresholds at doorways to toilet rooms full width of door. Set thresholds in thinset mortar flush with finish floors on each side of door frame and pitch towards corridor. Chip away concrete as required to set thresholds flush with adjacent materials.

END OF SECTION 123661

SECTION 211313 - WET-PIPE FIRE-SUPPRESSION SPRINKLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Fire-department connections.
4. Sprinklers.
5. Alarm devices.
6. Pressure gages.

1.2 SYSTEM DESCRIPTIONS

- A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.3 PERFORMANCE REQUIREMENTS

- A. Fire Flow Test Data: Contractor shall obtain current fire flow test data and field verify existing conditions prior to the design of the sprinkler systems and submission of drawings and calculations to the Fire Marshall's Office for review.
- B. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- C. Delegated Design: Design sprinkler system(s), including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- D. Sprinkler system design shall be approved by authorities having jurisdiction.
1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Sprinkler Occupancy Hazard Classifications:
 - a. Building Service Areas: Ordinary Hazard, Group 1.

- b. Electrical Equipment Rooms: Ordinary Hazard, Group 1.
 - c. General Storage Areas: Ordinary Hazard, Group 1.
 - d. Boiler/chiller Room: Ordinary Hazard Group 2.
 - e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1.
 - f. Exam Rooms and Public Areas: Light Hazard.
- 3. Minimum Density for Automatic-Sprinkler Piping Design:
 - a. 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.
- 4. Maximum Protection Area per Sprinkler:
 - a. Office Spaces: 225 sq. ft.
 - b. Storage Areas: 130 sq. ft.
 - c. Mechanical Equipment Rooms: 130 sq. ft.
 - d. Electrical Equipment Rooms: 130 sq. ft.
 - e. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.
- 5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:
 - a. Light-Hazard Occupancies: 100 gpm.
 - b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.
- E. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Contractor shall prepare preliminary shop drawings of the installation and shall submit drawings with calculations and product data sheets to the Architect for preliminary review by the Engineer in accordance with plans and specifications.
 - 1. Contractor shall include completed Data Sheet attached as required by the State Fire Marshall's office for Engineer use and verification with preliminary shop drawings and calculations.
 - 2. (See attached data sheet and furnish current flow test data, location and elevation and all test information as applicable)
- C. After receipt of reviewed preliminary shop drawings, contractor shall revise drawings and calculations as required to comply with all preliminary review comments.

- D. Notify Engineer once all items from Preliminary Review are corrected to obtain updated Data Sheet and Certificate of Compliance for submission to the Fire Marshall's Office.
- E. Contractor shall submit revised shop drawings. Updated Data Sheet and Certificate of Compliance to the Fire Marshall's office for review.
 - 1. Contractor shall make all changes necessary for obtaining final approval from the Fire Marshall and the Insurance Underwriter prior to the start of construction.
- F. Review of contractor's drawings shall not relieve him from the responsibility for errors, omissions or deviations from plans and specifications, unless the contractor has called the Owner's attention to such deviations in writing at time of submittal.
- G. Delegated-Design Submittal: For 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.
- H. Qualification Data: For qualified Installer and professional engineer.
- I. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.
- J. Welding certificates.
- K. 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."
- L. Field quality-control reports.
- M. Operation and maintenance data.

1.5 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.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

- 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. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:
 - 1. NFPA 13, "Installation of Sprinkler Systems."

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

- A. Standard Weight, Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 30, Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.
- C. Thinwall, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.
- D. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with plain ends.
- E. Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.
- F. Steel Couplings: ASTM A 865, threaded.
- G. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- H. Malleable- or Ductile-Iron Unions: UL 860.
- I. Cast-Iron Flanges: ASME 16.1, Class 125.

- J. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- K. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.
- L. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. 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:
 - a. Anvil International, Inc.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - 2. Pressure Rating: 175 psig minimum.
 - 3. 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.
 - 4. 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 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch.
 - 1. Class 125, Cast-Iron Flat-Face Flanges: Full-face gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.
- C. 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.

2.4 LISTED FIRE-PROTECTION VALVES

- A. General Requirements:
 - 1. Valves shall be UL listed or FM approved.
 - 2. Minimum Pressure Rating: 175 psig.
- B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following.
 - a. AFAC Inc.
 - b. Anvil International, Inc.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Fire-End & Croker Corporation.
 - e. Fire Protection Products, Inc.
 - f. Globe Fire Sprinkler Corporation.
 - g. Kennedy Valve; a division of McWane, Inc.
 - h. Milwaukee Valve Company.
 - i. Mueller Co.; Water Products Division.
 - j. NIBCO INC.
 - k. Reliable Automatic Sprinkler Co., Inc.
 - l. Tyco Fire & Building Products LP.
 - m. Victaulic Company.
 - n. Viking Corporation.
 - o. Watts Water Technologies, Inc.
2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

C. Bronze OS&Y Gate Valves:

1. 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:
 - a. Crane Co.; Crane Valve Group; Stockham Division
 - b. Anvil International
 - c. Milwaukee Valve Company.
 - d. NIBCO INC.
 - e. United Brass Works, Inc.
 - f. Watts Water Technologies, Inc.
2. Standard: UL 262.
3. Pressure Rating: 175 psig.
4. Body Material: Bronze.
5. End Connections: Threaded.

D. Iron OS&Y Gate Valves:

1. 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:
 - a. Crane Co.; Crane Valve Group; Stockham Division.
 - b. Hammond Valve.
 - c. Milwaukee Valve Company.
 - d. Mueller Co.; Water Products Division.
 - e. NIBCO INC.
 - f. Tyco Fire & Building Products LP.
 - g. United Brass Works, Inc.
 - h. Watts Water Technologies, Inc.
2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.

B. Ball Valves:

1. 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:
 - a. Anvil International, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Fire-End & Croker Corporation.
 - d. Fire Protection Products, Inc.
 - e. Flowserve.
 - f. Kennedy Valve; a division of McWane, Inc.
 - g. Milwaukee Valve Company.
 - h. NIBCO INC.
 - i. Tyco Fire & Building Products LP.
 - j. Victaulic Company.
 - k. Watts Water Technologies, Inc.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Minimum Pressure Rating: 175 psig.
3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Globe Fire Sprinkler Corporation.
 - c. Reliable Automatic Sprinkler Co., Inc.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Viking Corporation.
2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain without valves and separate from main drain piping.
6. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AFAC Inc.
 - b. Reliable Automatic Sprinkler Co., Inc.
 - c. Tyco Fire & Building Products LP.
 - d. Viking Corporation.
2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 FIRE-DEPARTMENT CONNECTIONS

A. Flush-Type, Fire-Department Connection:

1. 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:
 - a. AFAC Inc.
 - b. Elkhart Brass Mfg. Company, Inc.
 - c. GMR International Equipment Corporation.
 - d. Guardian Fire Equipment, Inc.
 - e. Potter Roemer.
2. Standard: UL 405.
3. Type: Flush, for wall mounting.
4. Pressure Rating: 175 psig minimum.
5. Body Material: Corrosion-resistant metal.
6. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
7. Caps: Brass, lugged type, with gasket and chain.
8. Escutcheon Plate: Rectangular, brass, wall type.
9. Outlet: With pipe threads.
10. Body Style: Horizontal.
11. Number of Inlets: Two.
12. Outlet Location: Back.
13. Escutcheon Plate Marking: Similar to "AUTO SPKR."
14. Finish: Polished chrome plated.
15. Outlet Size: NPS 4.

2.8 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. 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:
 - a. Anvil International, Inc.
 - b. National Fittings, Inc.
 - c. Shurjoint Piping Products.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
2. Standard: UL 213.

3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Sprinkler Inspector's Test Fittings:

1. 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:
 - a. AGF Manufacturing Inc.
 - b. Reliable Automatic Sprinkler
 - c. Triple R Specialty.
 - d. Tyco Fire & Building Products LP.
 - e. Victaulic Company.
 - f. Viking Corporation.
2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Adjustable Drop Nipples:

1. 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:
 - a. CECA, LLC.
 - b. Corcoran Piping System Co.
 - c. Merit Manufacturing; a division of Anvil International, Inc.
2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

2.9 SPRINKLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AFAC Inc.
 - 2. Globe Fire Sprinkler Corporation.
 - 3. Reliable Automatic Sprinkler Co., Inc.
 - 4. Tyco Fire & Building Products LP.
 - 5. Viking Corporation.
- B. General Requirements:
 - 1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
 - 2. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
 - 3. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum
- C. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Nonresidential Applications: UL 199.
 - 2. Characteristics: Quick response, 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.
- D. Sprinkler Finishes:
 - 1. Chrome plated.
 - 2. Bronze.
- E. Special Coatings:
 - 1. Wax.
- F. 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: Chrome-plated steel, one piece, flat.
 - 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- G. Sprinkler Guards:
 - 1. 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:

- a. Reliable Automatic Sprinkler Co., Inc.
 - b. Tyco Fire & Building Products LP.
 - c. Victaulic Company.
 - d. Viking Corporation.
2. Standard: UL 199.
 3. Type: Wire cage with fastening device for attaching to sprinkler.

2.10 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Water-Flow Indicators:

1. 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:
 - a. ADT Security Services, Inc.
 - b. McDonnell & Miller; ITT Industries.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.
 - e. Viking Corporation.
 - f. Watts Industries (Canada) Inc.
2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.
6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

C. Valve Supervisory Switches:

1. 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:
 - a. Fire-Lite Alarms, Inc.; a Honeywell company.
 - b. Kennedy Valve; a division of McWane, Inc.
 - c. Potter Electric Signal Company.
 - d. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

PART 3 - EXECUTION

3.1 WATER-SUPPLY CONNECTIONS

- A. Connect sprinkler piping to building's interior water-distribution piping. Comply with requirements for interior piping in Division 15 Section "Domestic Water Piping."
- B. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.2 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 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.
- B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.
- C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.
- 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 alarm devices in piping systems.
- K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
- L. 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 will not be subject to freezing.
- M. Fill sprinkler system piping with water.
- N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 15 Section "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 15 Section "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 Division 15 Section "Escutcheons for Fire-Suppression Piping."

3.3 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. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.
- I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- J. 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.
- K. 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.
- L. 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.
- M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.
- N. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.4 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. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.5 SPRINKLER INSTALLATION

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.
- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.6 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.

3.7 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 Division 16 Section "Electrical Identification."

3.8 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 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. Coordinate with fire-pump tests. Operate as required.
 7. Verify that equipment hose threads are same as local fire-department equipment.
- C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.9 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

- A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends and grooved joints.
- B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.
- C. Wet-pipe sprinkler system, NPS 2 and smaller, shall be the following:
 1. Standard-weight, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- D. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 6, shall be one of the following:
 1. Standard-weight, black-steel pipe with cut or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
 2. Thinwall black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Recessed sprinklers or Concealed sprinklers
Wall Mounting: Sidewall sprinklers.
3. Rooms with gypsum ceilings: Concealed sprinklers.
4. Spaces Subject to Freezing: Pendent, dry sprinklers sidewall, dry sprinklers
Special Applications: Extended-coverage, quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
3. Upright, Pendent and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

Project Data				
Project name: Seacoast Hospital New Bed Tower Shell (project 0370.30)				
Location in South Carolina:	Address (street # & street name): 4000 Highway 9 East			State project: ☐ Yes ☒ No
	City: Little River	County: Horry	State project #: NA	
Water Supply Information (flow test data must be less than 1 year old per §40-10-250(A)(1))				
Date test conducted:	06 / 24 / 2015	Static pressure (psi): 60	Residual pressure (psi): 58	Flow (gpm): 1130
Distances of test gauges relative to the base of the riser:		Horizontal (ft): 975	Vertical (elevation difference in ft): 4	
Source of water supply:	☐ Municipal dead-end ☒ Municipal circulation ☐ Other:			Pipe Size (in.): 6
Test data by/from:	Name: Steven Shadron, Derrick Elliott		Title: Technician	
	Organization: Little River Water and Sewerage Co.		Telephone #: 843-399-1888	
Fire pump:	X Yes ☐ No	Pump Capacity (gpm): 1000	Churn Pressure (psi): 156	
	X New ☐ Existing	Rated Pressure 140: NA	Pressure @ 150% flow (psi): 115	
On-site storage tank:	☐ Yes ☒ No	☐ New ☒ Existing	Tank capacity (gallons): NA	
NFPA Hazard Classification (attach continuation page when necessary)				
Area #	Class or Code Reference	Description of Hazard Protected (commodity description, storage height, and arrangement as applicable.)		
1	Light Hazard	Exam Rooms, Public Areas		
2	Ordinary Hazard Group 1	Electrical rooms, Storage Rooms, Building service areas, Mechanical Rooms		
Design Parameters (attach continuation page when necessary)				
Area #	System Type	Density (gpm/ft ²) / Area (ft ²) or Other (reference code section)	Inside Hose (gpm)	Outside Hose (gpm)
1	Wet	0.10gpm/ft ² / 1500 ft ²	0	100 gpm
2	Wet	0.15gpm/ft ² / 1500 ft ²	0	250 gpm
Seismic Design Data: S _s = 0.474				
Codes and Standards (attach continuation page when necessary)				
Applicable Codes, Standards & Editions (i.e. "2006 IBC", "2007 NFPA 13", etc.) for the Scope of Work on the Sprinkler System				
NFPA 13, 2016 edition, SCBC, 2018 edition, IFC, 2018 edition				
Scope of work: New Bed Tower Upfit. Notes: 1 st floor is Public Areas and Offices, 2 nd and 3 rd Floor are Patient Care.				
Specifier's Information				
Name: Don Bailey				
Engineering services provided through a firm: ☒ Yes ☐ No				
Firm name: Design Strategies, LLC				
Address: 130 S. Main St.				
City: Greenville				
State: SC	Zip:			
Phone #:	Fax #: 864-527-6501			
E-mail: dbailey@designstrategies.net		Certificate of Authorization	Professional Engineer's Seal	

Project Data			
Project name: Seacoast Hospital New Bed Tower (project 0370.30)			
Location in South Carolina:	Address (street # & street name): 4000 Highway 9 East		State project: ☐ Yes ☒ No
	City: Little River	County: Horry	State project #: NA
Drawing Information			
Fire Sprinkler Contractor (company name):			License #:
Drawing #	Title	Revision #	Date (MM/DD/YYYY)
Notes:			
Notice			
The engineer who prepared the Fire Protection Sprinkler System Specification Sheet and reviewed and approved the sprinkler system shop drawings must complete this form before a certificate of occupancy may be issued. The completed certificate must be delivered to the owner of the building and to the authority having jurisdiction per §40-10-260 (D).			
Certification Statement			
<i>By sealing this form, I hereby confirm that I have reviewed the fire protection sprinkler system layout (shop) drawings, related calculations, and documents for the above project. Based upon my review, the documents comply with the design criteria indicated on the Fire Protection Sprinkler System Specification Sheet.</i>			
Certifier's Information			
Name: Don Bailey			
Engineering services provided through a firm: ☒ Yes ☐ No			
Firm name: Design Strategies, LLC			
Address: 130 S. Main St.			
City: Greenville			
State: SC Zip: 29601			
Phone #: 864-527- Fax #: 864-233-8385 6500			
E-mail: dbailey@designstrategies.net			
		Certificate of Authorization	Professional Engineer's Seal

SECTION 220529 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

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 pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

- B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 21 fire-suppression piping Sections for pipe hangers for fire-suppression piping.
3. Division 22 Section "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
4. Division 22 Section "Vibration and Seismic Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.
- D. Welding certificates.

1.6 QUALITY ASSURANCE

- A. Structural Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

- B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.

B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

- 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. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.
 4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.

9. Value Engineered Products, Inc.

- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: ASTM C 552, Type II cellular glass with 100-psig, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 Finishes

A. Indoor Finishes

- 1. Hangers and clamps for support of bare copper piping shall be coated with copper colored epoxy paint, B-Line Dura-Copper®. Additional PVC coating of the epoxy painted hanger shall be used where necessary.
- 2. Hangers for other than bare copper pipe shall be zinc plated in accordance with ASTM B633 OR shall have an electro-deposited green epoxy finish, B-Line Dura-Green®.
- 3. Strut channels shall be pre-galvanized in accordance with ASTM A653 SS Grade 33 G90 OR have an electro-deposited green epoxy finish, B-Line Dura-Green®.

B. Outdoor and Corrosive Area Finishes

1. Hangers and strut located outdoors shall be hot dip galvanized after fabrication in accordance with ASTM A123. All hanger hardware shall be hot dip galvanized or stainless steel. Zinc plated hardware is not acceptable for outdoor or corrosive use.
2. Hangers and strut located in corrosive areas shall be type 304 [316] stainless steel with stainless steel hardware.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- D. Fastener System Installation:
 1. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
 2. Powder driven fasteners not allowed.
- E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

- G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- H. Install lateral bracing with pipe hangers and supports to prevent swaying.
- I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- L. Insulated Piping:
 - 1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
 - 2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
 - 4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/2 to NPS 3: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.

5. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

- A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.
- B. Grouting: Place grout under supports for equipment and make bearing surface smooth.
- C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

- A. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- B. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

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 a minimum dry film thickness of 2.0 mils.

- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09 painting Sections. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers, and attachments for general service applications.
- F. Use zinc-plated pipe hangers and attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
 2. Pipe Hangers (MSS Type 5): For suspension of pipes (NPS 1/2 to NPS 4), to allow off-center closure for hanger installation before pipe erection.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps MSS Type 8: For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps MSS Type 42: For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

- K. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 5. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 6. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 7. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- L. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- M. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- N. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- O. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548 – PLUMBING VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads and mounts.
2. Restrained elastomeric isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Thrust limits.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Seismic snubbers.
12. Restraining cables.

1.2 PERFORMANCE REQUIREMENTS

- A. Component Amplification Factor: $A_p = 2.5$ for vibration isolated equipment.
- B. Component Importance: Factor = $I_p = 1.0$.
- C. Height Factor: $h = 60$ feet.

1.3 SUBMITTALS

- A. Product Data: Include load deflection curves for each vibration isolation device indicated.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:
1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building

structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.

3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
5. Details for Interlocking Snubbers: Include load deflection curves up to 1/2-inch deflection in x, y, and z planes.

1.4 QUALITY ASSURANCE

- A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to International Building Code Chapter 16 and shall bear anchorage preapproval "R" number. 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) to support seismic-restraint designs must be signed and sealed by a registered professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.
- B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 VIBRATION ISOLATORS

- A. Manufacturers:

1. Amber/Booth Company, Inc.
 2. B-Line Systems, Inc.
 3. Isolation Technology, Inc.
 4. Kinetics Noise Control, Inc.
 5. Mason Industries, Inc.
- B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.
1. Material: Standard neoprene.
 2. Durometer Rating: 30.
 3. Number of Layers: 1.
- C. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.
1. Durometer Rating: 30.
- D. Restrained Elastomeric Mounts: All-directional elastomeric mountings with seismic restraint.
1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.
 2. Neoprene: Shock-absorbing materials compounded according to, the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch-thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig.
 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

- F. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.
1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
 2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
 5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
 7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch movement at start and stop.
- G. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch-thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig and for equal resistance in all directions.
- H. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch-thick, 60-durometer neoprene. Factory set guide height with a shear pin to allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.3 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers:
1. Amber/Booth Company, Inc.
 2. B-Line Systems, Inc.
 3. Kinetics Noise Control, Inc.
 4. Loos & Co., Inc.; Cableware Technology Division.
 5. Mason Industries, Inc.
 6. TOLCO Incorporated.
 7. Unistrut Diversified Products Co.; Wayne Manufacturing Division.
 8. Vibration Eliminator Co., Inc.
 9. Vibration Isolation Co., Inc.
 10. Vibration Mountings & Controls/Korfund.

- B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5, with a flat washer face.
- C. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.
 - 1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
 - 2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40, plus or minus 5.
- D. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.
- E. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."
- B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.
- C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
- D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.
- E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.
- F. Install resilient bolt isolation washers on equipment anchor bolts.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect isolator seismic-restraint clearance.
2. Test isolator deflection.
3. Inspect minimum snubber clearances.

3.3 ADJUSTING

- A. Adjust isolators after piping systems have been filled and equipment is at operating weight.
- B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.
- C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch movement during start and stop.
- D. Adjust air spring leveling mechanism.
- E. Adjust active height of spring isolators.
- F. Adjust snubbers according to manufacturer's written recommendations.
- G. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.
- H. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

END OF SECTION 220548

SECTION 220553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

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. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- D. Valve numbering scheme.
- E. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.

- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Metal Labels for Equipment:

1. Material and Thickness: Brass, 0.032-inch, Stainless steel, 0.025-inch, Aluminum, 0.032-inch or anodized aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
2. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
3. 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-fourths the size of principal lettering.
4. Fasteners: Stainless-steel rivets or self-tapping screws.
5. 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-fourths 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), plus 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), plus 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: White.
- C. Background Color: Red.
- 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-fourths 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.
- B. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full 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, 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 1-1/2 inches high.

2.4 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 1. Stencil Material: Aluminum.
 2. Stencil Paint: Exterior, gloss, acrylic enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 3. Identification Paint: Exterior, acrylic enamel in colors according to ASME A13.1 unless otherwise indicated.

2.5 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 1. Tag Material: Brass, 0.032-inch, Stainless steel, 0.025-inch, or Aluminum, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 2. Fasteners: Brass wire-link or beaded chain; or S-hook.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 1. Valve-tag schedule shall be included in operation and maintenance data.

2.6 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 1. Size: Approximately 4 by 7 inches.
 2. Fasteners: Brass grommet and wire.
 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."

4. Color: Yellow background with black lettering.

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 in Division 9 Section "Interior Painting."
- B. 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 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. Low-Pressure, Compressed-Air Piping:
 - a. Background Color: Yellow.
 - b. Letter Color: Black.

2. Medium-Pressure, Compressed-Air Piping:

- a. Background Color: Yellow.
- b. Letter Color: Black.

3. Domestic Water Piping:

- a. Background Color: White.
- b. Letter Color: Green.

4. Sanitary Waste and Storm Drainage Piping:

- a. Background Color: White.
- b. Letter Color: Black.

3.4 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:

- a. Cold Water: inches round.
- b. Hot Water: 2 inches round.
- c. Low-Pressure Compressed Air: 2 inches round.
- d. High-Pressure Compressed Air: 2 inches round.

2. Valve-Tag Color:

- a. Cold Water: Green.
- b. Hot Water: Green.
- c. Low-Pressure Compressed Air: Natural.
- d. High-Pressure Compressed Air: Natural.

3. Letter Color:

- a. Cold Water: White.
- b. Hot Water: White.
- c. Low-Pressure Compressed Air: Black.
- d. High-Pressure Compressed Air: Black.

3.5 WARNING-TAG INSTALLATION

- A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

SECTION 220716 - PLUMBING EQUIPMENT 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 plumbing equipment:
 - 1. Domestic water, hot-water and cold-water.
- B. Related Sections:
 - 1. Division 22 Section "Plumbing Piping Insulation."

1.3 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).
- B. Samples: For each type of insulation and jacket indicated. Identify each Sample, describing product and intended use. Sample sizes are as follows:
 - 1. Sheet Form Insulation Materials: 12 inches square.
 - 2. Sheet Jacket Materials: 12 inches square.
 - 3. Manufacturer's Color Charts: For products where color is specified, show the full range of colors available for each type of finish material.
- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

- E. Field quality-control reports.

1.4 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with equipment Installer for equipment insulation application.
- C. Coordinate installation and testing of heat tracing.

1.7 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 "Domestic Water Boiler Breeching Insulation Schedule" and "Equipment 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. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Sheet and K-FLEX LS.
- G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- H. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
2. 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.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Super-Stik.

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. Calcium Silicate Adhesive: Fibrous, sodium-silicate-based adhesive with a service temperature range of 50 to 800 deg F.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-97.
 - b. Eagle Bridges - Marathon Industries; 290.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-27.
 - d. Mon-Eco Industries, Inc.; 22-30.
 - e. Vimasco Corporation; 760.
 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.

- C. 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. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-84.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.
- D. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Aeroflex USA, Inc.; Aeroseal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.
- E. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.
- F. 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. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, 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.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.

2.4 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.

5. Color: White or gray.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

2.5 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.

2.6 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, available products that may be incorporated into the Work include, but are not limited to, 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. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:

- a. ABI, Ideal Tape Division; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.7 SECUREMENTS

A. Bands:

1. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, 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; 0.015 inch thick, 1/2 inch wide with 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 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, 0.106-inch-0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, 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. 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.
 - a. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, 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: 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.
3. 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.
 - a. Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, 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: 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.
4. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick, 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, products that may be incorporated into the Work include, but are not limited to, 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.
- 5. 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, manufacturers offering products that may be incorporated into the Work include, but are not limited to, 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, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. C & F Wire.

2.8 CORNER ANGLES

- A. 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.
- B. 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.

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 and equipment 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.
- B. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
- C. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.
- D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment.
- B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item 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. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

- H. Install insulation with least number of joints practical.
- I. 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.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. 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 4 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.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. 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.

O. 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.

3.4 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.

3.5 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. 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.

3.6 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 09 painting Sections.

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.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. Tests and Inspections:
 - 1. Inspect field-insulated equipment, 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 two locations for each type of equipment defined in the "Equipment Insulation Schedule" Article. For large equipment, remove only a portion adequate to determine compliance.
- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.8 EQUIPMENT INSULATION SCHEDULE

- A. Insulation materials and thicknesses are identified below. If more than one material is listed for a type of equipment, selection from materials listed is Contractor's option.
- B. Insulate indoor and outdoor equipment that is not factory insulated.
- C. Domestic water pump insulation shall be one of the following:
 - 1. Cellular Glass: 2 inches thick.
 - 2. Mineral-Fiber Blanket: 1 inch thick and 3-lb/cu. ft. nominal density.
 - 3. Mineral-Fiber Board: 1 inch thick and 3-lb/cu. ft. nominal density.

3.9 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. Equipment, Concealed:

1. None.

D. Equipment, Exposed, up to (48 Inches) in Diameter or with Flat Surfaces up to (72 Inches):

1. PVC (20 mils thick.
2. Aluminum, Corrugated: 0.020 inch thick.
3. Painted Aluminum, Corrugated: 0.020 inch thick.
4. Stainless Steel, Type 304, Smooth 2B Finish 0.016 inch thick.

E. Equipment, Exposed, Larger Than (48 Inches) in Diameter or with Flat Surfaces Larger Than (72 Inches):

1. Painted Aluminum, 1 Inch- Deep Corrugations 0.032 inch thick.
2. Stainless Steel, Type 304 Smooth 0.024 inch thick.

END OF SECTION 220716

SECTION 220719 - PLUMBING PIPING INSULATION

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. Section includes insulating the following plumbing piping services:
 - 1. Domestic cold-water piping.
 - 2. Domestic hot-water piping.
 - 3. Domestic recirculating hot-water piping.
 - 4. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 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).

1.4 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 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports for Plumbing Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.7 SCHEDULING

- A. Schedule insulation application after pressure testing systems. 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 "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.
- B. Products shall not contain asbestos, lead, mercury, or mercury compounds.
- C. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.
- D. 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. Products: Subject to compliance with requirements, provide one of the following:

- a. Pittsburgh Corning Corporation; Foamglas.
 2. Block Insulation: ASTM C 552, Type I.
 3. Special-Shaped Insulation: ASTM C 552, Type III.
 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.
- E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aerocel.
 - b. Armacell LLC; AP Armaflex.
 - c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.
- F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- G. Mineral-Fiber, Preformed Pipe Insulation:
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 2. 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.
- H. Phenolic:

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Kingspan Tarec Industrial Insulation NV; Koolphen K.
 - b. Resolco International BV; Insul-phen.
 2. Preformed pipe insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type III, Grade 1.
 3. Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.
 4. Factory fabricate shapes according to ASTM C 450 and ASTM C 585.
 5. Factory-Applied Jacket: ASJ. Requirements are specified in "Factory-Applied Jackets" Article.
- I. Polyolefin: Unicellular, polyethylene thermal plastic insulation. Comply with ASTM C 534 or ASTM C 1427, Type I, Grade 1 for tubular materials.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Armacell LLC; Tubolit.
 - b. Nomaco Insulation; IMCOLOCK and NOMALOCK.

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. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.
1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Aeroflex USA, Inc.; Aero seal.
 - b. Armacell LLC; Armaflex 520 Adhesive.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
 - d. K-Flex USA; R-373 Contact Adhesive.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.
- C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

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-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.
- D. Phenolic Adhesive: Solvent-based resin adhesive, with a service temperature range of minus 75 to plus 300 deg F.
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-96.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 81-33.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 3. Use adhesive that complies 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," including 2004 Addenda.
- E. 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; 85-20.
 - d. Mon-Eco Industries, Inc.; 22-25.
 2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

3. Use adhesive that complies 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," including 2004 Addenda.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Dow Corning Corporation; 739, Dow Silicone.
 - b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
 - c. P.I.C. Plastics, Inc.; Welding Adhesive.
 - d. Speedline Corporation; Polyco VP Adhesive.
2. For indoor applications, use adhesive that has a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Use adhesive that complies 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," including 2004 Addenda.

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.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.

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-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
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; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.
 4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
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-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F. Solids Content: 60 percent by volume and 66 percent by weight.
 4. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A, and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. 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-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.5 SEALANTS

- A. Joint Sealants:
1. Joint Sealants for Cellular-Glass and Phenolic 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-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
 - d. Mon-Eco Industries, Inc.; 44-05.
 - e. Pittsburgh Corning Corporation; Pittseal 444.
 2. Materials shall be compatible with insulation materials, jackets, and substrates.
 3. Permanently flexible, elastomeric sealant.
 4. Service Temperature Range: Minus 100 to plus 300 deg F.
 5. Color: White or gray.
 6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 7. Use sealants that 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," including 2004 Addenda.

B. FSK and Metal Jacket Flashing Sealants:

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-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

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-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Use sealants that 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," including 2004 Addenda.

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.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.
 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; Chil-Glas Number 10.
- B. 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.
 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; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.
- B. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Division 1 Section "Product Requirements."
 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

- B. 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. Products: Subject to compliance with requirements, provide one of the following:
 - a. Johns Manville; Zeston.
 - b. P.I.C. Plastics, Inc.; FG Series.
 - c. Proto Corporation; LoSmoke.
 - d. Speedline Corporation; SmokeSafe.
 2. Adhesive: As recommended by jacket material manufacturer.
 3. Color: White.
 4. 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.
 - 1) Available.

2.10 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. FSK Tape: Foil-face, 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; 491 AWF FSK.
 - b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
 - c. Compac Corporation; 110 and 111.
 - d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
 2. Width: 3 inches.
 3. Thickness: 6.5 mils.
 4. Adhesion: 90 ounces force/inch in width.
 5. Elongation: 2 percent.
 6. Tensile Strength: 40 lbf/inch in width.
 7. 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. Products: Subject to compliance with requirements provide one of the following:
 - a. ABI, Ideal Tape Division; 370 White PVC tape.
 - b. Compac Corporation; 130.
 - c. Venture Tape; 1506 CW NS.
 2. Width: 2 inches.
 3. Thickness: 6 mils.
 4. Adhesion: 64 ounces force/inch in width.
 5. Elongation: 500 percent.
 6. Tensile Strength: 18 lbf/inch in width.
- D. 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 width.

2.11 PROTECTIVE SHIELDING GUARDS

- A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Engineered Brass Company.
 - b. McGuire Manufacturing.
 - c. Plumberex.
 - d. Truebro; a brand of IPS Corporation.
 - e. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.
2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

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.
- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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 4 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. Cleanouts.

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 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 Division 7 Section "Through-Penetration Firestop Systems" 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 Division 7 Section "Through-Penetration Firestop Systems."

3.5 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.

3.6 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.

3.7 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.
- B. Insulation Installation on Pipe Flanges:
 1. Install 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 sheet insulation of same thickness as pipe insulation.
 4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- C. Insulation Installation on Pipe Fittings and Elbows:
 1. Install mitered sections of pipe insulation.
 2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.
- D. Insulation Installation on Valves and Pipe Specialties:
 1. Install preformed valve covers manufactured of same material as pipe insulation when available.
 2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
 3. Install insulation to flanges as specified for flange insulation application.
 4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 INSTALLATION OF MINERAL-FIBER 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.

3.9 INSTALLATION OF PHENOLIC INSULATION

A. General Installation Requirements:

1. Secure single-layer insulation with stainless-steel bands at 12-inch intervals and tighten bands without deforming insulation materials.

2. Install 2-layer insulation with joints tightly butted and staggered at least 3 inches. Secure inner layer with 0.062-inch wire spaced at 12-inch intervals. Secure outer layer with stainless-steel bands at 12-inch intervals.

B. 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 with vapor retarders 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.

C. 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 block insulation of same material and thickness as pipe insulation.

D. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.

E. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed insulation sections of same material as straight segments of pipe insulation. Secure according to manufacturer's written instructions.
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.

3.10 INSTALLATION OF POLYOLEFIN INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Seal split-tube longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install 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 polyolefin sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of polyolefin pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install cut sections of polyolefin pipe and sheet 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.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.11 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. 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.
- C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. 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.
- D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches and at end joints.

3.12 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
 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.

3.13 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections.
- C. 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.

- D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.14 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.

3.15 INDOOR PIPING INSULATION SCHEDULE

- A. Domestic Cold Water:
 - 1. NPS 1 and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1 inch thick.
 - b. Flexible Elastomeric: 1/2 inch Phenolic: 1/2 inch thick.
 - c. Polyolefin: 1/2 inch thick.
 - 2. NPS 1-1/4 and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1 inch thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Phenolic: 1 inch thick.
 - e. Polyolefin: 3/4 inch thick.
- B. Domestic Hot and Recirculated Hot Water:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be one of the following:
 - a. Cellular Glass: 1 inch thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Phenolic: 1 inch thick.

- e. Polyolefin: 3/4 inch thick.
- 2. NPS 1-1/2 and Larger: Insulation shall be one of the following:
 - a. Cellular Glass: 1-1/2 inches thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Phenolic: 1 inch thick.
 - e. Polyolefin: 1 inch thick.
- C. Stormwater and Overflow:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1 inch thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Phenolic: 1 inch thick.
 - e. Polyolefin: 1 inch thick.
- D. Roof Drain and Overflow Drain Bodies:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Cellular Glass: 1" thick.
 - b. Flexible Elastomeric: 1 inch thick.
 - c. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.
 - d. Phenolic: 1 inch thick.
 - e. Polyolefin: 1 inch thick.
 - f.
- E. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
 - 1. All Pipe Sizes: Insulation shall be one of the following:
 - a. Flexible Elastomeric: 1/2 inch thick.
 - b. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1/2 inch thick.
 - c. Polyolefin: 1/2 inch thick.

3.16 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. All Service Jacket
 - 2. PVC: 20 mils thick.
- D. Piping, Exposed:
 - 1. All Service Jacket
 - 2. PVC: 20 mils thick.

3.17 OUTDOOR, 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
- D. Piping, Exposed:
 - 1. PVC: 20 mils thick.

END OF SECTION 220719

SECTION 221116 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes domestic water piping inside the building.
- B. Water meters will be furnished and installed by utility company.
- C. See Division 2 Section "Water Distribution" for water-service piping and water meters outside the building from source to the point where water-service piping enters the building.
- D. See Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
- E. See Division 15 Section "Plumbing Specialties" for water distribution piping specialties.

1.2 SUBMITTALS

- A. Field quality-control test reports.

1.3 QUALITY ASSURANCE

- A. Comply with NSF 61, "Drinking Water System Components - Health Effects; Sections 1 through 9," for potable domestic water piping and components.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Refer to Part 3 "Pipe and Fitting Applications" Article for applications of pipe, tube, fitting, and joining materials.
- B. Transition Couplings for Aboveground Pressure Piping: Coupling or other manufactured fitting the same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
1. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 2. Malleable-Iron Unions: ASME B16.39, Class 150, hexagonal-stock body, with ball-and-socket, metal-to-metal, bronze seating surface and female threaded ends.
 3. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 4. Cast-Iron Flanges: ASME B16.1, Class 125.
 5. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
 6. Steel-Piping, Expansion Joints: Compound, galvanized steel fitting with telescoping body and slip-pipe section. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
 7. Steel-Piping, Double Expansion Joints: Compound, galvanized steel fitting with telescoping body and two slip-pipe sections. Include packing rings, packing, limit rods, chrome-plated finish on slip-pipe sections, and flanged ends.
- D. Soft Copper Tube: ASTM B 88, Types K and L, water tube, annealed temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- E. Hard Copper Tube: ASTM B 88, Type L, water tube, drawn temper.
1. Copper Pressure Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint fittings. Furnish wrought-copper fittings if indicated.
 2. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Furnish Class 300 flanges if required to match piping.
 3. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.

2.2 VALVES

- A. Bronze and cast-iron, general-duty valves are specified in Division 22 Section "Valves."
- B. Balancing and drain valves are specified in Division 22 Section "Plumbing Specialties."

- C. Union Ball Valves: MSS SP-122, with full-port ball, threaded detachable end connectors, and pressure rating not less than 125 psig at 73 deg F.
- D. Non-Union Ball Valves: MSS SP-122, with full- or reduced-port ball, socket or threaded ends, and pressure rating not less than 125 psig 150 psig at 73 deg F.
- E. Check Valves: Swing or ball-check design and pressure rating not less than 150 psig at 73 deg F.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.2 PIPE AND FITTING APPLICATIONS

- A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
- B. Flanges may be used on aboveground piping, unless otherwise indicated.
- C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.
- D. Under-Building-Slab, Water-Service Piping on Service Side of Water Meter: Refer to Division 33 Section "Water Distribution."
- E. Domestic Water Piping on Service Side of Water Meter inside the Building: Use the following piping materials for each size range:
 - 1. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
- F. Under-Building-Slab, Domestic Water Piping on House Side of Water Meter, NPS 4 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
- G. Aboveground Domestic Water Piping: Use the following piping materials for each size range:
 - 1. NPS 1 and Smaller: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
 - 2. NPS 1-1/4 and NPS 1-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

3. NPS 2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
4. NPS 2-1/2 to NPS 3-1/2: Hard copper tube, Type L; copper pressure fittings; and soldered joints.
5. NPS 4 to NPS 6: Hard copper tube, Type L; copper pressure fittings; and soldered joints.

3.3 VALVE APPLICATIONS

- A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 1. Shutoff Duty: Use bronze ball or gate valves for piping NPS 2 and smaller. Use cast-iron butterfly or gate valves with flanged ends for piping NPS 2-1/2 and larger.
 2. Throttling Duty: Use bronze ball or globe valves for piping NPS 2 and smaller. Use cast-iron butterfly valves with flanged ends for piping NPS 2-1/2 and larger.
 3. Hot-Water-Piping, Balancing Duty: Calibrated balancing valves.
 4. Drain Duty: Hose-end drain valves.
- B. Ball, butterfly, and check valves may be used in matching piping materials.
- C. Install shutoff valve close to water main on each branch and riser serving plumbing fixtures or equipment, on each water supply to equipment, and on each water supply to plumbing fixtures that do not have supply stops. Use ball or gate valves for piping NPS 2 and smaller. Use butterfly or gate valves for piping NPS 2-1/2 and larger.
- D. Install drain valves for equipment at base of each water riser, at low points in horizontal piping, and where required to drain water piping.
 1. Install hose-end drain valves at low points in water mains, risers, and branches.
 2. Install stop-and-waste drain valves where indicated.
- E. Install balancing valve in each hot-water circulation return branch and discharge side of each pump and circulator. Set balancing valves partly open to restrict but not stop flow. Use ball valves for piping NPS 2 and smaller and butterfly valves for piping NPS 2-1/2 and larger. Balancing valves are specified in Division 15 Section "Plumbing Specialties."
- F. Install calibrated balancing valves in each hot-water circulation return branch and discharge side of each pump and circulator. Set calibrated balancing valves partly open to restrict but not stop flow. Calibrated balancing valves are specified in Division 15 Section "Plumbing Specialties."

3.4 PIPING INSTALLATION

- A. Basic piping installation requirements are specified in Division 22 Section "Basic Materials and Methods."
- B. Install under-building-slab copper tubing according to CDA's "Copper Tube Handbook."
- C. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Materials and Methods."
- D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve, inside the building at each domestic water service entrance. Pressure gages are specified in Division 22 Section "Meters and Gages," and drain valves and strainers are specified in Division 22 Section "Plumbing Specialties."
- E. Install domestic water piping level without pitch and plumb.
- F. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

3.5 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Materials and Methods."
- B. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.
- C. Extruded-Tee Connections: Form tee in copper tube according to ASTM F 2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

3.6 ROUGHING-IN FOR WATER METERS

- A. Rough-in domestic water piping for water meter installation according to utility company's requirements.
- B. Water meters will be furnished and installed by Contractor.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Pipe hanger and support devices are specified in Division 22 Section "Hangers and Supports." Install the following:
 - 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 - 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet: MSS Type 49, spring cushion rolls, if indicated.
 - 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 - 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- B. Install supports according to Division 22 Section "Hangers and Supports."
- C. Support vertical piping and tubing at base and at each floor.
- D. Rod diameter may be reduced 1 size for double-rod hangers, to a minimum of 3/8 inch.
- E. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4 and Smaller: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3 and NPS 3-1/2: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
- F. Install supports for vertical steel piping every 15 feet.
- G. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
 - 2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 4. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 6. NPS 6: 10 feet with 5/8-inch rod.
- H. Install supports for vertical copper tubing every 10 feet.

- I. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.8 CONNECTIONS

- A. Install piping adjacent to equipment and machines to allow service and maintenance.
- B. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.
- C. Connect domestic water piping to water-service piping with shutoff valve, and extend and connect to the following:
 1. Water Heaters: Cold-water supply and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
 2. Plumbing Fixtures: Cold- and hot-water supply piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 15 Section "Plumbing Fixtures."
 3. Equipment: Cold- and hot-water supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.9 FIELD QUALITY CONTROL

- A. Inspect domestic water piping as follows:
 1. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
 2. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
 - a. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - b. Final Inspection: Arrange final inspection for authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
 3. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
 4. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- B. Test domestic water piping as follows:

1. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
2. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
3. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
4. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
5. Repair leaks and defects with new materials and retest piping or portion thereof until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.10 CLEANING

- A. Clean and disinfect potable domestic water piping using purging and disinfecting procedures prescribed by authorities having jurisdiction.
- B. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.
- C. Prepare and submit reports of purging and disinfecting activities.

END OF SECTION 221116

SECTION 221119 - DOMESTIC WATER PIPING 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 domestic water piping specialties:

1. Balancing valves.
2. Temperature-actuated water mixing valves.
3. Drain valves.
4. Hose Bibbs.
5. Wall Hydrants.
6. Vacuum Breakers
7. Water hammer arresters.
8. Trap-seal primer valves.

- B. Related Sections include the following:

1. Division 22 Section "Domestic Water Piping".
2. Division 22 Section "Plumbing Fixtures".

1.3 PERFORMANCE REQUIREMENTS

- A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Field quality-control test reports.
- D. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. NSF Compliance:
 - 1. Comply with NSF 61 "Drinking Water System Components - Health Effects; Sections 1 through 9."

PART 2 - PRODUCTS

2.1 VACUUM BREAKERS

- A. Hose-Connection Vacuum Breakers:
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrowhead Brass Products, Inc.
 - b. Cash Acme.
 - c. Conbraco Industries, Inc.
 - d. Legend Valve.
 - e. MIFAB, Inc.
 - f. Prier Products, Inc.
 - g. Watts Industries, Inc.; Water Products Div.
 - h. Woodford Manufacturing Company.
 - i. Zurn Plumbing Products Group; Light Commercial Operation.
 - j. Zurn Plumbing Products Group; Wilkins Div.
 - 3. Standard: ASSE 1011.
 - 4. Body: Bronze, nonremovable, with manual drain.
 - 5. Outlet Connection: Garden-hose threaded complying with ASME B1.20.7.
 - 6. Finish: Chrome or nickel plated.
- B. Laboratory-Faucet Vacuum Breakers.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. Conbraco Industries, Inc.
 - b. Watts Industries, Inc.; Water Products Div.
 - c. Woodford Manufacturing Company.
 - d. Zurn Plumbing Products Group; Wilkins Div.
3. Standard: ASSE 1035.
 4. Size: NPS 1/4 or NPS 3/8 matching faucet size.
 5. Body: Bronze.
 6. End Connections: Threaded.
 7. Finish: Chrome plated.

2.2 BALANCING VALVES

A. Copper-Alloy Calibrated Balancing Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. ITT Industries; Bell & Gossett Div.
 - c. NIBCO INC.
 - d. TAC Americas.
 - e. Taco, Inc.
 - f. Watts Industries, Inc.; Water Products Div.
3. Type: Ball or Y-pattern valve with two readout ports, memory setting indicator and positive shut off.
4. Body: Bronze,
5. Size: Same as connected piping, but not larger than NPS 2. Accessories: Meter hoses, fittings, valves, differential pressure meter, and carrying case.

2.3 TEMPERATURE-ACTUATED WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Armstrong International, Inc.
 - b. Cash Acme.

- c. Conbraco Industries, Inc.
 - d. Honeywell Water Controls.
 - e. Legend Valve.
 - f. Leonard Valve Company.
 - g. Powers; a Watts Industries Co.
 - h. Symmons Industries, Inc.
 - i. Taco, Inc.
 - j. Watts Industries, Inc.; Water Products Div.
 - k. Zurn Plumbing Products Group; Wilkins Div.
- 3. Standard: ASSE 1017.
 - 4. Pressure Rating: 125 psig.
 - 5. Type: Thermostatically controlled water mixing valve.
 - 6. Material: Bronze body with corrosion-resistant interior components.
 - 7. Connections: Threaded union inlets and outlet.
 - 8. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
 - 9. Tempered-Water Setting: 90 deg F.
 - 10. Tempered-Water Design Flow Rate: 25 gpm.
 - 11. Valve Finish: Chrome plated.

2.4 BACKFLOW PREVENTERS

A. Dual-Check-Valve Backflow Preventers:

- 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cash Acme.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Honeywell Water Controls.
 - e. Mueller Co.; Water Products Div.
 - f. Watts Industries, Inc.; Water Products Div.
 - g. Zurn Plumbing Products Group; Wilkins Div.
- 2. Standard: ASSE 1024.
- 3. Operation: Continuous-pressure applications.
- 4. Size: NPS 3/4
- 5. Body: Bronze with union inlet.

B. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

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

- a. Cash Acme.
 - b. Lancer Corporation.
 - c. Watts Industries, Inc.; Water Products Div.
 2. Standard: ASSE 1032.
 3. Operation: Continuous-pressure applications.
 4. Size: NPS 3/8.
 5. Body: Stainless steel.
 6. End Connections: Threaded.
- C. Icemaker Outlet Box:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Acorn Engineering Company.
 - b. Guy Gray Manufacturing.
 - c. IPS Corporation.
 - d. LSP Products Group, Inc.
 - e. Whitehall
 3. Mounting: Recessed.
 4. Material and Finish: Powder coated steel box and faceplate.
 5. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
 6. Supply Shutoff Fitting: NPS 1/2 gate or ball valve and NPS 1/2 copper, water tubing.

2.5 HOSE BIBBS

- A. Hose Bibbs:
1. Standard: ASME A112.18.1 for sediment faucets.
 2. Body Material: Bronze.
 3. Seat: Bronze, replaceable.
 4. Supply Connections: NPS 3/4 threaded or solder-joint inlet.
 5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
 6. Pressure Rating: 125 psig.
 7. Vacuum Breaker: Integral, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
 8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
 9. Finish for Service Areas: Rough bronze.
 10. Finish for Finished Rooms: Chrome or nickel plated.
 11. Operation for Equipment Rooms: Wheel handle or operating key.

12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.6 WALL HYDRANTS

A. Nonfreeze Wall Hydrants:

1. Available Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company.
 - b. MIFAB, Inc.
 - c. Prier Products, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Tyler Pipe; Wade Div.
 - f. Watts Drainage Products Inc.
 - g. Woodford Manufacturing Company.
 - h. Zurn Plumbing Products Group; Light Commercial Operation.
2. Standard: ASME A112.21.3M for exposed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4.
7. Outlet: Exposed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Nozzle and Wall-Plate Finish: Polished nickel bronze.
9. Operating Keys(s): Two with each wall hydrant.

2.7 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

B. Gate-Valve-Type, Hose-End Drain:

1. Standard: MSS SP-80 for gate valves.
2. Pressure Rating: Class 125.
3. Size: NPS $\frac{3}{4}$.
4. Body: ASTM B 62 bronze.
5. Inlet: NPS $\frac{3}{4}$. threaded or solder joint.
6. Outlet: Garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.8 WATER HAMMER ARRESTERS

A. Water Hammer:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. AMTROL, Inc.
 - b. Josam Company.
 - c. MIFAB, Inc.
 - d. PPP Inc.
 - e. Sioux Chief Manufacturing Company, Inc.
 - f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - g. Tyler Pipe; Wade Div.
 - h. Watts Drainage Products Inc.
 - i. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASSE 1010 or PDI-WH 201.
4. Type: Copper tube with piston.
5. Size: ASSE 1010, Sizes AA and A through F or PDI-WH 201, Sizes A through F.

2.9 TRAP-SEAL PRIMER VALVES

A. Supply-Type, Trap-Seal Primer Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. MIFAB, Inc.
 - b. PPP Inc.

- c. Sioux Chief Manufacturing Company, Inc.
 - d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - e. Watts Industries, Inc.; Water Products Div.
-
- 3. Standard: ASSE 1018.
 - 4. Pressure Rating: 125 psig minimum.
 - 5. Body: Bronze.
 - 6. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
 - 7. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
 - 8. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Basic Plumbing Materials and Methods" for piping joining materials, joint construction, and basic installation requirements.
- B. Install balancing valves in locations where they can easily be adjusted.
- C. Install temperature-actuated water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.
 - 1. Install thermometers and water regulators if specified.
 - 2. Install cabinet-type units recessed in or surface mounted on wall as specified.
- D. Install outlet boxes recessed in wall. Install 2-by-4-inch fire-retardant-treated-wood blocking wall reinforcement between studs. Fire-retardant-treated-wood blocking is specified in Division 6 Section "Rough Carpentry."
- E. Install water hammer arresters in water piping according to PDI-WH 201.
- F. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping and specialties.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding."
- C. Connect wiring according to Division 26 Section "Conductors and Cables."

3.3 LABELING AND IDENTIFYING

- A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each of the following:
 - 1. Calibrated balancing valves.
 - 2. Primary, thermostatic, water mixing valves.
 - 3. Outlet boxes.
 - 4. Supply-type, trap-seal primer valves.
- B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Division 22 Section "Plumbing Identification."

3.4 ADJUSTING

- A. Set field-adjustable pressure set points of water pressure-reducing valves.
- B. Set field-adjustable flow set points of balancing valves.
- C. Set field-adjustable temperature set points of temperature-actuated water mixing valves.

END OF SECTION 221119

SECTION 221313 - FACILITY SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe and fittings.
2. Nonpressure and pressure couplings.
3. Expansion joints.
4. Cleanouts.
5. Encasement for piping.
6. Manholes.

1.2 ACTION SUBMITTALS

- A. Product Data: For expansion joints.

1.3 INFORMATIONAL SUBMITTALS

- A. Record Drawings: Show pipe sizes, locations, and final installed elevations. Show other piping in same trench and clearances from sewer system piping. Indicate interface and spatial relationship between manholes, piping, and proximate structures.
- B. Product Certificates: For each type of pipe and fitting, from manufacturer.
- C. Field quality-control reports.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS FOR GRAVITY SEWER SERVICE

- A. Ductile iron pipe, for a minimum working pressure of 350 psi, shall be centrifugally cast and manufactured in accordance with ANSI A 21.51 of ductile cast iron, Grade 60-42-10. Trench loads shall be calculated as described in ASTM A746 Joints shall be slip-on, ANSI A21.11
- B. The interior of all pipe and fittings shall be cement mortar lined, ANSI A21.4, similar to the "Enameline" process as patented by The American Cast Iron Pipe Company.

Exterior of all pipe and fittings shall be coated with coal tar or asphalt base pipe coating.

2.2 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

B. PVC Type PSM Sewer Piping:

1. Pipe: ASTM D 3034, SDR 35, PVC Type PSM sewer pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM D 3034, PVC with bell ends.
3. Gaskets: ASTM F 477, elastomeric seals.

2.3 NONPRESSURE-TYPE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Ductile Iron Pipes: ASTM C 564, rubber.
2. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3. For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Ring-Type, Flexible Couplings: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.4 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug. Provide “floating” access plug that is not attached to cleanout so surface wheel loads do not bear directly on pipe, as detailed on plans.
1. Top-Loading Classification(s): Heavy Duty.
 2. Sewer Pipe Fitting and Riser to Cleanout: ASTM A 74, Service class, cast-iron soil pipe and fittings.

2.5 MANHOLES

- A. Standard Precast Concrete Manholes:
1. Description: ASTM C 478, precast, reinforced concrete, of depth indicated, with provision for sealant joints.
 2. Diameter: 48 inches minimum unless otherwise indicated.
 3. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent flotation.
 4. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section; with separate base slab or base section with integral floor.
 5. Riser Sections: 4-inch minimum thickness, of length to provide depth indicated.
 6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated; with top of cone of size that matches grade rings.
 7. Joint Sealant: ASTM C 990, bitumen or butyl rubber.
 8. Resilient Pipe Connectors: ASTM C 923, cast or fitted into manhole walls, for each pipe connection.
 9. Steps: Individual FRP steps or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP; wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of manhole to finished grade is less than 60 inches.
 10. Adjusting Rings: Interlocking HDPE rings, with level or sloped edge in thickness and diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope. Include sealant recommended by ring manufacturer.
 11. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, with diameter matching manhole frame and cover, and with height as required to adjust manhole frame and cover to indicated elevation and slope.
- B. Manhole Frames and Covers:

1. Description: Ferrous; 24-inch ID by 7- to 9-inch riser, with 4-inch minimum-width flange and 26-inch- diameter cover. Include indented top design with lettering cast into cover, using wording equivalent to "SANITARY SEWER."
2. Material: ASTM A 48/A 48M, Class 35 gray iron unless otherwise indicated.

2.6 CONCRETE

- A. General: Cast-in-place concrete complying with ACI 318, ACI 350/350R, and the following:
 1. Cement: ASTM C 150, Type II.
 2. Fine Aggregate: ASTM C 33, sand.
 3. Coarse Aggregate: ASTM C 33, crushed gravel.
 4. Water: Potable.
- B. Portland Cement Design Mix: 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio.
 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.
- C. Manhole Channels and Benches: Factory or field formed from concrete. Portland cement design mix, 4000 psi minimum, with 0.45 maximum water/cementitious materials ratio. Include channels and benches in manholes.
 1. Channels: Concrete invert, formed to same width as connected piping, with height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope.
 - a. Invert Slope: 2.5 percent through manhole.
 2. Benches: Concrete, sloped to drain into channel.
 - a. Slope: 4 percent.
- D. Ballast and Pipe Supports: Portland cement design mix, 3000 psi minimum, with 0.58 maximum water/cementitious materials ratio.
 1. Reinforcing Fabric: ASTM A 185/A 185M, steel, welded wire fabric, plain.
 2. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (420 MPa) deformed steel.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."

3.2 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground sanitary sewer piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- C. Install manholes for changes in direction unless fittings are indicated. Use fittings for branch connections unless direct tap into existing sewer is indicated.
- D. Install proper size increasers, reducers, and couplings where different sizes or materials of pipes and fittings are connected. Reducing size of piping in direction of flow is prohibited.
- E. Install gravity-flow, nonpressure, drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow, at minimum slope of 1 percent unless otherwise indicated.
 - 2. Install ductile iron piping according to DIPRA's "Handbook of Ductile Iron Pipe."
 - 3. Install PVC corrugated sewer piping according to ASTM D 2321 and ASTM F 1668.
 - 4. Install PVC Type PSM sewer piping according to ASTM D 2321 and ASTM F 1668.
- F. Clear interior of piping and manholes of dirt and superfluous material as work progresses. Maintain swab or drag in piping, and pull past each joint as it is completed. Place plug in end of incomplete piping at end of day and when work stops.

3.3 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure, drainage piping according to the following:

1. Join bell-and-spigot, ductile-iron piping with gasket joints according to DIPRA's "Handbook of Ductile Iron Pipe" for compression joints.
 2. Join PVC corrugated sewer piping according to ASTM D 2321.
 3. Join PVC Type PSM sewer piping according to ASTM D 2321 and ASTM D 3034 for elastomeric-seal joints or ASTM D 3034 for elastomeric-gasket joints.
 4. Join dissimilar pipe materials with nonpressure-type, flexible couplings.
- B. Pipe couplings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
1. Use nonpressure flexible couplings where required to join gravity-flow, nonpressure sewer piping unless otherwise indicated.
 - a. Unshielded flexible couplings for pipes of same or slightly different OD.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.4 MANHOLE INSTALLATION

- A. General: Install manholes complete with appurtenances and accessories indicated.
- B. Install precast concrete manhole sections with sealants according to ASTM C 891.
- C. Form continuous concrete channels and benches between inlets and outlet.
- D. Set tops of frames and covers flush with finished surface of manholes that occur in pavements. Set tops 3 inches above finished surface elsewhere unless otherwise indicated.

3.5 CONCRETE PLACEMENT

- A. Place cast-in-place concrete according to ACI 318.

3.6 CLEANOUT INSTALLATION

- A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade in accordance with plans. Install piping so cleanouts open in direction of flow in sewer pipe.
 1. Use Medium-Duty, top-loading classification cleanouts in earth or unpaved foot-traffic areas.

2. Use Heavy-Duty, top-loading classification cleanouts in vehicle-traffic service areas.
- B. Set cleanout frames and covers in earth in cast-in-place-concrete block, 18 by 18 by 6 inches deep. Set with tops 1 inch above surrounding grade.
- C. Set cleanout frames and covers in concrete pavement and roads with tops flush with pavement surface.

3.7 CONNECTIONS

- A. Connect nonpressure, gravity-flow drainage piping to building's sanitary building drains specified in Division 22 Section "Sanitary Waste and Vent Piping."
- B. Make connections to existing piping and underground manholes.
 1. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap with not less than 6 inches of concrete with 28-day compressive strength of 3000 psi.
 2. Make connections to underground manholes by cutting opening into existing unit large enough to allow 3 inches of concrete to be packed around entering connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe or manhole wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches to provide additional support of collar from connection to undisturbed ground.
 - a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
 3. Protect existing piping and manholes to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- C. Connect to grease interceptors specified in Division 22 Section "Sanitary Waste Interceptors."

3.8 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground manholes.

1. Use warning tape or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground manholes.

3.9 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
 1. Submit separate report for each system inspection.
 2. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
 - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
 - d. Infiltration: Water leakage into piping.
 - e. Exfiltration: Water leakage from or around piping.
 3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
 4. Reinspect and repeat procedure until results are satisfactory.
- B. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
 1. Do not enclose, cover, or put into service before inspection and approval.
 2. Test completed piping systems according to requirements of authorities having jurisdiction.
 3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
 4. Submit separate report for each test.
 5. Hydrostatic Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction and the following:
 - a. Fill sewer piping with water. Test with pressure of at least 10-foot head of water, and maintain such pressure without leakage for at least 15 minutes.
 - b. Close openings in system and fill with water.
 - c. Purge air and refill with water.
 - d. Disconnect water supply.
 - e. Test and inspect joints for leaks.
 6. Air Tests: Test sanitary sewerage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

- a. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 - b. Option: Test concrete gravity sewer piping according to ASTM C 924.
7. Manholes: Perform hydraulic test according to ASTM C 969.
- C. Leaks and loss in test pressure constitute defects that must be repaired.
- D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.10 CLEANING

- A. Clean dirt and superfluous material from interior of piping. Flush with potable water.

END OF SECTION 221313

SECTION 221316 - SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following soil and waste, sanitary drainage and vent piping inside the building:
 - 1. Pipe, tube, and fittings.
 - 2. Special pipe fittings.

1.2 PERFORMANCE REQUIREMENTS

- A. Components and installation shall be capable of withstanding the following minimum working pressure, unless otherwise indicated:
 - 1. Soil, Waste, and Vent Piping: 10-foot head of water.

1.3 SUBMITTALS

- A. Field quality-control inspection and test reports.

1.4 QUALITY ASSURANCE

- A. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- B. All cast iron pipe, fittings and shielded couplings shall bear the collective trademark of the Cast Iron Soil Pipe Institute, and be listed by NSF.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Hub-and-Spigot, Cast-Iron Pipe and Fittings: ASTM A 74, Service class.
 - 1. Gaskets: ASTM C 564, rubber.
- B. Hubless Cast-Iron Pipe and Fittings: ASTM A 888 or CISPI 301.

1. Shielded Couplings: ASTM C 1277 assembly of metal shield or housing, corrosion-resistant fasteners, and rubber sleeve with integral, center pipe stop.
 - a. Standard, Shielded, Stainless-Steel Couplings: CISPI 310, with stainless-steel corrugated shield; stainless-steel bands and tightening devices; and ASTM C 564, rubber sleeve.
 - b. Heavy-Duty, Shielded, Stainless-Steel Couplings: With stainless-steel shield, stainless-steel bands and tightening devices, and ASTM C 564, rubber sleeve.
- C. Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade A or B, Schedule 40, galvanized. Include ends matching joining method.
 1. Drainage Fittings: ASME B16.12, galvanized, threaded, cast-iron drainage pattern.
 2. Pressure Fittings:
 - a. Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized, seamless steel pipe. Include ends matching joining method.
 - b. Malleable-Iron Unions: ASME B16.39; Class 150; hexagonal-stock body with ball-and-socket, metal-to-metal, bronze seating surface; and female threaded ends.
 - c. Gray-Iron, Threaded Fittings: ASME B16.4, Class 125, galvanized, standard pattern.
 - d. Cast-Iron Flanges: ASME B16.1, Class 125.
 - e. Cast-Iron, Flanged Fittings: ASME B16.1, Class 125, galvanized.
- D. Copper DWV Tube: ASTM B 306, drainage tube, drawn temper.
 1. Copper Drainage Fittings: ASME B16.23, cast copper or ASME B16.29, wrought-copper, solder-joint fittings.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Special pipe fittings with pressure ratings at least equal to piping pressure ratings may be used in applications below, unless otherwise indicated.
- B. Flanges and unions may be used on aboveground pressure piping, unless otherwise indicated.
- C. Aboveground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:

1. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 2. Steel pipe, drainage fittings, and threaded joints.
 3. Copper DWV tube, copper drainage fittings, and soldered joints.
- D. Aboveground, soil, waste, and vent piping NPS 5 and larger shall be any of the following:
1. Service class, cast-iron soil pipe and fittings; gaskets; and compression joints.
 2. Hubless cast-iron soil pipe and fittings; heavy-duty shielded, stainless-steel couplings; and hubless-coupling joints.
 3. Steel pipe, drainage fittings, and threaded joints.
 4. Copper DWV tube, copper drainage fittings, and soldered joints.
- E. Underground, soil, waste, and vent piping shall be the following:
1. Service class, hub-and-spigot, cast-iron soil pipe and fittings; gaskets; and compression joints.

3.2 PIPING INSTALLATION

- A. Sanitary sewer piping outside the building is specified in Division 2 Section "Sanitary Sewerage."
- B. Basic piping installation requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- C. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers.
- D. Install cast-iron sleeve with water stop and mechanical sleeve seal at each service pipe penetration through foundation wall. Select number of interlocking rubber links required to make installation watertight. Sleeves and mechanical sleeve seals are specified in Division 22 Section "Basic Materials and Methods."
- E. Install wall penetration system at each service pipe penetration through foundation wall. Make installation watertight. Wall penetration systems are specified in Division 22 Section "Basic Materials and Methods."
- F. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
- G. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from

horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if 2 fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

- H. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.
- I. Install soil and waste drainage and vent piping at the following minimum slopes, unless otherwise indicated:
 - 1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
 - 2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.
 - 3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.
- J. Sleeves are not required for cast-iron soil piping passing through concrete slabs-on-grade if slab is without membrane waterproofing.
- K. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

3.3 JOINT CONSTRUCTION

- A. Basic piping joint construction requirements are specified in Division 22 Section "Basic Mechanical Materials and Methods."
- B. Cast-Iron, Soil-Piping Joints: Make joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
 - 1. Gasketed Joints: Make with rubber gasket matching class of pipe and fittings.
 - 2. Hubless Joints: Make with rubber gasket and sleeve or clamp.
- C. Soldered Joints: Use ASTM B 813, water-flushable, lead-free flux; ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise indicated.

3.4 VALVE INSTALLATION

- A. Backwater Valves: Install backwater valves in piping subject to sewage backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type, unless otherwise indicated.
2. Floor Drains: Drain outlet backwater valves, unless drain has integral backwater valve.
3. Install backwater valves in accessible locations.
4. Backwater valves are specified in Division 22 Section "Plumbing Specialties."

3.5 HANGER AND SUPPORT INSTALLATION

- A. Seismic-restraint devices are specified in Division 22 Section "Vibration and Seismic Controls."
- B. Pipe hangers and supports are specified in Division 22 Section "Hangers and Supports." Install the following:
 1. Vertical Piping: MSS Type 8 or Type 42, clamps.
 2. Individual, Straight, Horizontal Piping Runs: According to the following:
 - a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
 - b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
 - c. Longer Than 100 Feet, if Indicated: MSS Type 49, spring cushion rolls.
 3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
 4. Base of Vertical Piping: MSS Type 52, spring hangers.
- C. Install supports according to Division 22 Section "Hangers and Supports."
- D. Support vertical piping and tubing at base and at each floor.
- E. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.
- F. Install hangers for cast-iron soil piping with the following maximum horizontal spacing and minimum rod diameters:
 1. NPS 1-1/2 and NPS 2: 60 inches with 3/8-inch rod.
 2. NPS 3: 60 inches with 1/2-inch rod.
 3. NPS 4 and NPS 5: 60 inches with 5/8-inch rod.
 4. NPS 6: 60 inches with 3/4-inch rod.
 5. Spacing for 10-foot lengths may be increased to 10 feet. Spacing for fittings is limited to 60 inches.
- G. Install supports for vertical cast-iron soil piping every 15 feet.

- H. Install hangers for steel piping with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 84 inches with 3/8-inch rod.
 - 2. NPS 1-1/2: 108 inches with 3/8-inch rod.
 - 3. NPS 2: 10 feet with 3/8-inch rod.
 - 4. NPS 2-1/2: 11 feet with 1/2-inch rod.
 - 5. NPS 3: 12 feet with 1/2-inch rod.
 - 6. NPS 4 and NPS 5: 12 feet with 5/8-inch rod.
 - 7. NPS 6: 12 feet with 3/4-inch rod.
- I. Install supports for vertical steel piping every 15 feet.
- J. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1-1/4: 72 inches with 3/8-inch rod.
 - 2. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
 - 3. NPS 2-1/2: 108 inches with 1/2-inch rod.
 - 4. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
 - 5. NPS 6: 10 feet with 5/8-inch rod.
- K. Install supports for vertical copper tubing every 10 feet.
- L. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

- A. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.
- B. Connect drainage and vent piping to the following:
 - 1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Fixtures."
 - 2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
 - 3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code. Refer to Division 22 Section "Plumbing Specialties."
 - 4. Equipment: Connect drainage piping as indicated. Provide shutoff valve, if indicated, and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

3.7 FIELD QUALITY CONTROL

- A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
 - 1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
 - 2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.
- B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.
- C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.
- D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction.
 - 1. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
 - 2. Prepare reports for tests and required corrective action.

3.8 CLEANING

- A. Clean interior of piping. Remove dirt and debris as work progresses.
- B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.
- C. Place plugs in ends of uncompleted piping at end of day and when work stops.

END OF SECTION 221316

SECTION 221319 - SANITARY WASTE PIPING 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 sanitary drainage piping specialties:
 - 1. Cleanouts.
 - 2. Floor drains.
 - 3. Miscellaneous sanitary drainage piping specialties.

1.3 SUBMITTALS

1.4 QUALITY ASSURANCE

- A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.5 COORDINATION

- A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 BACKWATER VALVES

- A. Horizontal, Cast-Iron Backwater Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfr. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
2. Standard: ASME A112.14.1.
3. Size: Same as connected piping.
4. Body: Cast iron.
5. Cover: Cast iron with bolted or threaded access.
6. End Connections: Hub and spigot.
7. Type Valve: Removable, bronze, swing check, factory assembled or field modified to hang closed; and bronze gate valve with removable wheel handle.
8. Extension: ASTM A 74, Service class; full-size, cast-iron, soil-pipe extension to field-installed cleanout at floor; replaces backwater valve cover.

2.2 CLEANOUTS

A. Exposed Metal Cleanouts:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. MIFAB, Inc.
 - c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - d. Tyler Pipe; Wade Div.
 - e. Watts Drainage Products Inc.
 - f. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Raised-head, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Closure: Stainless-steel plug with seal.

2.3 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Josam Company; Josam Div.
 - b. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
 - c. Tyler Pipe; Wade Div.
 - d. Watts Drainage Products Inc.
 - e. Zurn Plumbing Products Group; Specification Drainage Operation.
3. Standard: ASME A112.6.3.
4. Pattern: Floor drain.
5. Body Material: Gray iron.
6. Top or Strainer Material: Nickel bronze.
7. Top of Body and Strainer Finish: Nickel bronze.
8. Top Shape: Round.

2.4 AIR-ADMITTANCE VALVES

A. Fixture Air-Admittance Valves:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
2. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ayrlett, LLC.
 - b. Durgo, Inc.
 - c. Oatey.
 - d. ProSet Systems Inc.
 - e. RectorSeal.
 - f. Studor, Inc.
3. Standard: ASSE 1051, Type A for single fixture or Type B for branch piping.
4. Housing: Plastic.
5. Operation: Mechanical sealing diaphragm.
6. Size: Same as connected fixture or branch vent piping.

2.5 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Deep-Seal Traps:

1. Description: Cast-iron or bronze casting, with inlet and outlet matching connected piping and cleanout trap-seal primer valve connection.
2. Size: Same as connected waste piping.
 - a. NPS 24-inch minimum water seal.
 - b. NPS 2-1/2 and Larger: 5-inch-minimum water seal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Refer to Division 22 Section "Common Work Results for Plumbing" for piping joining materials, joint construction, and basic installation requirements.
- B. Install backwater valves in building drain piping. For exterior installation, provide extension up to grade centered over backwater valve cover, and of adequate size to remove valve cover for servicing.
- C. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
 1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
 2. Locate at each change in direction of piping greater than 45 degrees.
 3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
 4. Locate at base of each vertical soil and waste stack.
- D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.
- E. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.
 1. Position floor drains for easy access and maintenance.
 - a. Set floor drains below elevation of surrounding finished floor to allow floor drainage.
 2. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.

- 3. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.
- F. Install fixture air-admittance valves on fixture drain piping.
- G. Install deep-seal traps on floor drains and other waste outlets, if indicated.
- H. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
 - 1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
 - 2. Size: Same as floor drain inlet.
- I. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Division 22 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to equipment to allow service and maintenance.
- C. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system 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.

3.4 PROTECTION

- A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.
- B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 224200 - COMMERCIAL PLUMBING FIXTURES

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. Water Closets.
 - 2. Urinals.
 - 3. Lavatories.
 - 4. Sinks.
 - 5. Faucets.
 - 6. Water Coolers.

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 fixtures.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets or flush valves.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fixtures and faucets to include in operation and maintenance manuals.
 - 1. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - a. Servicing and adjustments of automatic faucets and flush valves.

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 Cartridges and O-Rings: Equal to 10 percent of amount of each type and size installed.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, BOTTOM-OUTLET WATER CLOSETS

- A. Water Closets: Floor mounted, bottom outlet, top spud.
 - 1. 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:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Kohler Co.
 - d. TOTO USA, INC.
 - 2. Bowl:
 - a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
 - b. Material: Vitreous china.
 - c. Type: Siphon jet.
 - d. Style: Flushometer valve.
 - e. Height: Standard or Handicapped/elderly, complying with ICC/ANSI A117.1].
 - f. Rim Contour: Elongated.
 - g. Water Consumption: 1.6 gal. per flush.
 - h. Spud Size and Location: NPS 1-1/2; top.

- i. Color: White.
- 3. Bowl-to-Drain Connecting Fitting: ASTM A 1045 or ASME A112.4.3.

2.2 FLUSHOMETER VALVES

A. Lever-Handle, Piston Flushometer Valves:

- 1. 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:
 - a. American Standard.
 - b. Delany Co.
 - c. Hydrotek.
 - d. Sloan Valve Company.
 - e. Zurn Industries, LLC; Commercial Brass and Fixtures.
- 2. Standard: ASSE 1037.
- 3. Minimum Pressure Rating: 125 psig.
- 4. Features: Include integral check stop and backflow-prevention device.
- 5. Material: Brass body with corrosion-resistant components.
- 6. Exposed Flushometer-Valve Finish: Chrome plated.
- 7. Panel Finish: Chrome plated or stainless steel.
- 8. Style: Exposed.
- 9. Consumption: 1.28 gal per flush.
- 10. Minimum Inlet: NPS 1.
- 11. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats:

- 1. 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:
 - a. American Standard America.
 - b. Bemis Manufacturing Company.
 - c. Church Seats.
 - d. Kohler Co.
 - e. TOTO USA, INC.
- 2. Standard: IAPMO/ANSI Z124.5.
- 3. Material: Plastic.

4. Type: Commercial Heavy duty.
5. Shape: Elongated rim, open front.
6. Hinge: Self-sustaining, check.
7. Hinge Material: Noncorroding metal.
8. Seat Cover: Not required.
9. Color: White.

2.4 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Vitreous china, wall mounted, with back.

1. 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:
 - a. American Standard America.
 - b. Crane Plumbing, L.L.C.
 - c. Kohler Co.
2. Fixture:
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For wall hanging.
 - c. Nominal Size: Rectangular, 20 by 18 inches.
 - d. Faucet-Hole Punching: Three holes, 4-inch centers.
 - e. Faucet-Hole Location: Top.
 - f. Color: White.
 - g. Mounting Material: Chair carrier.
3. Faucet: Solid-Brass, Manually Operated Faucet.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier include rectangular, steel uprights.

2.5 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory: Oval, Corian, under counter mounted.

1. 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:
 - a. Dupont Corian.
2. Fixture:

- a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Type: For undercounter mounting.
 - c. Nominal Size: Oval, 18 by 15 inches.
 - d. Faucet-Hole Punching: No holes.
 - e. Faucet-Hole Location: On countertop.
 - f. Color: White
 - g. Mounting Material: Sealant and undercounter mounting kit.
3. Faucet: Solid-Brass, Manually Operated Faucet.

2.6 CLINIC SINKS

- A. Clinic Sinks: Floor mounted.
 1. Fixture: Bottom-outlet, vitreous-china, siphon-jet, flushing-rim, service sink.
 - a. Standard: ASME A112.19.2/CSA B45.1.
 - b. Nominal Size: 27 by 20 inches.
 - c. Color: White.
 - d. Rim Guards: Stainless steel on front.
 2. Sink Base: 10 inches high; cast terrazzo if required.
 3. Supply Fittings: Comply with requirements in "Supply Fittings" Article.

2.7 SOLID-BRASS, MANUALLY OPERATED FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.
- B. Lavatory Faucets: Manual-type, two-handle mixing, solid-brass valve.
 1. 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:
 - a. American Standard America.
 - b. Chicago Faucets.
 - c. Delta Faucet Company.
 - d. Kohler Co.
 - e. T & S Brass and Bronze Works, Inc.
 2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.

4. Body Type: Widespread.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.0 gpm.
8. Mounting Type: Deck, exposed.
9. Valve Handle(s): Wrist blade, 4 inches.
10. Spout: Swivel, gooseneck type.
11. Spout Outlet: Laminar flow.
12. Operation: Noncompression, manual.

2.8 UTILITY SINKS

A. Utility Sinks: Stainless steel, counter mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Tabco.
 - b. Elkay Manufacturing Co.
 - c. Just Manufacturing.
 - d. Kohler
2. Fixture:
 - a. Standard: ASME A112.19.3/CSA B45.4.
 - b. Type: Ledge back.
 - c. Number of Compartments: One.
 - d. Overall Dimensions: See schedule on plans.
 - e. Metal Thickness: 18 gauge.
 - f. Compartment:
 - 1) Dimensions: See schedule on plans.
3. Supply Fittings:
 - a. Standard: ASME A112.18.1/CSA B125.1.
 - b. Supplies: Chrome-plated brass compression stop with inlet connection matching water-supply piping type and size.
 - 1) Operation: Loose key.
 - 2) Risers: NPS 1/2, chrome-plated, rigid copper tube, ASME A112.18.6, braided or corrugated stainless-steel flexible hose.
4. Waste Fittings:
 - a. Standard: ASME A112.18.2/CSA B125.2.

b. Trap(s):

- 1) Size: NPS 1-1/2.
- 2) Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 17 gauge brass tube to wall; and chrome-plated brass or steel wall flange.

5. Mounting: On counter with sealant.

2.9 SERVICE BASINS

A. Service Basins: Terrazzo, floor mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Fiat.
 - b. Florestone Products Co., Inc.
 - c. Stern-Williams Co., Inc.
2. Fixture:
 - a. Standard: IAPMO PS 99.
 - b. Shape: Square.
 - c. Nominal Size: 24 by 24 inches.
 - d. Height: 12 inches with dropped front.
 - e. Tiling Flange: On two sides
 - f. Rim Guard: On all top surfaces.
 - g. Color: Not applicable.
 - h. Drain: Grid with NPS 3 outlet.
3. Mounting: On floor and flush to wall.
4. Faucet: Wall mounted with lever handles.

2.10 SINK FAUCETS

- A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.
- B. Sink Faucets: Manual type, two-lever-handle mixing valve.
 1. 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:

- a. American Standard America.
 - b. Chicago Faucets.
 - c. Delta Faucet Company.
 - d. Kohler Co.
 - e. Speakman Company.
 - f. T & S Brass and Bronze Works, Inc.
2. Standard: ASME A112.18.1/CSA B125.1.
 3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
 4. Body Type: Widespread.
 5. Body Material: Commercial, solid brass.
 6. Finish: Chrome plated.
 7. Maximum Flow Rate: 2.2 gpm.
 8. Handle(s): Lever.
 9. Mounting Type: back/wall, exposed.
 10. Spout Type: Rigid, solid brass.
 11. Vacuum Breaker: Required for hose outlet.
 12. Spout Outlet: Hose thread according to ASME B1.20.7.

2.11 SUPPLY FITTINGS

- A. NSF Standard: Comply with NSF/ANSI 61, "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.
- F. Risers:
 1. NPS 3/8.
 2. Chrome-plated, rigid-copper-pipe and brass straight or offset tailpieces or ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser.

2.12 WASTE FITTINGS

- A. Standard: ASME A112.18.2/CSA B125.2.

- B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.
- C. Trap:
 - 1. Size: NPS 1-1/2 by NPS 1-1/4.
 - 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.

2.13 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 EXAMINATION

- A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.
- B. Examine counters and walls for suitable conditions where plumbing fixtures will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install plumbing fixtures level and plumb according to roughing-in drawings.
- B. Install laminar-flow, faucet-spout fittings in faucet spouts where laminar-flow fittings are specified.
- C. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible sinks. Comply with requirements in Division 22 Section "Plumbing Piping Insulation."

- D. Seal joints between plumbing fixtures, 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 Division 07 Section "Joint Sealants."
- E. 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 Division 22 Section "Escutcheons for Plumbing Piping."
- F. Install supports, affixed to building substrate, for wall-mounted fixtures.
- G. Install accessible wall-mounted water closets and lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.
- H. 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 Division 22 Section "Escutcheons for Plumbing Piping."
- I. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Division 07 Section "Joint Sealants."

3.3 CONNECTIONS

- A. Connect fixtures 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 Division 22 Section "Domestic Water Piping."
- C. Comply with soil and waste piping requirements specified in Division 22 Section "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

- A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.
- B. Adjust water pressure at faucets and flushometer valves to produce proper flow.
- C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

- A. After completing installation of fixtures, inspect and repair damaged finishes.
- B. Clean fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.
- C. Provide protective covering for installed fixtures and fittings.
- D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224200

SECTION 224500 - EMERGENCY PLUMBING FIXTURES

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. Section Includes:
 - 1. Emergency showers.
 - 2. Eyewash equipment.
 - 3. Water-tempering equipment.

1.3 DEFINITIONS

- A. Accessible Fixture: Emergency plumbing fixture that can be approached, entered, and used by people with disabilities.
- B. Plumbed Emergency Plumbing Fixture: Fixture with fixed, potable-water supply.
- C. Tepid: Moderately warm.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated. Include flow rates and capacities, furnished specialties, and accessories.
- B. Shop Drawings: Diagram power, signal, and control wiring.
- C. Product Certificates: Submit certificates of performance testing specified in "Source Quality Control" Article.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For emergency plumbing fixtures to include in operation and maintenance manuals.

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. ANSI Standard: Comply with ANSI Z358.1, "Emergency Eyewash and Shower Equipment."
- C. NSF Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects," for fixture materials that will be in contact with potable water.

PART 2 - PRODUCTS

2.1 EMERGENCY SHOWERS

- A. Off-Floor, Plumbed Emergency Showers:
 - 1. 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:
 - a. Acorn Safety; a division of Acorn Engineering Company.
 - b. Bradley Corporation.
 - c. Guardian Equipment Co.
 - d. Haws Corporation.
 - e. Speakman Company.
 - f. WaterSaver Faucet Co.
 - 2. Capacity: Not less than 20 gpm for at least 15 minutes.
 - 3. Supply Piping: NPS 1/2-inch-plate brass or stainless steel with flow regulator and stay-open control valve.
 - 4. Control-Valve Actuator: Wall mounted lever.
 - 5. Shower Head: 8-inch minimum diameter, stainless steel.
 - 6. Mounting: Vertical from ceiling and supported from piping.

2.2 EYEWASH EQUIPMENT

- A. Sink, Plumbed Eyewash Unit:
 - 1. 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]:

- a. Acorn Safety; a division of Acorn Engineering Company.
 - b. Bradley Corporation.
 - c. Guardian Equipment Co.
 - d. Haws Corporation.
 - e. Speakman Company.
 - f. WaterSaver Faucet Co.
2. Capacity: Not less than 0.4 gpm for at least 15 minutes.
 3. Supply Piping: NPS 1/2 chrome-plated brass or stainless steel with flow regulator and stay-open control valve.
 4. Control-Valve Actuator: Pull knob.
 5. Spray-Head Assembly: Two spray heads.
 6. Mounting: Mounted on faucet.

2.3 WATER-TEMPERING EQUIPMENT

A. Hot- and Cold-Water, Water-Tempering Equipment:

1. 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:
 - a. Acorn Safety; a division of Acorn Engineering Company.
 - b. Guardian Equipment Co.
 - c. Haws Corporation.
 - d. Lawler Manufacturing Co., Inc.
 - e. Leonard Valve Company.
 - f. Powers; a division of Watts Water Technologies, Inc.
 - g. Speakman Company.
2. Description: Factory-fabricated equipment with thermostatic mixing valve.
 - a. Thermostatic Mixing Valve: Designed to provide 85 deg F tepid, potable water at emergency plumbing fixtures, to maintain temperature at plus or minus 5 deg F throughout required 15-minute test period, and in case of unit failure to continue cold-water flow, with union connections, controls, metal piping, and corrosion-resistant enclosure.
 - b. Supply Connections: For hot and cold water.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for water and waste piping systems to verify actual locations of piping connections before plumbed emergency plumbing fixture installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EMERGENCY PLUMBING FIXTURE INSTALLATION

- A. Assemble emergency plumbing fixture piping, fittings, control valves, and other components.
- B. Install fixtures level and plumb.
- C. Fasten fixtures to substrate.
- D. Install shutoff valves in water-supply piping to fixtures. Use ball, gate, or globe valve if specific type valve is not indicated. Install valves chained or locked in open position if permitted. Install valves in locations where they can easily be reached for operation. Comply with requirements for valves specified in Division 22 Section "General-Duty Valves for Plumbing Piping."
 - 1. Exception: Omit shutoff valve on supply to group of plumbing fixtures that includes emergency equipment.
 - 2. Exception: Omit shutoff valve on supply to emergency equipment if prohibited by authorities having jurisdiction.
- E. Install dielectric fitting in supply piping to emergency equipment if piping and equipment connections are made of different metals. Comply with requirements for dielectric fittings specified in Division 22 Section "Domestic Water Piping."
- F. Install thermometers in supply and outlet piping connections to water-tempering equipment. Comply with requirements for thermometers specified in Division 22 Section "Meters and Gages for Plumbing Piping."
- G. Install trap and waste piping on drain outlet of emergency equipment receptors that are indicated to be directly connected to drainage system. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."
- H. Install indirect waste piping on drain outlet of emergency equipment receptors that are indicated to be indirectly connected to drainage system. Comply with requirements for waste piping specified in Division 22 Section "Sanitary Waste and Vent Piping."

- I. Install escutcheons on piping wall and ceiling penetrations in exposed, finished locations. Comply with requirements for escutcheons specified in Division 22 Section "Escutcheons for Plumbing Piping."
- J. Fill self-contained fixtures with flushing fluid.

3.3 CONNECTIONS

- A. Connect cold-water-supply piping to plumbed emergency plumbing fixtures not having water-tempering equipment. Comply with requirements for cold-water piping specified in Division 22 Section "Domestic Water Piping."
- B. Connect hot- and cold-water-supply piping to hot- and cold-water, water-tempering equipment. Connect output from water-tempering equipment to emergency plumbing fixtures. Comply with requirements for hot- and cold-water piping specified in Division 22 Section "Domestic Water Piping."
- C. Indirectly connect emergency plumbing fixture receptors without trapped drain outlet to sanitary waste or storm drainage piping.
- D. Where installing piping adjacent to emergency plumbing fixtures, allow space for service and maintenance of fixtures.

3.4 IDENTIFICATION

- A. Install equipment nameplates or equipment markers on emergency plumbing fixtures and equipment and equipment signs on water-tempering equipment. Comply with requirements for identification materials specified in Division 22 Section "Identification for Plumbing Piping and Equipment."

3.5 FIELD QUALITY CONTROL

- A. Mechanical-Component Testing: After plumbing connections have been made, test for compliance with requirements. Verify ability to achieve indicated capacities.
- B. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Leak Test: After installation, charge system 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 unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

- C. Emergency plumbing fixtures and water-tempering equipment will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.6 ADJUSTING

- A. Adjust or replace fixture flow regulators for proper flow.
- B. Adjust equipment temperature settings.

END OF SECTION 224500

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1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

2.7 MEDICAL COMPRESSED-AIR PRESSURE CONTROL PANELS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
1. Amico Corporation.
 2. BeaconMedaes.
- B. Description:
1. Steel box and support brackets for recessed roughing-in with stainless-steel or anodized-aluminum cover plate with printed operating instructions.
 2. Manifold assembly consisting of inlet supply valve, inlet supply pressure gage, line-pressure control regulator, outlet supply pressure gage, D.I.S.S. service connection, and piping outlet for remote service connection.
 3. Minimum Working Pressure: 200 psig.
 4. Line-Pressure Control Regulator: Self-relieving diaphragm type with precision manual adjustment.
 5. Pressure Gages: 0 to 300 psig.
 6. Service Connection: CGA V-5, D.I.S.S. No. 1160, instrument air outlet.
 7. Before final assembly, provide temporary dust shield and U-tube for testing.
 8. Label cover plate "Air Pressure Control."

2.8 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

- A. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- B. Threaded Joints: Apply appropriate tape to external pipe threads.
- C. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free dry nitrogen during brazing.
- D. Flanged Joints: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- E. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

A. Install compressed-air pressure control panel in walls. Attach to substrate.

- A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or Type 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
 2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.

3.8 FIELD QUALITY CONTROL FOR MEDICAL COMPRESSED-AIR PIPING IN HEALTHCARE FACILITIES

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical compressed-air piping in healthcare facilities and to prepare test and inspection reports.
- B. Tests and Inspections:
 - 1. Medical Compressed-Air Testing Coordination: Perform tests, inspections, verifications, and certification of medical compressed-air piping systems concurrently with tests, inspections, and certification of medical gas piping and medical vacuum piping systems.
 - 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - a. Initial blowdown.
 - b. Initial pressure test.
 - c. Cross-connection test.
 - d. Piping purge test.
 - e. Standing pressure test for positive-pressure medical compressed-air piping.
 - f. Repair leaks and retest until no leaks exist.
 - 3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:
 - a. Standing pressure test.
 - b. Individual-pressurization or pressure-differential cross-connection test.
 - c. Valve test.
 - d. Master and area alarm tests.
 - e. Piping purge test.
 - f. Piping particulate test.
 - g. Piping purity test.
 - h. Final tie-in test.
 - i. Operational pressure test.
 - j. Medical air purity test.
 - k. Verify correct labeling of equipment and components.
 - 4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - a. Inspections performed.
 - b. Procedures, materials, and gases used.
 - c. Test methods used.
 - d. Results of tests.

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.
- C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

- A. Connect new tubing to existing tubing with memory-metal couplings.
- B. Flanges may be used where connection to flanged equipment is required.

- A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.
- B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

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SECTION 226213 - VACUUM PIPING FOR HEALTHCARE FACILITIES

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. Medical-surgical vacuum piping, designated "medical vacuum."
- B. Related Requirements:
 - 1. Section 226219 "Vacuum Equipment for Healthcare Facilities" for vacuum producers and accessories.
 - 2. Section 226400 "Medical Gas Alarms" for vacuum piping alarms.

1.3 DEFINITIONS

- A. Medical vacuum piping systems include medical vacuum, WAGD, dental vacuum, HVE, and medical laboratory vacuum piping systems.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Material Certificates: Signed by Installer certifying that medical vacuum piping materials comply with requirements in NFPA 99.
- C. Brazing certificates.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For vacuum piping 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. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical vacuum suction inlets.
 - a. Medical Vacuum: Equal to 10 percent of amount installed, but no fewer than 3 units.
 - 2. D.I.S.S. Service Connections: Furnish complete medical vacuum suction inlets complying with CGA V-5.
 - a. Medical Vacuum D.I.S.S. No. 1220: Equal to 10 percent of amount installed, but no fewer than 3 units.
 - b. WAGD D.I.S.S. No. 2220: Equal to 10 percent of amount installed, but no fewer than 3 units.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Medical Vacuum Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
 - 2. Pressure-Seal Joining Procedure for Copper Tubing: An authorized representative who is trained and approved by manufacturer.
 - 3. Extruded-Tee Outlet Procedure: An authorized representative who is trained and approved by manufacturer.
 - 4. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the vacuum piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
 - 1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

- C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Medical vacuum operating at 15 in. Hg.

2.2 PIPES, TUBES, AND FITTINGS

- A. Comply with NFPA 99 for medical vacuum piping materials.
- B. Copper Medical Gas Tube: ASTM B 819, Type L, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in blue.
- C. Copper Water Tube: ASTM B 88, Type M, seamless, drawn temper that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service.
- D. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type that has been manufacturer cleaned, purged, and sealed for medical gas service or according to CGA G-4.1 for oxygen service.
- E. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- F. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.
 - 1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, full-face type.
 - 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- G. Shape-Memory-Metal Couplings:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Aerofit, Inc.

2. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy, and that has been manufacturer cleaned, purged, and sealed for oxygen service according to CGA G-4.1.

H. Pressure-Seal Fittings:

1. <Double click here to find, evaluate, and insert list of manufacturers and products.>
2. NPS 2 and Smaller: Wrought-copper fitting with EPDM O-ring seal in each end.
3. NPS 2-1/2 to NPS 4: Bronze fitting with stainless-steel grip ring and EPDM O-ring seal in each end.

I. Flexible Pipe Connectors:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flex-Hose Co., Inc.
 - b. Metraflex Company (The).
 - c. Unaflex.
2. Description: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.
 - a. Working-Pressure Rating: 200 psig minimum.
 - b. End Connections: Plain-end copper tube.

2.3 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.

2.4 VALVES

- A. General Requirements for Valves: Manufacturer cleaned, purged, and bagged according to CGA G-4.1 for oxygen service.
 1. Exception: Factory cleaning and bagging are not required for valves for WAGD service.
- B. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.

1. Zone-Valve Boxes:
 - a. Steel Box with Aluminum Cover:
 - 1) Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a) Allied Healthcare Products Inc.
 - b) Amico Corporation.
 - b. Steel Box with Stainless-Steel Cover:
 - 1) <Double click here to find, evaluate, and insert list of manufacturers and products.>
 - c. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.
 - 1) Interior Finish: Factory-applied white enamel.
 - 2) Cover Plate: Aluminum or stainless-steel with frangible or removable windows.
 - 3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.

C. Copper-Alloy Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Healthcare Products Inc.
 - b. Amico Corporation.
 - c. Apollo Valves; Conbraco Industries, Inc.
 - d. BeaconMedaes.
 - e. NIBCO INC.
 - f. Ohio Medical Corporation.
2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.

8. Stem: Blowout proof with PTFE or TFE seal.
9. Ends: manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

D. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Healthcare Products Inc.
 - b. Amico Corporation.
 - c. BeaconMedaes.
 - d. Ohio Medical Corporation.
2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.

2.5 MEDICAL VACUUM SERVICE CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Allied Healthcare Products Inc.
 2. Amico Corporation.
 3. BeaconMedaes.
 4. Ohio Medical Corporation.
- B. General Requirements for Medical Vacuum Service Connections:
1. Suitable for specific medical vacuum service listed.
 2. Include roughing-in assemblies, finishing assemblies, and cover plates.
 3. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
 4. Recessed-type units made for concealed piping unless otherwise indicated.
- C. Roughing-in Assembly:
1. Steel outlet box for recessed mounting and concealed piping.
 2. Brass-body inlet block.
 3. Seals that will prevent vacuum leakage.
 4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.

D. Finishing Assembly:

1. Brass housing with primary check valve.
2. Seals that will prevent vacuum leakage.
3. Cover plate with gas-service label.

E. Quick-Coupler Suction Service Connections:

1. Inlets for medical vacuum with noninterchangeable keyed indexing to prevent interchange between services.
2. Constructed to permit one-handed connection and removal of equipment.
3. With positive-locking ring that retains equipment stem in valve during use.

F. D.I.S.S. Suction Service Connections:

1. Inlets complying with CGA V-5.
2. Threaded indexing to prevent interchange between services.
3. Constructed to permit one-handed connection and removal of equipment.
4. Medical Vacuum: CGA V-5, D.I.S.S. No. 1220.
5. WAGD: CGA V-5, D.I.S.S. No. 2220.

G. Vacuum Bottle Brackets: One piece, with pattern and finish matching corresponding service cover plate.

H. Cover Plates:

1. One piece.
2. Aluminum or stainless steel.
3. Permanent, color-coded, identifying label matching corresponding service.

2.6 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:

1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.
2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.
 - a. Scrub to ensure complete cleaning.
 - b. Rinse with clean, hot water to remove cleaning solution.

3.2 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of vacuum piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, vacuum producer sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Comply with NFPA 99 for installation of vacuum piping.
- C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- F. Install piping adjacent to equipment and specialties to allow service and maintenance.
- G. Install vacuum piping with 1 percent slope downward in direction of flow.
- H. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than piping pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- I. Install eccentric reducers, if available, where vacuum piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.
- J. Provide drain leg and drain trap at end of each main and branch and at low points.
- K. Install piping to permit valve servicing.

- L. Install piping free of sags and bends.
- M. Install fittings for changes in direction and for branch connections. Extruded-tee branch outlets in copper tubing may be made where specified.
- N. Install medical vacuum piping from medical vacuum service connections specified in this Section, to equipment specified in Section 226219 "Vacuum Equipment for Laboratory and Healthcare Facilities," and to equipment specified in other Sections requiring medical vacuum service.
- O. Piping Restraint Installation: Install seismic restraints on vacuum piping. Seismic-restraint devices are specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- P. Install medical vacuum service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- Q. Install medical vacuum bottle bracket adjacent to each wall-mounted medical vacuum service connection suction inlet.
- R. Connect vacuum piping to vacuum producers and to equipment requiring vacuum service.
- S. Install unions in copper vacuum tubing adjacent to each valve and at final connection to each machine, specialty, and piece of equipment.
- T. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- U. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 VALVE INSTALLATION

- A. Install shutoff valve at each connection to and from vacuum equipment and specialties.
- B. Install check valves to maintain correct direction of vacuum flow to vacuum-producing equipment.
- C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- D. Install zone valves and gages in valve boxes. Rotate valves to angle that prevents closure of cover when valve is in closed position.

- E. Install flexible pipe connectors in suction inlet piping to each vacuum producer.

3.4 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. Threaded Joints: Apply appropriate tape to external pipe threads.
- E. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Do not use flux. Continuously purge joint with oil-free dry nitrogen during brazing.
- F. Soldered Joints: Apply ASTM B 813, water-flushable flux to tube end. Join copper tube and fittings according to ASTM B 828.
- G. Flanged Joints:
 - 1. Copper Tubing: Install flange on copper tubes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
 - 2. PVC Piping: Install PVC flange on PVC pipes. Use pipe-flange gasket between flanges. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.
- H. Pressure-Sealed Joints: Join copper tube and copper and copper-alloy fittings with tools recommended by fitting manufacturer.
- I. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.
- J. Solvent-Cemented Joints: Clean and dry joining surfaces. Join PVC pipe and fittings according to the following:
 - 1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
 - 2. Apply primer and join according to ASME B31.9 and ASTM D 2672 for solvent-cemented joints.

3.5 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or Type 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - 2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.
- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch-minimum rods.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
 - 7. NPS 2: 11 feet with 3/8-inch rod.
 - 8. NPS 2-1/2: 13 feet with 1/2-inch rod.
 - 9. NPS 3: 14 feet with 1/2-inch rod.
 - 10. NPS 3-1/2: 15 feet with 1/2-inch rod.
 - 11. NPS 4: 16 feet with 1/2-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.

3.6 IDENTIFICATION

- A. Install identifying labels and devices for laboratory vacuum piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Install identifying labels and devices for medical vacuum piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - 1. Medical Vacuum: Black letters on white background.

3.7 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL VACUUM PIPING

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections of medical vacuum piping systems in healthcare facilities and to prepare test and inspection reports.
- B. Tests and Inspections:
 - 1. Medical Vacuum Testing Coordination: Perform tests, inspections, verifications, and certification of medical vacuum piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical gas piping systems.
 - 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - a. Initial blowdown.
 - b. Initial pressure test.
 - c. Cross-connection test.
 - d. Piping purge test.
 - e. Standing pressure test for vacuum systems.
 - f. Repair leaks and retest until no leaks exist.
 - 3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:
 - a. Standing pressure test.
 - b. Individual-pressurization or pressure-differential cross-connection test.
 - c. Valve test.
 - d. Master and area alarm tests.
 - e. Piping purge test.
 - f. Final tie-in test.
 - g. Operational vacuum test.
 - h. Verify correct labeling of equipment and components.

4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - a. Inspections performed.
 - b. Procedures, materials, and gases used.
 - c. Test methods used.
 - d. Results of tests.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.

3.8 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.
- C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.9 PIPING SCHEDULE

- A. Connect new copper tubing to existing copper tubing with memory-metal couplings.
- B. Flanges may be used where connection to flanged equipment is required.
- C. Medical Vacuum Piping: Use copper medical gas tube, wrought-copper fittings, and brazed joints.
 1. NPS 4 and Smaller: Copper medical gas tube, wrought-copper fittings, and brazed joints.

3.10 VALVE SCHEDULE

- A. Shutoff Valves:
 1. Copper Tubing: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.
 2. PVC Piping:
 - a. NPS 4 and Smaller: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.

- B. Zone Valves: Copper-alloy ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 226213

SECTION 226313 - GAS PIPING FOR HEALTHCARE FACILITIES

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. Oxygen piping, designated "medical oxygen."
- B. Owner-Furnished Material:
 - 1. Patient-service consoles.
 - 2. Owner will furnish gases for medical gas concentration testing specified in this Section.
- C. Related Requirements:
 - 1. Section 226400 "Medical Gas Alarms" for combined medical air, vacuum, and gas alarms.

1.3 DEFINITIONS

- A. CR: Chlorosulfonated polyethylene synthetic rubber.
- B. Medical gas piping systems include medical oxygen for healthcare facility patient care.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.

- B. Material Certificates: Signed by Installer certifying that medical gas piping materials comply with requirements in NFPA 99 for positive-pressure medical gas systems.
- C. Field Quality Control Reports: Brazing certificates.
- D. Source Quality Control Reports:
 - 1. Certificates of Shop Inspection and Data Report for Bulk Gas Storage Tanks: As required by ASME Boiler and Pressure Vessel Code.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For medical gas piping 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. Quick-Coupler Service Connections: Furnish complete noninterchangeable medical gas pressure outlets and suction inlets.
 - a. Medical Oxygen: Equal to 10 percent of quantity installed, but no fewer than 3 units.
 - 2. D.I.S.S. Service Connections: Furnish complete medical gas pressure outlets and suction inlets complying with CGA V-5.
 - a. Medical Oxygen D.I.S.S. No. 1240: Equal to 10 percent of quantity installed, but no fewer than 3 units.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications:
 - 1. Medical Gas Piping Systems for Healthcare Facilities: According to ASSE Standard #6010 for medical-gas-system installers.
 - 2. Bulk Medical Gas Systems for Healthcare Facilities: According to ASSE Standard #6015 for bulk-medical-gas-system installers.
 - 3. Shape-Memory-Metal Coupling Joints: An authorized representative who is trained and approved by manufacturer.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the medical gas piping testing indicated, that is a member of the

Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.

1. Qualify testing personnel according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.
- C. Brazing: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code, Section IX, "Welding and Brazing Qualifications"; or AWS B2.2, "Standard for Brazing Procedure and Performance Qualification."

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Medical oxygen operating at 50 to 55 psig.

2.2 PIPES, TUBES, AND FITTINGS

- A. Comply with NFPA 99.
- B. For all medical gases, all positive pressure medical gas piping, tubing, and fittings shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
 1. Each length of tubing shall be delivered plugged or capped by the manufacturer and kept sealed until prepared for installation.
 2. Fittings and other components shall be delivered manufacturer sealed and labeled, and kept sealed until prepared for installation.
- C. Copper Medical Gas Tube: ASTM B 819, Type K and Type L, seamless, drawn temper. Include standard color marking "OXY," "MED," "OXY/MED," "OXY/ACR," or "ACR/MED" in green for Type K tube and blue for Type L tube.
- D. Wrought-Copper Fittings: ASME B16.22, solder-joint pressure type.
- E. Copper Unions: ASME B16.22 or MSS SP-123, wrought-copper or cast-copper alloy.
- F. Cast-Copper-Alloy Flanges: ASME B16.24, Class 150.
 1. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, full-face type.
 2. Flange Bolts and Nuts: ASME B18.2.1, carbon steel.
- G. Shape-Memory-Metal Couplings:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Aerofit, Inc.
2. Description: Cryogenic compression fitting made of nickel-titanium, shape-memory alloy.

2.3 JOINING MATERIALS

- A. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys.
- B. Threaded-Joint Tape: PTFE.
- C. Solvent Cement for Joining PVC Piping: ASTM D 2564. Include primer complying with ASTM F 656.

2.4 VALVES

- A. Zone-Valve Box Assemblies: Box with medical gas valves, tube extensions, and gages.
 1. Steel Box with Aluminum Cover:
 - a. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1) Amico Corporation.
 - b. Description: Formed steel box with cover, anchors for recessed mounting, holes with grommets in box sides for tubing extension protection, and of size for single or multiple valves with pressure gages and in sizes required to permit manual operation of valves. Medical air and medical vacuum tubing, valves, and gages may be incorporated in zone valve boxes for medical gases.
 - 1) Interior Finish: Factory-applied white enamel.
 - 2) Cover Plate: Aluminum with frangible or removable windows.
 - 3) Valve-Box Windows: Clear or tinted transparent plastic with labeling that includes rooms served, according to NFPA 99.
 2. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.

- a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

B. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amico Corporation.
 - b. BeaconMedaes.
 - c. NIBCO INC.
2. Standard: MSS SP-110.
3. Description: Three-piece body, brass or bronze.
4. Pressure Rating: 300 psig minimum.
5. Ball: Full-port, chrome-plated brass.
6. Seats: PTFE or TFE.
7. Handle: Lever type with locking device.
8. Stem: Blowout proof with PTFE or TFE seal.
9. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions and manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.
10. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
 - a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

C. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amico Corporation.
 - b. BeaconMedaes.
2. Description: In-line pattern, bronze.
3. Pressure Rating: 300 psig minimum.
4. Operation: Spring loaded.
5. Ends: Manufacturer-installed ASTM B 819, copper-tube extensions.
6. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.

- a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

D. Medical Gas Safety Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Beacon Medaes.
- 2. Bronze body.
- 3. ASME-construction, poppet, pressure-relief type.
- 4. Settings to match system requirements.
- 5. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
 - a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

E. Pressure Regulators:

- 1. Stainless-steel body and trim.
- 2. Spring-loaded, diaphragm-operated, relieving type.
- 3. Manual pressure-setting adjustment.
- 4. Rated for 250-psig minimum inlet pressure.
- 5. Capable of controlling delivered gas pressure within 0.5 psig for each 10-psig inlet pressure.
- 6. Positive pressure medical gas valves, for all medical gas types, shall have been manufacturer cleaned, purged, and sealed for oxygen service, according to CGA G-4.1.
 - a. Valves shall be delivered sealed and labeled and kept sealed until prepared for installation.

2.5 MEDICAL GAS SERVICE CONNECTIONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amico Corporation.
 - 2. BeaconMedaes.
- B. General Requirements for Medical Gas Service Connections:

1. All positive pressure medical gas service connections, for all medical gas type, shall be manufacturer cleaned, purged, and sealed as for oxygen service in accordance with CGA G-4.
2. Suitable for specific medical gas pressure and suction service listed.
3. Include roughing-in assemblies, finishing assemblies, and cover plates.
4. Individual cover plates are not required if service connection is in multiple unit or assembly with cover plate.
5. Recessed-type units made for concealed piping unless otherwise indicated.

C. Roughing-in Assembly:

1. Steel outlet box for recessed mounting and concealed piping.
2. Brass-body outlet block with secondary check valve that will prevent gas flow when primary valve is removed. Suction inlets to be without secondary valve.
3. Double seals that will prevent gas leakage.
4. ASTM B 819, NPS 3/8 copper outlet tube brazed to valve with service marking and tube-end dust cap.

D. Finishing Assembly:

1. Brass housing with primary check valve.
2. Double seals that will prevent gas leakage.
3. Cover plate with gas-service label.

E. Quick-Coupler Pressure Service Connections: Outlets for oxygen with noninterchangeable keyed indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment, and with positive-locking ring that retains equipment stem in valve during use.

F. D.I.S.S. Pressure Service Connections: Outlets, complying with CGA V-5, with threaded indexing to prevent interchange between services, constructed to permit one-handed connection and removal of equipment.

1. Medical Oxygen: D.I.S.S. No. 1240.

G. Cover Plates: One piece, aluminum or stainless steel and permanent, color-coded, identifying label matching corresponding service.

2.6 PATIENT-SERVICE CONSOLES

A. Patient-Service Consoles: Recessed mounted.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amico Corporation.
 - b. BeaconMedaes.

2. Manufacturer cleaned, purged, and sealed, for all medical gas type, for oxygen service in accordance with CGA G-4.1.
3. Standard: UL 60601.
4. 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.
5. General Requirements for Patient-Service Consoles: Wall units with service connections. Include labels indicating services, and the following:
 - a. Steel console box or mounting bracket.
 - b. Concealed supplies.
 - c. Cover: One piece, aluminum or stainless steel and permanent identifying label.
 - d. Medical gas service connections as specified in "Medical Gas Service Connections" Article.
 - 1) Medical Oxygen: One quick-coupler pressure outlet(s).
 - e. Electrical Service Connections:
 - 1) General Requirements for Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

2.7 NITROGEN

- A. Comply with USP 32 - NF 27 for oil-free dry nitrogen.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Cleaning of Medical Gas Tubing: If manufacturer-cleaned and -capped fittings or tubing is not available or if precleaned fittings or tubing must be recleaned because of exposure, have supplier or separate agency acceptable to authorities having jurisdiction perform the following procedures:
 1. Clean medical gas tube and fittings, valves, gages, and other components of oil, grease, and other readily oxidizable materials as required for oxygen service according to CGA G-4.1.

2. Wash medical gas tubing and components in hot, alkaline-cleaner-water solution of sodium carbonate or trisodium phosphate in proportion of 1 lb of chemical to 3 gal. of water.
 - a. Scrub to ensure complete cleaning.
 - b. Rinse with clean, hot water to remove cleaning solution.

3.2 EARTHWORK

- A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling and for underground warning tapes.

3.3 PIPING INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of gas piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
- B. Comply with NFPA 99 for installation of medical gas piping.
- C. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and coordinate with other services occupying that space.
- F. Install piping adjacent to equipment and specialties to allow service and maintenance.
- G. Install nipples, unions, special fittings, and valves with pressure ratings same as or higher than system pressure rating used in applications specified in "Piping Schedule" Article unless otherwise indicated.
- H. Install piping to permit valve servicing.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and for branch connections.

- K. Install medical gas piping to medical gas service connections specified in this Section, to medical gas service connections in equipment specified in this Section, and to equipment specified in other Sections requiring medical gas service.
- L. Install exterior, buried medical gas piping in protective conduit fabricated with PVC pipe and fittings. Do not extend conduit through foundation wall.
- M. Piping Restraint Installation: Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
- N. Install medical gas service connections recessed in walls. Attach roughing-in assembly to substrate; attach finishing assembly to roughing-in assembly.
- O. Connect gas piping to gas sources and to gas outlets and equipment requiring gas service.
- P. Install unions in copper tubing adjacent to each valve and at final connection to each specialty and piece of equipment.
- Q. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- R. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
- S. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.4 VALVE INSTALLATION

- A. Install shutoff valve at each connection to gas laboratory and healthcare equipment and specialties.
- B. Install check valves to maintain correct direction of gas flow from laboratory and healthcare gas supplies.
- C. Install valve boxes recessed in wall and anchored to substrate. Single boxes may be used for multiple valves that serve same area or function.
- D. Install zone valves and gages in valve boxes. Arrange valves so largest valve is lowest. Rotate valves to angle that prevents closure of cover when valve is in closed position.

- E. Install pressure regulators on gas piping where reduced pressure is required.
- F. Install emergency oxygen connection with pressure relief valve and full-size discharge piping to outside, with check valve downstream from pressure relief valve, and with ball valve and check valve in supply main from bulk oxygen storage tank.

3.5 JOINT CONSTRUCTION

- A. Ream ends of PVC pipes and remove burrs.
- B. Remove scale, slag, dirt, and debris from outside of cleaned tubing and fittings before assembly.
- C. Threaded Joints: Apply appropriate tape to external pipe threads.
- D. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Brazed Joints" chapter. Continuously purge joint with oil-free, dry nitrogen during brazing.
- E. Shape-Memory-Metal Coupling Joints: Join new copper tube to existing tube according to procedures developed by fitting manufacturer for installation of shape-memory-metal coupling joints.

3.6 GAS SERVICE COMPONENT INSTALLATION

- A. Assemble patient-service console with service connections. Install with supplies concealed in walls. Attach console box or mounting bracket to substrate.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.
- B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.
- C. Vertical Piping: MSS Type 8 or Type 42, clamps.
- D. Individual, Straight, Horizontal Piping Runs:
 - 1. 100 Feet and Less: MSS Type 1, adjustable, steel, clevis hangers.
 - 2. Longer Than 100 Feet: MSS Type 43, adjustable, roller hangers.

- E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for trapeze hangers.
- F. Base of Vertical Piping: MSS Type 52, spring hangers.
- G. Support horizontal piping within 12 inches of each fitting and coupling.
- H. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch-minimum rods.
- I. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:
 - 1. NPS 1/4: 60 inches with 3/8-inch rod.
 - 2. NPS 3/8 and NPS 1/2: 72 inches with 3/8-inch rod.
 - 3. NPS 3/4: 84 inches with 3/8-inch rod.
 - 4. NPS 1: 96 inches with 3/8-inch rod.
 - 5. NPS 1-1/4: 108 inches with 3/8-inch rod.
 - 6. NPS 1-1/2: 10 feet with 3/8-inch rod.
 - 7. NPS 2: 11 feet with 3/8-inch rod.
 - 8. NPS 2-1/2: 13 feet with 1/2-inch rod.
 - 9. NPS 3: 14 feet with 1/2-inch rod.
- J. Install supports for vertical copper tubing every 10 feet.

3.8 IDENTIFICATION

- A. Install identifying labels and devices for specialty gas piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."
- B. Install identifying labels and devices for healthcare medical gas piping systems according to NFPA 99. Use the following or similar captions and color-coding for piping products where required by NFPA 99:
 - 1. Oxygen: White letters on green background or green letters on white background.

3.9 FIELD QUALITY CONTROL FOR HEALTHCARE FACILITY MEDICAL GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:

1. Medical Gas Piping Testing Coordination: Perform tests, inspections, verifications, and certification of medical gas piping systems concurrently with tests, inspections, and certification of medical compressed-air piping and medical vacuum piping systems.
 2. Preparation: Perform the following Installer tests according to requirements in NFPA 99 and ASSE Standard #6010:
 - a. Initial blowdown.
 - b. Initial pressure test.
 - c. Cross-connection test.
 - d. Piping purge test.
 - e. Standing pressure test for positive-pressure medical gas piping.
 - f. Standing pressure test for vacuum systems.
 - g. Repair leaks and retest until no leaks exist.
 3. System Verification: Perform the following tests and inspections according to NFPA 99, ASSE Standard #6020, and ASSE Standard #6030:
 - a. Standing pressure test.
 - b. Individual-pressurization or pressure-differential cross-connection test.
 - c. Valve test.
 - d. Master and area alarm tests.
 - e. Piping purge test.
 - f. Piping particulate test.
 - g. Piping purity test.
 - h. Final tie-in test.
 - i. Operational pressure test.
 - j. Medical gas concentration test.
 - k. Medical air purity test.
 - l. Verify correct labeling of equipment and components.
 - m. Verify medical gas supply sources.
 4. Testing Certification: Certify that specified tests, inspections, and procedures have been performed and certify report results. Include the following:
 - a. Inspections performed.
 - b. Procedures, materials, and gases used.
 - c. Test methods used.
 - d. Results of tests.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.
- D. Prepare test and inspection reports.

3.10 FIELD QUALITY CONTROL FOR LABORATORY FACILITY SPECIALTY GAS

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Tests and Inspections:
 - 1. Piping Leak Tests for Specialty Gas Piping: Test new and modified parts of existing piping. Cap and fill specialty gas piping with oil-free, dry nitrogen to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.
 - 2. Repair leaks and retest until no leaks exist.
 - 3. Inspect specialty gas regulators for proper operation.
- C. Remove and replace components that do not pass tests and inspections and retest as specified above.
- D. Prepare test and inspection reports.

3.11 PROTECTION

- A. Protect tubing from damage.
- B. Retain sealing plugs in tubing, fittings, and specialties until installation.
- C. Clean tubing not properly sealed, and where sealing is damaged, according to "Preparation" Article.

3.12 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain bulk gas storage tanks.

3.13 PIPING SCHEDULE

- A. Connect new tubing to existing tubing with memory-metal couplings.
- B. Medical Gas Piping except Medical Nitrogen Piping Larger Than NPS 3 and Operating at More Than 185 psig: Type L, copper tube; wrought-copper fittings; and brazed joints.

3.14 VALVE SCHEDULE

- A. Shutoff Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions.
- B. Zone Valves: Ball valve with manufacturer-installed ASTM B 819, copper-tube extensions with pressure gage on one copper-tube extension.

END OF SECTION 226313

SECTION 226400 - MEDICAL GAS ALARMS

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. Area alarm panels.
 - 2. Computer-interface cabinet.

1.3 DEFINITIONS

- A. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing agency.
- B. Product Test Reports: For each alarm panel, for tests performed by a qualified testing agency.
- C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For alarm panels and computer-interface cabinet to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Qualify Installers for air, vacuum, and gas piping systems for healthcare facilities according to ASSE Standard #6010 for medical-gas-system installers.
- B. Testing Agency Qualifications: An independent testing agency, with the experience and capability to conduct the air, vacuum, and gas piping testing indicated, that is a member of the Medical Gas Professional Healthcare Organization or is an NRTL, and that is acceptable to authorities having jurisdiction.
 - 1. Qualify testing personnel for air, vacuum, and gas piping systems for healthcare facilities according to ASSE Standard #6020 for medical-gas-system inspectors and ASSE Standard #6030 for medical-gas-system verifiers.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Gas and Vacuum Systems Monitored:
 - 1. Medical compressed air, designated "medical air."
 - 2. Medical-surgical vacuum, designated "medical vacuum."
 - 3. Oxygen, designated "medical oxygen."

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amico Corporation.
 - 2. BeaconMedaes.
 - 3. Ohio Medical Corporation.
- B. Source Limitations: Obtain medical alarm systems and components from single manufacturer.

2.3 GENERAL REQUIREMENTS FOR ALARM PANELS

- A. Description: Factory wired with audible and color-coded visible signals to indicate specified functions.
 - 1. Mounting: Recessed installation.
 - 2. Enclosures: Fabricated from minimum 0.047-inch-thick steel or minimum 0.05-inch-thick aluminum, with knockouts for electrical and piping connections.
- B. Components: Designed for continuous service and to operate on power supplied from 120-V ac power source to alarm panels and with connections for low-voltage wiring to remote sensing devices. Include step-down transformers if required.
- C. Pressure Switches or Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - 1. Low-Pressure Operating Range: 0 to 100 psig.
 - 2. High-Pressure Operating Range: Up to 250 psig.
- D. Vacuum Switches or Pressure Transducer Sensors: Continuous line monitoring with electrical connections for alarm system.
 - 1. Vacuum Operating Range: 0 to 30 in. Hg.

2.4 AREA ALARM PANELS

- A. Area Alarm Panels: Separate trouble alarm signals and indicators for each system.
 - 1. Standards: Comply with NFPA 99 and UL 544.
 - 2. 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.
 - 3. Include alarm signals when the following condition exists:
 - a. Medical Air: Pressure drops below 40 psig or rises above 60 psig.
 - b. Medical Vacuum: Vacuum drops below 12 in. Hg.
 - c. Medical Oxygen: Pressure drops below 40 psig or rises above 60 psig.

2.5 COMPUTER-INTERFACE CABINET

- A. Description:
 - 1. Wall-mounted, welded-steel, control cabinet with gasketed door.
 - 2. Mounting brackets.
 - 3. Grounding device.

4. White-enamel finish.
5. Factory-installed signal circuit boards.
6. Power transformer.
7. Circuit breaker.
8. Wiring terminal board, and internal wiring capable of interfacing 20 alarm signals.

PART 3 - EXECUTION

3.1 ALARM-PANEL INSTALLATION

- A. Install alarm panels in locations required by and according to NFPA 99.
- B. Install computer-interface cabinet with connection to alarm panels and facility computer.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 226113 "Compressed-Air Piping for Laboratory and Healthcare Facilities," Section 226213 "Vacuum Piping for Laboratory and Healthcare Facilities," and Section 226313 "Gas Piping for Laboratory and Healthcare Facilities." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to alarm panels, allow space for service and maintenance.

3.3 IDENTIFICATION

- A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment" and according to NFPA 99.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to 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. Perform each visual and mechanical inspection.
 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
 3. Test and adjust controls and safeties. Replace damaged and malfunctioning panels and equipment.
- D. Alarm panels will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 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.

3.6 ADJUSTING

- A. Adjust initial alarm panel pressure and vacuum set points.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain alarm panels and computer-interface cabinet.

END OF SECTION 226400

SECTION 230500 – BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Piping materials and installation instructions common to most piping systems.
 - 2. Dielectric fittings.
 - 3. Mechanical sleeve seals.
 - 4. Sleeves.
 - 5. Escutcheons.
 - 6. Grout.
 - 7. Equipment installation requirements common to equipment sections.
 - 8. Concrete bases.
 - 9. Supports and anchorages.

1.2 DEFINITIONS

- A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.
- B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.
- C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.
- D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

1.3 QUALITY ASSURANCE

- A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."
- B. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

PART 2 - PRODUCTS

2.1 PIPE, TUBE, AND FITTINGS

- A. Refer to individual Division 23 piping Sections for pipe, tube, and fitting materials and joining methods.
- B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS

- A. Refer to individual Division 23 piping Sections for special joining materials not listed below.
- B. Pipe-Flange Gasket Materials: ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless thickness or specific material is 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, BCuP Series or BAg1, unless otherwise indicated.
- F. Welding Filler Metals: Comply with AWS D10.12.

2.3 DIELECTRIC FITTINGS

- A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.
- B. Insulating Material: Suitable for system fluid, pressure, and temperature.
- C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig minimum working pressure at 180 deg F.
- D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig minimum working pressure as required to suit system pressures.
- E. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig minimum working pressure at 225 deg F.

- F. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig minimum working pressure at 225 deg F.

2.4 MECHANICAL SLEEVE SEALS

- A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.
- B. Sealing Elements: EPDM interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
- C. Pressure Plates: Carbon steel. Include two for each sealing element.
- D. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.5 SLEEVES

- A. Galvanized-Steel Sheet: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.
- B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.
- C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with set screws.

2.6 ESCUTCHEONS

- A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.
- C. One-Piece, Cast-Brass Type: With set screw.
 - 1. Finish: Polished chrome-plated and rough brass.

2.7 GROUT

- A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.
 - 1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

- A. COORDINATE WITH ALL TRADES TO PROVIDE ACCESS TO ALL TERMINAL UNIT CONTROLS, DAMPERS, VALVES AND OTHER MECHANICAL EQUIPMENT AND DEVICES INSTALLED ABOVE ARCHITECTURAL CEILINGS, INCLUDING CONTROL PANELS, FIRE DAMPERS, VOLUME DAMPERS, CONTROL VALVES, BALANCING VALVES AND ISOLATION VALVES FOR SERVICING AND MAINTENANCE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATION MANUAL. WHERE ACCESS AS DESCRIBED ABOVE IS NOT PROVIDED, CONTRACTOR SHALL BE RESPONSIBLE THROUGH PROJECT WARRANTY PERIOD TO MODIFY INSTALLATION AS NECESSARY TO PROVIDE REQUIRED ACCESS.

3.2 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.
- C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.
- D. 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.
- E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

- F. Install piping to permit valve servicing.
- G. Install piping at indicated slopes.
- H. Install piping free of sags and bends.
- I. Install fittings for changes in direction and branch connections.
- J. Install piping to allow application of insulation.
- K. Select system components with pressure rating equal to or greater than system operating pressure.
- L. Install escutcheons for penetrations of walls, ceilings, and floors.
- M. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.
- N. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.
- O. Verify final equipment locations for roughing-in.
- P. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.3 PIPING JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- D. 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.
- E. Brazed Joints: Construct joints according to AWS's "Brazeing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

- F. 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.
- G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

3.4 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

- A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.
- B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.
- C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations.
- D. Install equipment to allow right of way for piping installed at required slope.

END OF SECTION 230500

SECTION 230513 – COMMON MOTOR REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes basic requirements for factory- and field-installed motors.
- B. See Division 23 Section "Mechanical Vibration and Seismic Controls" for mounting motors and vibration isolation and seismic-control devices.
- C. See individual Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.2 SUBMITTALS

- A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; enclosure type and mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.
- B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:
 - 1. Each installed unit's type and details.
 - 2. Nameplate legends.
 - 3. Diagrams of power, signal, and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

1.4 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices and features that comply with the following:

1. Compatible with the following:
 - a. Magnetic controllers.
 - b. Multispeed controllers.
 2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
 3. Matched to torque and horsepower requirements of the load.
 4. Matched to ratings and characteristics of supply circuit and required control sequence.
- B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.
- C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

- A. Comply with requirements in this Section except when stricter requirements are specified in HVAC equipment schedules or Sections.
- B. Comply with NEMA MG 1 unless otherwise indicated.

2.2 Comply with IEEE 841 for severe-duty motors

2.3 MOTOR CHARACTERISTICS

- A. Motors 1/2 HP and Larger: Three phase.
- B. Motors Smaller Than 1/2 HP: Single phase.
- C. Frequency Rating: 60 Hz.
- D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.
- E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.
- F. Duty: Continuous duty at ambient temperature of 105 deg F(40 deg C) and at altitude of 3300 feet(1005 m) above sea level.

- G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
- H. Enclosure: Open dripproof.

2.4 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Premium, as defined in NEMA MG 1.
- C. Stator: Copper windings, unless otherwise indicated.
 - 1. Multispeed motors shall have separate winding for each speed.
- D. Rotor: Squirrel cage, unless otherwise indicated.
- E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.
- F. Temperature Rise: Match insulation rating, unless otherwise indicated.
- G. Insulation: Class F, unless otherwise indicated.
- H. Code Letter Designation:
 - 1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
 - 2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.
- I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.
 - 1. Finish: Gray enamel.

2.5 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.
- B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Designed with critical vibration frequencies outside operating range of controller output.
 2. Temperature Rise: Matched to rating for Class B insulation.
 3. Insulation: Class H.
 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with non-hygroscopic material.
1. Finish: Chemical-resistant paint over corrosion-resistant primer.
- D. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
1. Measure winding resistance.
 2. Read no-load current and speed at rated voltage and frequency.
 3. Measure locked rotor current at rated frequency.
 4. Perform high-potential test.

2.6 SINGLE-PHASE MOTORS

- A. Type: One of the following, to suit starting torque and requirements of specific motor application:
1. Permanent-split capacitor.
 2. Split-phase start, capacitor run.
 3. Capacitor start, capacitor run.
- B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.
- C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.
- D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.
- E. Source Quality Control for Field-Installed Motors: Perform the following tests on each motor according to NEMA MG 1:
1. Measure winding resistance.
 2. Read no-load current and speed at rated voltage and frequency.
 3. Measure locked rotor current at rated frequency.
 4. Perform high-potential test.

PART 3 - EXECUTION

3.1 FIELD-INSTALLED MOTOR INSTALLATION

- A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.
- B. Install motors on concrete bases complying with Division 3.
- C. Comply with mounting and anchoring requirements specified in Division 23 Section "Mechanical Vibration and Seismic Controls."

3.2 FIELD QUALITY CONTROL FOR FIELD-INSTALLED MOTORS

- A. Prepare for acceptance tests.
 - 1. Align motors, bases, shafts, pulleys, and belts. Tension belts according to manufacturer's written instructions.
 - 2. Verify bearing lubrication.
 - 3. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
 - 4. Test interlocks and control and safety features for proper operation.
 - 5. Verify that current and voltage for each phase comply with nameplate rating and NEMA MG 1 tolerances.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Perform electrical tests and visual and mechanical inspections except optional tests and inspections stated in NETA ATS on factory-installed motors. 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.

END OF SECTION 230513

SECTION 230519 - METERS AND GAGES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Liquid-in-glass thermometers.
 - 2. Thermowells.
 - 3. Dial-type pressure gages.
 - 4. Gage attachments.
 - 5. Test plugs.
 - 6. Test-plug kits.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Product Certificates: For each type of meter and gage, from manufacturer.
- D. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 LIQUID-IN-GLASS THERMOMETERS

- A. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flo Fab Inc.

- b. Palmer Wahl Instrumentation Group.
 - c. Tel-Tru Manufacturing Company.
 - d. Trerice, H. O. Co.
 - e. Weiss Instruments, Inc.
- 2. Standard: ASME B40.200.
 - 3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
 - 4. Case Form: Adjustable angle unless otherwise indicated.
 - 5. Tube: Glass with magnifying lens and blue organic liquid.
 - 6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F.
 - 7. Window: Glass or plastic.
 - 8. Stem: Aluminum and of length to suit installation.
 - a. Design for Air-Duct Installation: With ventilated shroud.
 - b. Design for Thermowell Installation: Bare stem.
 - 9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
 - 10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.2 DUCT-THERMOMETER MOUNTING BRACKETS

- A. Description: Flanged bracket with screw holes, for attachment to air duct and made to hold thermometer stem.

2.3 THERMOWELLS

- A. Thermowells:
 - 1. Standard: ASME B40.200.
 - 2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
 - 3. Material for Use with Copper Tubing: CNR.
 - 4. Material for Use with Steel Piping: CRES.
 - 5. Type: Stepped shank unless straight or tapered shank is indicated.
 - 6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
 - 7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
 - 8. Bore: Diameter required to match thermometer bulb or stem.
 - 9. Insertion Length: Length required to match thermometer bulb or stem.
 - 10. Lagging Extension: Include on thermowells for insulated piping and tubing.
 - 11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.
- B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Ashcroft Inc.
 - b. Palmer Wahl Instrumentation Group.
 - c. Trerice, H. O. Co.
 - d. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 - e. Weiss Instruments, Inc.
2. Standard: ASME B40.100.
3. Case: Sealed type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi.
8. Pointer: Dark-colored metal.
9. Window: Glass or plastic.
10. Ring: Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

- A. Snubbers: ASME B40.100, brass; with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.
- B. Siphons: Loop-shaped section of brass or steel pipe with NPS 1/4 or NPS 1/2 pipe threads.
- C. Valves: Brass ball, with NPS 1/4 or NPS 1/2, ASME B1.20.1 pipe threads.

2.6 TEST PLUGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Flow Design, Inc.
 2. National Meter, Inc.
 3. Peterson Equipment Co., Inc.

4. Sisco Manufacturing Company, Inc.
5. Trerice, H. O. Co.
6. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
7. Weiss Instruments, Inc.

- B. Description: Test-station fitting made for insertion into piping tee fitting.
- C. Body: Brass or stainless steel with core inserts and gasketed and threaded cap. Include extended stem on units to be installed in insulated piping.
- D. Thread Size: NPS 1/2, ASME B1.20.1 pipe thread.
- E. Minimum Pressure and Temperature Rating: 500 psig at 200 deg F.
- F. Core Inserts: EPDM self-sealing rubber.

2.7 TEST-PLUG KITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Flow Design, Inc.
 2. National Meter, Inc.
 3. Peterson Equipment Co., Inc.
 4. Sisco Manufacturing Company, Inc.
 5. Trerice, H. O. Co.
 6. Watts Regulator Co.; a div. of Watts Water Technologies, Inc.
 7. Weiss Instruments, Inc.
- B. Furnish one test-plug kit(s) containing two thermometer(s), one pressure gage and adapter, and carrying case. Thermometer sensing elements, pressure gage, and adapter probes shall be of diameter to fit test plugs and of length to project into piping.
- C. High-Range Thermometer: Small, bimetallic insertion type with 1- to 2-inch diameter dial and tapered-end sensing element. Dial range shall be at least 0 to 220 deg F.
- D. Pressure Gage: Small, Bourdon-tube insertion type with 2- to 3-inch diameter dial and probe. Dial range shall be at least 0 to 200 psig.
- E. Carrying Case: Metal or plastic, with formed instrument padding.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

COORDINATE WITH ALL TRADES TO PROVIDE ACCESS TO ALL METERS AND GAGES FOR HVAC PIPING AND OTHER RELATED MECHANICAL EQUIPMENT AND DEVICES INSTALLED ABOVE ARCHITECTURAL CEILINGS, INCLUDING CONTROL PANELS, FIRE DAMPERS, VOLUME DAMPERS, CONTROL VALVES, BALANCING VALVES AND ISOLATION VALVES FOR SERVICING AND MAINTENANCE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATION MANUAL. WHERE ACCESS AS DESCRIBED ABOVE IS NOT PROVIDED TO HVAC METERS AND GAGES, CONTRACTOR SHALL BE RESPONSIBLE THROUGH PROJECT WARRANTY PERIOD TO MODIFY INSTALLATION AS NECESSARY TO PROVIDE REQUIRED ACCESS.

3.2 INSTALLATION

- A. Install thermowells with socket extending one-third of pipe diameter and in vertical position in piping tees.
- B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.
- C. Install thermowells with extension on insulated piping.
- D. Fill thermowells with heat-transfer medium.
- E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.
- F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.
- G. Install duct-thermometer mounting brackets in walls of ducts. Attach to duct with screws.
- H. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.
- I. Install remote-mounted pressure gages on panel.
- J. Install valve and snubber in piping for each pressure gage for fluids (except steam).

- K. Install valve and syphon fitting in piping for each pressure gage for steam.
- L. Install test plugs in piping tees.
- M. Install flow indicators in piping systems in accessible positions for easy viewing.
- N. Assemble and install connections, tubing, and accessories between flow-measuring elements and flowmeters according to manufacturer's written instructions.
- O. Install flowmeter elements in accessible positions in piping systems.
- P. Install wafer-orifice flowmeter elements between pipe flanges.
- Q. Install differential-pressure-type flowmeter elements, with at least minimum straight lengths of pipe, upstream and downstream from element according to manufacturer's written instructions.
- R. Install permanent indicators on walls or brackets in accessible and readable positions.
- S. Install connection fittings in accessible locations for attachment to portable indicators.
- T. Mount thermal-energy meters on wall if accessible; if not, provide brackets to support meters.
- U. Install thermometers in the following locations:
 - 1. Inlet and outlet of each hydronic zone.
 - 2. Inlet and outlet of each hydronic coil in air-handling units.
- V. Install pressure gages in the following locations:
 - 1. Suction and discharge of each pump.

3.3 CONNECTIONS

- A. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

3.4 ADJUSTING

- A. After installation, calibrate meters according to manufacturer's written instructions.
- B. Adjust faces of meters and gages to proper angle for best visibility.

3.5 THERMOMETER SCHEDULE

- A. Thermometers at inlet and outlet of each hydronic zone shall be the following:
 - 1. Test plug with EPDM self-sealing rubber inserts.
- B. Thermometers at inlet and outlet of each hydronic coil in air-handling units and built-up central systems shall be one of the following:
 - 1. Industrial-style, liquid-in-glass type.
- C. Thermometer stems shall be of length to match thermowell insertion length.

3.6 THERMOMETER SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 20 to 240 deg F.
- B. Scale Range for Air Ducts: 0 to 150 deg F.

3.7 PRESSURE-GAGE SCALE-RANGE SCHEDULE

- A. Scale Range for Heating, Hot-Water Piping: 0 to 100 psi.

END OF SECTION 230519

SECTION 230523 - GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Brass ball valves.
 - 2. Bronze ball valves.
 - 3. Iron ball valves.
 - 4. Iron, single-flange butterfly valves.
 - 5. Iron, grooved-end butterfly valves.
 - 6. Bronze swing check valves.
 - 7. Iron swing check valves.

1.3 DEFINITIONS

- A. CWP: Cold working pressure.
- B. EPDM: Ethylene propylene copolymer rubber.
- C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.
- D. NRS: Nonrising stem.
- E. OS&Y: Outside screw and yoke.
- F. RS: Rising stem.
- G. SWP: Steam working pressure.

1.4 SUBMITTALS

- A. Product Data: For each type of valve indicated.

1.5 QUALITY ASSURANCE

- A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
- B. ASME Compliance:
 - 1. ASME B31.9 for building services piping valves.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, grooves, and weld ends.
 - 3. Set angle, gate, and globe valves closed to prevent rattling.
 - 4. Set ball and plug valves open to minimize exposure of functional surfaces.
 - 5. Set butterfly valves closed or slightly open.
 - 6. Block check valves in either closed or open position.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

- A. Refer to HVAC valve schedule articles for applications of valves.
- B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
- C. Valve Sizes: Same as upstream piping unless otherwise indicated.
- D. Valve Actuator Types:
 - 1. Gear Actuator: For quarter-turn valves NPS 8 and larger.
 - 2. Handwheel: For valves other than quarter-turn types.

3. Handlever: For quarter-turn valves NPS 6 and smaller except plug valves.
- E. Valves in Insulated Piping: With 2-inch stem extensions and the following features:
 1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
 2. Butterfly Valves: With extended neck.
- F. Valve-End Connections:
 1. Flanged: With flanges according to ASME B16.1 for iron valves.
 2. Grooved: With grooves according to AWWA C606.
 3. Solder Joint: With sockets according to ASME B16.18.
 4. Threaded: With threads according to ASME B1.20.1.
- G. Valve Bypass and Drain Connections: MSS SP-45.

2.2 BRASS BALL VALVES

- A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Crane Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Two piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.
- B. Three-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Jomar International, LTD.
 - b. Kitz Corporation.
 - c. Marwin Valve; a division of Richards Industries.
 - d. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-110.
 - b. SWP Rating: 150 psig.
 - c. CWP Rating: 600 psig.
 - d. Body Design: Three piece.
 - e. Body Material: Forged brass.
 - f. Ends: Threaded.
 - g. Seats: PTFE or TFE.
 - h. Stem: Stainless steel.
 - i. Ball: Stainless steel, vented.
 - j. Port: Full.

2.3 IRON BALL VALVES

A. Class 125, Iron Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Valve, Inc.
 - b. Conbraco Industries, Inc.; Apollo Valves.
 - c. Kitz Corporation.
 - d. Sure Flow Equipment Inc.
 - e. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-72.
 - b. CWP Rating: 200 psig.
 - c. Body Design: Split body.
 - d. Body Material: ASTM A 126, gray iron.
 - e. Ends: Flanged.
 - f. Seats: PTFE or TFE.
 - g. Stem: Stainless steel.
 - h. Ball: Stainless steel.
 - i. Port: Full.

2.4 IRON, SINGLE-FLANGE BUTTERFLY VALVES

A. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Aluminum-Bronze Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. DeZurik Water Controls.
 - e. Hammond Valve.
 - f. Milwaukee Valve Company.
 - g. NIBCO INC.
 - h. Tyco Valves & Controls; a unit of Tyco Flow Control.
 - i. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 150 psig.
 - c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
 - d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
 - e. Seat: EPDM.
 - f. Stem: One- or two-piece stainless steel.
 - g. Disc: Aluminum bronze.

B. 200 CWP, Iron, Single-Flange Butterfly Valves with EPDM Seat and Stainless-Steel Disc:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Conbraco Industries, Inc.; Apollo Valves.
 - b. Crane Co.; Crane Valve Group; Jenkins Valves.
 - c. Crane Co.; Crane Valve Group; Stockham Division.
 - d. Hammond Valve.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Tyco Valves & Controls; a unit of Tyco Flow Control.
 - h. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-67, Type I.

- b. CWP Rating: 150 psig.
- c. Body Design: Lug type; suitable for bidirectional dead-end service at rated pressure without use of downstream flange.
- d. Body Material: ASTM A 126, cast iron or ASTM A 536, ductile iron.
- e. Seat: EPDM.
- f. Stem: One- or two-piece stainless steel.
- g. Disc: Stainless steel.

2.5 IRON, GROOVED-END BUTTERFLY VALVES

A. 175 CWP, Iron, Grooved-End Butterfly Valves:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Kennedy Valve; a division of McWane, Inc.
 - b. Shurjoint Piping Products.
 - c. Tyco Fire Products LP; Grinnell Mechanical Products.
 - d. Victaulic Company.
- 2. Description:
 - a. Standard: MSS SP-67, Type I.
 - b. CWP Rating: 175 psig.
 - c. Body Material: Coated, ductile iron.
 - d. Stem: Two-piece stainless steel.
 - e. Disc: Coated, ductile iron.
 - f. Seal: EPDM.

2.6 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Jenkins Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Kitz Corporation.
 - e. Milwaukee Valve Company.
 - f. NIBCO INC.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
- 2. Description:

- a. Standard: MSS SP-80, Type 3.
- b. CWP Rating: 200 psig.
- c. Body Design: Horizontal flow.
- d. Body Material: ASTM B 62, bronze.
- e. Ends: Threaded.
- f. Disc: Bronze.

2.7 IRON SWING CHECK VALVES

A. Class 125, Iron Swing Check Valves with Metal Seats:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Crane Co.; Crane Valve Group; Jenkins Valves.
 - b. Crane Co.; Crane Valve Group; Stockham Division.
 - c. Hammond Valve.
 - d. Milwaukee Valve Company.
 - e. NIBCO INC.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
2. Description:
 - a. Standard: MSS SP-71, Type I.
 - b. NPS 2-1/2 to NPS 12, CWP Rating: 200 psig.
 - c. NPS 14 to NPS 24, CWP Rating: 150 psig.
 - d. Body Design: Clear or full waterway.
 - e. Body Material: ASTM A 126, gray iron with bolted bonnet.
 - f. Ends: Flanged.
 - g. Trim: Bronze.
 - h. Gasket: Asbestos free.

PART 3 - EXECUTION

3.1 COORDINATION WITH OTHER TRADES

COORDINATE WITH ALL TRADES TO PROVIDE ACCESS TO ALL HVAC VALVES AND OTHER RELATED MECHANICAL EQUIPMENT AND DEVICES INSTALLED ABOVE ARCHITECTURAL CEILINGS, INCLUDING CONTROL PANELS, FIRE DAMPERS, VOLUME DAMPERS, CONTROL VALVES, BALANCING VALVES AND ISOLATION VALVES FOR SERVICING AND MAINTENANCE IN ACCORDANCE WITH THE MANUFACTURER'S INSTALLATION AND OPERATION MANUAL. WHERE ACCESS AS DESCRIBED ABOVE IS NOT PROVIDED, CONTRACTOR

SHALL BE RESPONSIBLE THROUGH PROJECT WARRANTY PERIOD TO MODIFY INSTALLATION AS NECESSARY TO PROVIDE REQUIRED ACCESS.

3.2 EXAMINATION

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.3 VALVE INSTALLATION

- A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
- B. Locate valves for easy access and provide separate support where necessary.
- C. Install valves in horizontal piping with stem at or above center of pipe.
- D. Install valves in position to allow full stem movement.
- E. Install check valves for proper direction of flow and as follows:
 - 1. Swing Check Valves: In horizontal position with hinge pin level.

3.4 ADJUSTING

- A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.5 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

- A. If valve applications are not indicated, use the following:
 - 1. Shutoff Service: Ball or butterfly valves.
 - 2. Butterfly Valve Dead-End Service: Single-flange (lug) type.
- B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP classes or CWP ratings may be substituted.
- C. Select valves, except wafer types, with the following end connections:
 - 1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
 - 2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 3. For Steel Piping, NPS 2 and Smaller: Threaded ends.
 - 4. For Steel Piping, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.
 - 5. For Grooved-End Copper Tubing and Steel Piping: Valve ends may be grooved.

3.6 HEATING-WATER VALVE SCHEDULE

- A. Pipe NPS 2 and Smaller:
 - 1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
 - 2. Ball Valves: Two or Three piece, full port, brass or bronze with brass, bronze or stainless-steel trim.
 - 3. Bronze Swing Check Valves: Class 125 , bronze disc.
- B. Pipe NPS 2-1/2 and Larger:
 - 1. Iron Valves, NPS 2-1/2 to NPS 4: May be provided with threaded ends instead of flanged ends.
 - 2. Iron Ball Valves, NPS 2-1/2 to NPS 10: Class 150.
 - 3. Iron, Single-Flange Butterfly Valves, NPS 2-1/2 to NPS 12: 200 CWP, EPDM seat, aluminum-bronze or stainless-steel disc.
 - 4. Iron, Grooved-End Butterfly Valves, NPS 2-1/2 to NPS 12: 175 CWP.
 - 5. Iron Swing Check Valves: Class 125, metal seats.

END OF SECTION 230523

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

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 pipe hangers and supports.
2. Trapeze pipe hangers.
3. Metal framing systems.
4. Thermal-hanger shield inserts.
5. Fastener systems.
6. Pipe stands.
7. Equipment supports.

- B. Related Sections:

1. Division 05 Section "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment" for vibration isolation devices.
3. Division 23 Section "Metal Ducts" for duct hangers and supports.

1.3 DEFINITIONS

- A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.4 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

- B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
 - 1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
 - 2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
 - 3. Design seismic-restraint hangers and supports for piping and equipment.

1.5 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Show fabrication and installation details and include calculations for the following; include Product Data for components:
 - 1. Trapeze pipe hangers.
 - 2. Metal framing systems.
 - 3. Fiberglass strut systems.
 - 4. Pipe stands.
 - 5. Equipment supports.
- C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail fabrication and assembly of trapeze hangers.
 - 2. Design Calculations: Calculate requirements for designing trapeze hangers.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

- A. Carbon-Steel Pipe Hangers and Supports:
 - 1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
 - 2. Galvanized Metallic Coatings: Pregalvanized or hot dipped.
 - 3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
 - 4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
 - 5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
- B. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel.

2.2 TRAPEZE PIPE HANGERS

- A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.
 - c. Flex-Strut Inc.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut Corporation; Tyco International, Ltd.
 2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
 3. Standard: MFMA-4.
 4. Channels: Continuous slotted steel channel with inturned lips.
 5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
 6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel.
 7. Metallic Coating: Hot-dipped galvanized.
 8. Paint Coating: Vinyl alkyd or Acrylic.
 9. Plastic Coating: Polyurethane.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Carpenter & Paterson, Inc.
 2. Clement Support Services.
 3. ERICO International Corporation.

4. National Pipe Hanger Corporation.
 5. PHS Industries, Inc.
 6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
 7. Piping Technology & Products, Inc.
 8. Rilco Manufacturing Co., Inc.
 9. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig minimum compressive strength.
- D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

- A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.6 PIPE STANDS

- A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.
- B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.
- C. Low-Type, Single-Pipe Stand: One-piece plastic base unit with plastic roller, for roof installation without membrane penetration.
- D. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 EQUIPMENT SUPPORTS

- A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.8 MISCELLANEOUS MATERIALS

- A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.
- B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
 - 1. Properties: Nonstaining, noncorrosive, and nongaseous.
 - 2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

- A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.
- B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.
 - 1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
 - 2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.
- C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.
- D. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.
- E. Fastener System Installation:
 - 1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer.

- Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- F. Pipe Stand Installation:
1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
 2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Division 07 Section "Roof Accessories" for curbs.
- G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- H. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- I. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.
- J. Install lateral bracing with pipe hangers and supports to prevent swaying.
- K. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.
- L. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.
- M. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.
- N. Insulated Piping:
1. Attach clamps and spacers to piping.
 - a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
 - b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
 - c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
 - a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
4. Shield Dimensions for Pipe: Not less than the following:
 - a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
 - b. NPS 4: 12 inches long and 0.06 inch thick.
 - c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
 - d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
 - e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.
5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 METAL FABRICATIONS

- A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.
- B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.
- C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.3 ADJUSTING

- A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.
- B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.4 PAINTING

- A. All painting is to be performed under Division 09.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.
- B. Touchup: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 09.
- C. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.5 HANGER AND SUPPORT SCHEDULE

- A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.
- B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.
- C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.
- D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.
- E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.
- F. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- G. Use padded hangers for piping that is subject to scratching.
- H. Use thermal-hanger shield inserts for insulated piping and tubing.
- I. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- J. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.
- K. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.
- L. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
 2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joint construction, to attach to top flange of structural shape.
 3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
 4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
 5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
 6. C-Clamps (MSS Type 23): For structural shapes.
 7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
 8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
 9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.

10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
 11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
 12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:
 - a. Light (MSS Type 31): 750 lb.
 - b. Medium (MSS Type 32): 1500 lb.
 - c. Heavy (MSS Type 33): 3000 lb.
 13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
 14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
 15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- M. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
 2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
 3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.
- N. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- O. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- P. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Isolation pads.
 - 2. Isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Freestanding and restrained spring isolators.
 - 5. Housed spring mounts.
 - 6. Elastomeric hangers.
 - 7. Spring hangers.
 - 8. Spring hangers with vertical-limit stops.
 - 9. Pipe riser resilient supports.
 - 10. Resilient pipe guides.
 - 11. Restraining braces and cables.

1.3 DEFINITIONS

- A. IBC: International Building Code.
- B. ICC-ES: ICC-Evaluation Service.

1.4 PERFORMANCE REQUIREMENTS

- A.
 - 1. Building Classification Category: III.
- B. Seismic-Restraint Loading:
 - 1. Refer to Structural drawings

2. Refer to Structural drawings

1.5 SUBMITTALS

A. Product Data: For the following:

1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
2. 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 agency acceptable to authorities having jurisdiction.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
3. Interlocking Snubbers: Include ratings for horizontal, vertical, and combined loads.

B. Delegated-Design Submittal: For vibration isolation and seismic-restraint details 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. **Design Calculations:** Calculate static and dynamic loading due to equipment weight and operation, seismic and wind forces required to select vibration isolators, seismic and wind 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 Division 23 Sections for equipment mounted outdoors.
2. **Riser Supports:** Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. **Vibration Isolation Base Details:** Detail overall dimensions, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.
4. **Seismic- and Wind-Restraint Details:**
 - a. **Design Analysis:** To support selection and arrangement of seismic and wind restraints. Include calculations of combined tensile and shear loads.

- 2. Neoprene: Shock-absorbing materials compounded according to the standard for bridge-bearing neoprene as defined by AASHTO.
- E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.
 - 1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
 - 5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 500 psig.
 - 6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.
- F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic or limit-stop restraint.
 - 1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to weight being removed; factory-drilled baseplate bonded to 1/4-inch- thick, neoprene or rubber isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
 - 2. Restraint: Seismic or limit stop as required for equipment and authorities having jurisdiction.
 - 3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
 - 4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
 - 5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
 - 6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
- G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.
 - 1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
 - 2. Base: Factory drilled for bolting to structure.
 - 3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch travel up or down before contacting a resilient collar.
- H. Elastomeric Hangers: Single or double-deflection type, fitted with molded, oil-resistant elastomeric isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.
- I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

2.2 SEISMIC-RESTRAINT DEVICES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Amber/Booth Company, Inc.
 2. Cooper B-Line, Inc.; a division of Cooper Industries.
 3. Hilti, Inc.
 4. Kinetics Noise Control.
 5. Mason Industries.
 6. TOLCO Incorporated; a brand of NIBCO INC.
 7. Unistrut; 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: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: ASTM A 603 galvanized-steel cables with end connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- F. 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.
- G. 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.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. 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. Minimum length of eight times diameter.

- J. Adhesive Anchor Bolts: Drilled-in and capsule anchor system containing polyvinyl 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.

2.3 FACTORY FINISHES

- A. Finish: Manufacturer's standard prime-coat finish ready for field painting.
- B. Finish: Manufacturer's standard paint applied to factory-assembled and -tested equipment before shipping.
 - 1. Powder coating on springs and housings.
 - 2. All hardware shall be galvanized. Hot-dip galvanize metal components for exterior use.
 - 3. Baked enamel or powder coat for metal components on isolators for interior use.
 - 4. Color-code or otherwise mark vibration isolation and seismic- and wind-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation and seismic- and wind-control devices for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Examine roughing-in of 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 Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.
- 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 due to 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 VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Equipment Restraints:
 - 1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.
 - 2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch.
 - 3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- C. Piping Restraints:
 - 1. Comply with requirements in MSS SP-127.
 - 2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 3. Brace a change of direction longer than 12 feet.
- D. Install cables so they do not bend across edges of adjacent equipment or building structure.
- E. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction providing required submittals for component.
- F. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- G. 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.
- H. 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.
- I. Drilled-in Anchors:

SECTION 230553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

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. Section Includes:
 - 1. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Valve tags.
 - 7. Warning tags.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Equipment Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.
- C. Valve numbering scheme.
- D. Valve Schedules: For each piping system to include in maintenance manuals.

1.4 COORDINATION

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
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-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified.

C. 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), plus 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, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Letter Color: White.
- C. Background Color: Red.
- 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-fourths the size of principal lettering.
- G. Fasteners: Stainless-steel rivets.
- 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.
- B. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- C. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, 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 1-1/2 inches high.

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-fourths the size of principal lettering.

- G. Fasteners: Stainless-steel 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, 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.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 STENCILS

- A. Stencils: Prepared with letter sizes according to ASME A13.1 for piping; minimum letter height of 1-1/4 inches for ducts; and minimum letter height of 3/4 inch for access panel and door labels, equipment labels, and similar operational instructions.
 - 1. Stencil Material: Fiberboard or metal.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel black unless otherwise indicated. Paint may be in pressurized spray-can form.
 - 3. Identification Paint: Exterior, alkyd enamel in colors according to ASME A13.1 unless otherwise indicated.

2.6 VALVE TAGS

- A. Valve Tags: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.032-inch minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire-link chain.
- B. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Valve-tag schedule shall be included in operation and maintenance data.

2.7 WARNING TAGS

- A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags, of plasticized card stock with matte finish suitable for writing.
 - 1. Size: 3 by 5-1/4 inches minimum.
 - 2. Fasteners: Brass grommet and wire.
 - 3. Nomenclature: Large-size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
 - 4. Color: Yellow background with black lettering.

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 in Division 9 Section "Interior Painting."
- B. Stenciled Pipe Label Option: Stenciled labels may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1 on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. 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 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.

D. Pipe Label Color Schedule:

1. Heating Water Piping:
 - a. Background Color: Green.
 - b. Letter Color: White.

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-ducts.
- B. Stenciled Duct Label Option: Stenciled labels, showing service and flow direction, may be provided instead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1 inch high is needed for proper identification because of distance from normal location of required identification.
- C. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.5 VALVE-TAG INSTALLATION

- A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Size and Shape:
 - a. Hot Water: 1-1/2 inches round.
2. Valve-Tag Color:
 - a. Hot Water: Natural.
3. Letter Color:
 - a. Hot Water: Black.

3.6 WARNING-TAG INSTALLATION

- A. Write required message and attach warning tags to equipment and other items.

END OF SECTION 230553

SECTION 230593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC (BY OWNER)

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. Constant-volume air systems.
 - b. Variable-air-volume systems.
 - 2. Balancing Hydronic Piping Systems:
 - a. Variable-flow hydronic systems.
 - 3. Testing, Adjusting, and Balancing Equipment:
 - a. Motors.
 - b. Heat-transfer coils.
 - 4. Testing, adjusting, and balancing existing systems and equipment.
 - 5. Sound tests.
 - 6. Vibration tests.
 - 7. Duct leakage tests.
 - 8. Control system verification.

1.3 DEFINITIONS

- A. AABC: Associated Air Balance Council.
- B. BAS: Building automation systems.
- C. NEBB: National Environmental Balancing Bureau.
- D. TAB: Testing, adjusting, and balancing.
- E. TABB: Testing, Adjusting, and Balancing Bureau.

- F. TAB Specialist: An independent entity meeting qualifications to perform TAB work.
- G. TDH: Total dynamic head.

1.4 PREINSTALLATION MEETINGS

- A. TAB Conference: If requested by the Owner, conduct a TAB conference at Project site after approval of the TAB strategies and procedures plan to develop a mutual understanding of the details. Provide a minimum of 14 days' advance notice of scheduled meeting time and location.
 - 1. Minimum Agenda Items:
 - a. The Contract Documents examination report.
 - b. The TAB plan.
 - c. Needs for coordination and cooperation of trades and subcontractors.
 - d. Proposed procedures for documentation and communication flow.

1.5 ACTION SUBMITTALS

- A. Design Submittals:
 - 1. TAB Report: Documentation indicating that Work complies with ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. 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.
- C. System Readiness Checklists: Within 90 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article.
- D. Examination Report: Submit a summary report of the examination review required in "Examination" Article.
- E. Certified TAB reports.
- F. Sample report forms.

G. 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.

1.7 QUALITY ASSURANCE

A. TAB Specialists Qualifications: Certified by AABC.

1. TAB Field Supervisor: Employee of the TAB specialist and certified by AABC.
2. TAB Technician: Employee of the TAB specialist and certified by AABC as a TAB technician.

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

1.8 FIELD CONDITIONS

A. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 TAB SPECIALISTS

A. Subject to compliance with requirements, engage one of the following:

1. Palmetto Air & Water 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 installed systems for 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 applicable for intended purpose and 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 ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.
- F. Examine equipment performance data including fan and pump curves.
 - 1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
 - 2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.
- G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.
- H. Examine test reports specified in individual system and equipment Sections.
- I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.
- J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.
- K. Examine strainers. Verify that startup screens have been replaced by permanent screens with indicated perforations.

- L. Examine control valves for proper installation for their intended function of throttling, diverting, or mixing fluid flows.
- M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.
- N. Examine system pumps to ensure absence of entrained air in the suction piping.
- O. Examine operating safety interlocks and controls on HVAC equipment.
- P. 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 the following:
 - 1. Equipment and systems to be tested.
 - 2. Strategies and step-by-step procedures for balancing the systems.
 - 3. Instrumentation to be used.
 - 4. Sample forms with specific identification for all equipment.
- B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
 - 1. Airside:
 - a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
 - b. Duct systems are complete with terminals installed.
 - c. Volume, smoke, and fire dampers are open and functional.
 - d. Clean filters are installed.
 - e. Fans are operating, free of vibration, and rotating in correct direction.
 - f. Variable-frequency controllers' startup is complete and safeties are verified.
 - g. Automatic temperature-control systems are operational.
 - h. Ceilings are installed.
 - i. Windows and doors are installed.
 - j. Suitable access to balancing devices and equipment is provided.
 - 2. Hydronics:
 - a. Verify leakage and pressure tests on water distribution systems have been satisfactorily completed.
 - b. Piping is complete with terminals installed.
 - c. Water treatment is complete.

- d. Systems are flushed, filled, and air purged.
- e. Strainers are pulled and cleaned.
- f. Control valves are functioning per the sequence of operation.
- g. Shutoff and balance valves have been verified to be 100 percent open.
- h. Pumps are started and proper rotation is verified.
- i. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
- j. Variable-frequency controllers' startup is complete and safeties are verified.
- k. Suitable access to balancing devices and equipment is provided.

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" and in this Section.
- 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 233300 "Air Duct Accessories."
 - 3. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," and Section 230719 "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. Take and report testing and balancing measurements in inch-pound (IP) units.

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. Cross-check 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 233113 "Metal Ducts."

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

- A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
 - 1. Measure total airflow.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
 - 2. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.
 - b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report artificial loading of filters at the time static pressures are measured.

3. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
 4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
 5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.
- B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
 2. Adjust submain and branch duct volume dampers for specified airflow.
 3. Re-measure each submain and branch duct after all have been adjusted.
- C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
 2. Measure inlets and outlets airflow.
 3. Adjust each inlet and outlet for specified airflow.
 4. Re-measure each inlet and outlet after they have been adjusted.
- D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
 2. Re-measure and confirm that total airflow is within design.
 3. Re-measure all final fan operating data, rpms, volts, amps, and static profile.
 4. Mark all final settings.
 5. Test system in economizer mode. Verify proper operation and adjust if necessary.
 6. Measure and record all operating data.
 7. Record final fan-performance data.

3.7 PROCEDURES FOR VARIABLE-AIR-VOLUME SYSTEMS

- A. Adjust the variable-air-volume systems as follows:
1. Verify that the system static pressure sensor is located two-thirds of the distance down the duct from the fan discharge.
 2. Verify that the system is under static pressure control.

3. Select the terminal unit that is most critical to the supply-fan airflow. Measure inlet static pressure, and adjust system static pressure control set point 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.
4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
 - a. Adjust controls so that terminal unit is calling for maximum airflow. Some controllers require starting with minimum airflow. Verify calibration procedure for specific project.
 - b. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor.
 - c. When maximum airflow is correct, balance the air outlets downstream from terminal units.
 - d. Adjust controls so that terminal is calling for minimum airflow.
 - e. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. If no minimum calibration is available, note any deviation from design airflow.
 - f. When in full cooling or full heating, ensure that there is no mixing of hot-deck and cold-deck airstreams unless so designed.
 - g. On constant volume terminals, in critical areas where room pressure is to be maintained, verify that the airflow remains constant over the full range of full cooling to full heating. Note any deviation from design airflow or room pressure.
5. After terminal units have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by fan manufacturer.
 - a. Set outside-air, return-air, and relief-air dampers for proper position that simulates minimum outdoor-air conditions.
 - b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflow so that connected total matches fan selection and simulates actual load in the building.
 - c. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
 - d. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
 - e. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.
6. Measure fan static pressures as follows:
 - a. Measure static pressure directly at the fan outlet or through the flexible connection.

- b. Measure static pressure directly at the fan inlet or through the flexible connection.
 - c. Measure static pressure across each component that makes up the air-handling system.
 - d. Report any artificial loading of filters at the time static pressures are measured.
- 7. Set final return and outside airflow to the fan while operating at maximum return airflow and minimum outdoor airflow.
 - a. Balance the return-air ducts and inlets the same as described for constant-volume air systems.
 - b. Verify that terminal units are meeting design airflow under system maximum flow.
- 8. Re-measure the inlet static pressure at the most critical terminal unit and adjust the system static pressure set point to the most energy-efficient set point to maintain the optimum system static pressure. Record set point and give to controls contractor.
- 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to match design if necessary.
 - b. Re-measure and confirm that total airflow is within design.
 - c. Re-measure final fan operating data, rpms, volts, amps, and static profile.
 - d. Mark final settings.
 - e. Test system in economizer mode. Verify proper operation and adjust if necessary. Measure and record all operating data.
 - f. Verify tracking between supply and return fans.

3.8 GENERAL PROCEDURES FOR HYDRONIC SYSTEMS

- A. Prepare test reports for pumps, coils, and heat exchangers. Obtain approved submittals and manufacturer-recommended testing procedures. Crosscheck the summation of required coil and heat exchanger flow rates with pump design flow rate.
- B. Prepare schematic diagrams of systems' "as-built" piping layouts.
- C. In addition to requirements in "Preparation" Article, prepare hydronic systems for testing and balancing as follows:
 - 1. Check liquid level in expansion tank.
 - 2. Check highest vent for adequate pressure.
 - 3. Check flow-control valves for proper position.
 - 4. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

5. Verify that motor starters are equipped with properly sized thermal protection.
6. Check that air has been purged from the system.

3.9 PROCEDURES FOR VARIABLE-FLOW HYDRONIC SYSTEMS

- A. Balance systems with automatic two- and three-way control valves by setting systems at maximum flow through heat-exchange terminals, and proceed as specified above for hydronic systems.
- B. Adjust the variable-flow hydronic system as follows:
 1. Verify that the differential-pressure sensor is located as indicated.
 2. Determine whether there is diversity in the system.
- C. For systems with no diversity:
 1. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
 2. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.

- c. Re-measure each main and branch after all have been adjusted.
 3. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
 4. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.
 5. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
 6. Prior to verifying final system conditions, determine the system differential-pressure set point.
 7. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
 8. Mark final settings and verify that all memory stops have been set.
 9. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
 10. Verify that memory stops have been set.
- D. For systems with diversity:
1. Determine diversity factor.
 2. Simulate system diversity by closing required number of control valves, as approved by the design engineer.

3. Adjust pumps to deliver total design gpm.
 - a. Measure total water flow.
 - 1) Position valves for full flow through coils.
 - 2) Measure flow by main flow meter, if installed.
 - 3) If main flow meter is not installed, determine flow by pump TDH or exchanger pressure drop.
 - b. Measure pump TDH as follows:
 - 1) Measure discharge pressure directly at the pump outlet flange or in discharge pipe prior to any valves.
 - 2) Measure inlet pressure directly at the pump inlet flange or in suction pipe prior to any valves or strainers.
 - 3) Convert pressure to head and correct for differences in gage heights.
 - 4) Verify pump impeller size by measuring the TDH with the discharge valve closed. Note the point on manufacturer's pump curve at zero flow and verify that the pump has the intended impeller size.
 - 5) With valves open, read pump TDH. Adjust pump discharge valve until design water flow is achieved.
 - c. Monitor motor performance during procedures and do not operate motor in an overloaded condition.
4. Adjust flow-measuring devices installed in mains and branches to design water flows.
 - a. Measure flow in main and branch pipes.
 - b. Adjust main and branch balance valves for design flow.
 - c. Re-measure each main and branch after all have been adjusted.
5. Adjust flow-measuring devices installed at terminals for each space to design water flows.
 - a. Measure flow at terminals.
 - b. Adjust each terminal to design flow.
 - c. Re-measure each terminal after it is adjusted.
 - d. Position control valves to bypass the coil, and adjust the bypass valve to maintain design flow.
 - e. Perform temperature tests after flows have been balanced.
6. For systems with pressure-independent valves at terminals:
 - a. Measure differential pressure, and verify that it is within manufacturer's specified range.
 - b. Perform temperature tests after flows have been verified.

7. For systems without pressure-independent valves or flow-measuring devices at terminals:
 - a. Measure and balance coils by either coil pressure drop or temperature method.
 - b. If balanced by coil pressure drop, perform temperature tests after flows have been verified.
8. Open control valves that were shut. Close a sufficient number of control valves that were previously open to maintain diversity, and balance terminals that were just opened.
9. Prior to verifying final system conditions, determine system differential-pressure set point.
10. If the pump discharge valve was used to set total system flow with variable-frequency controller at 60 Hz, at completion open discharge valve 100 percent and allow variable-frequency controller to control system differential-pressure set point. Record pump data under both conditions.
11. Mark final settings and verify that memory stops have been set.
12. Verify final system conditions as follows:
 - a. Re-measure and confirm that total water flow is within design.
 - b. Re-measure final pumps' operating data, TDH, volts, amps, and static profile.
 - c. Mark final settings.
13. Verify that memory stops have been set.

3.10 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. Phase and hertz.
 5. Nameplate and measured voltage, each phase.
 6. Nameplate and measured amperage, each phase.
 7. Starter size and thermal-protection-element rating.
 8. Service factor and frame size.
- B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.11 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each water coil:

1. Entering- and leaving-water temperature.
2. Water flow rate.
3. Water pressure drop for major (more than 20 gpm) equipment coils, excluding unitary equipment such as reheat coils, unit heaters, and fan-coil units.
4. Dry-bulb temperature of entering and leaving air.
5. Wet-bulb temperature of entering and leaving air for cooling coils.
6. Airflow.

3.12 SOUND TESTS

A. After the systems are balanced and construction is Substantially Complete, measure and record sound levels at 5 locations as designated by the Architect.

B. Instrumentation:

1. The sound-testing meter shall be a portable, general-purpose testing meter consisting of a microphone, processing unit, and readout.
2. The sound-testing meter shall be capable of showing fluctuations at minimum and maximum levels, and measuring the equivalent continuous sound pressure level (LEQ).
3. The sound-testing meter must be capable of using 1/3 octave band filters to measure mid-frequencies from 31.5 Hz to 8000 Hz.
4. The accuracy of the sound-testing meter shall be plus or minus one decibel.

C. Test Procedures:

1. Perform test at quietest background noise period. Note cause of unpreventable sound that affects test outcome.
2. Equipment should be operating at design values.
3. Calibrate the sound-testing meter prior to taking measurements.
4. Use a microphone suitable for the type of noise levels measured that is compatible with meter. Provide a windshield for outside or in-duct measurements.
5. Record a set of background measurements in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment off.
6. Take sound readings in dBA and sound pressure levels in the eight un-weighted octave bands 63 Hz to 8000 Hz (NC) with the equipment operating.
7. Take readings no closer than 36 inches from a wall or from the operating equipment and approximately 60 inches from the floor, with the meter held or mounted on a tripod.

8. For outdoor measurements, move sound-testing meter slowly and scan area that has the most exposure to noise source being tested. Use A-weighted scale for this type of reading.

D. Reporting:

1. Report shall record the following:
 - a. Location.
 - b. System tested.
 - c. dBA reading.
 - d. Sound pressure level in each octave band with equipment on and off.
2. Plot sound pressure levels on NC worksheet with equipment on and off.

3.13 VIBRATION TESTS

- A. After systems are balanced and construction is Substantially Complete, measure and record vibration levels on equipment having motor horsepower equal to or greater than 10.
- B. Instrumentation:
 1. Use portable, battery-operated, and microprocessor-controlled vibration meter with or without a built-in printer.
 2. The meter shall automatically identify engineering units, filter bandwidth, amplitude, and frequency scale values.
 3. The meter shall be able to measure machine vibration displacement in mils of deflection, velocity in inches per second, and acceleration in inches per second squared.
 4. Verify calibration date is current for vibration meter before taking readings.
- C. Test Procedures:
 1. To ensure accurate readings, verify that accelerometer has a clean, flat surface and is mounted properly.
 2. With the unit running, set up vibration meter in a safe, secure location. Connect transducer to meter with proper cables. Hold magnetic tip of transducer on top of the bearing, and measure unit in mils of deflection. Record measurement, then move transducer to the side of the bearing and record in mils of deflection. Record an axial reading in mils of deflection by holding nonmagnetic, pointed transducer tip on end of shaft.
 3. Change vibration meter to velocity (inches per second) measurements. Repeat and record above measurements.
 4. Record CPM or rpm.

5. Read each bearing on motor, fan, and pump as required. Track and record vibration levels from rotating component through casing to base.

D. Reporting:

1. Report shall record location and the system tested.
2. Include horizontal-vertical-axial measurements for tests.
3. Verify that vibration limits follow Specifications, or, if not specified, follow the General Machinery Vibration Severity Chart or Vibration Acceleration General Severity Chart from the AABC National Standards. Acceptable levels of vibration are normally "smooth" to "good."
4. Include in report General Machinery Vibration Severity Chart, with conditions plotted.

3.14 DUCT LEAKAGE TESTS

- A. Witness the duct pressure testing performed by Installer.
- B. Verify that proper test methods are used and that leakage rates are within specified tolerances.
- C. Report deficiencies observed.

3.15 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 1. Verify temperature control system is operating within the design limitations.
 2. Confirm that the sequences of operation are in compliance with Contract Documents.
 3. Verify that controllers are calibrated and function as intended.
 4. Verify that controller set points are as indicated.
 5. Verify the operation of lockout or interlock systems.
 6. Verify the operation of valve and damper actuators.
 7. Verify that controlled devices are properly installed and connected to correct controller.
 8. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 9. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
- B. Reporting: Include a summary of verifications performed, remaining deficiencies, and variations from indicated conditions.

3.16 PROCEDURES FOR TESTING, ADJUSTING, AND BALANCING EXISTING SYSTEMS

- A. Perform a preconstruction inspection of existing equipment that is to remain and be reused.
 - 1. Measure and record the operating speed, airflow, and static pressure of each fan.
 - 2. Measure motor voltage and amperage. Compare the values to motor nameplate information.
 - 3. Check the refrigerant charge.
 - 4. Check the condition of filters.
 - 5. Check the condition of coils.
 - 6. Check the operation of the drain pan and condensate-drain trap.
 - 7. Check bearings and other lubricated parts for proper lubrication.
 - 8. Report on the operating condition of the equipment and the results of the measurements taken. Report deficiencies.
- B. 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.
- C. 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 airflow 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.

3.17 TOLERANCES

- A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
 - 1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
 - 2. Air Outlets and Inlets: Plus or minus 10 percent.
 - 3. Heating-Water Flow Rate: Plus or minus 10 percent.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.18 PROGRESS REPORTING

- A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems balancing devices. Recommend changes and additions to systems balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.
- B. Status Reports: Prepare monthly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.19 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.
 - 3. Certify validity and accuracy of field data.
- 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 specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. 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.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. 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-Handling-Unit Test Reports: For existing air-handling units with coils expanded by this project, re-test the existing air handling unit to include the following:

1. Unit Data:

- a. Unit identification.
- b. Location.
- c. Make and type.
- d. Model number and unit size.
- e. Manufacturer's serial number.
- f. Unit arrangement and class.
- g. Discharge arrangement.
- h. Sheave make, size in inches, and bore.
- i. Center-to-center dimensions of sheave and amount of adjustments in inches.
- j. Number, make, and size of belts.
- k. Number, type, and size of filters.

2. Motor Data:

- a. Motor make, and frame type and size.
- b. Horsepower and rpm.
- c. Volts, phase, and hertz.
- d. Full-load amperage and service factor.
- e. Sheave make, size in inches, and bore.
- f. Center-to-center dimensions of sheave and amount of adjustments in inches.

3. Test Data (Indicated and Actual Values):

- a. Total airflow rate in cfm.
- b. Total system static pressure in inches wg.
- c. Fan rpm.
- d. Discharge static pressure in inches wg.
- e. Filter static-pressure differential in inches wg.
- f. Preheat-coil static-pressure differential in inches wg.
- g. Cooling-coil static-pressure differential in inches wg.
- h. Heating-coil static-pressure differential in inches wg.
- i. Outdoor airflow in cfm.
- j. Return airflow in cfm.
- k. Outdoor-air damper position.
- l. Return-air damper position.
- m. Vortex damper position.

F. Apparatus-Coil Test Reports:

1. Coil Data:

- a. System identification.
 - b. Location.
 - c. Coil type.
 - d. Number of rows.
 - e. Fin spacing in fins per inch o.c.
 - f. Make and model number.
 - g. Face area in sq. ft..
 - h. Tube size in NPS.
 - i. Tube and fin materials.
 - j. Circuiting arrangement.
 2. Test Data (Indicated and Actual Values):
 - a. Airflow rate in cfm.
 - b. Average face velocity in fpm.
 - c. Air pressure drop in inches wg.
 - d. Outdoor-air, wet- and dry-bulb temperatures in deg F.
 - e. Return-air, wet- and dry-bulb temperatures in deg F.
 - f. Entering-air, wet- and dry-bulb temperatures in deg F.
 - g. Leaving-air, wet- and dry-bulb temperatures in deg F.
 - h. Water flow rate in gpm.
 - i. Water pressure differential in feet of head or psig.
 - j. Entering-water temperature in deg F.
 - k. Leaving-water temperature in deg F.
- G. Fan Test Reports: For each supply, return, and exhaust fans, include the following:
1. Fan Data:
 - a. System identification.
 - b. Location.
 - c. Make and type.
 - d. Model number and size.
 - e. Manufacturer's serial number.
 - f. Arrangement and class.
 - g. Sheave make, size in inches, and bore.
 - h. Center-to-center dimensions of sheave and amount of adjustments in inches.
 2. Motor Data:
 - a. Motor make, and frame type and size.
 - b. Horsepower and rpm.
 - c. Volts, phase, and hertz.
 - d. Full-load amperage and service factor.
 - e. Sheave make, size in inches, and bore.

- f. Center-to-center dimensions of sheave, and amount of adjustments in inches.
 - g. Number, make, and size of belts.
 - 3. Test Data (Indicated and Actual Values):
 - a. Total airflow rate in cfm.
 - b. Total system static pressure in inches wg.
 - c. Fan rpm.
 - d. Discharge static pressure in inches wg.
 - e. Suction static pressure in inches wg.
- H. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
 - 1. Report Data:
 - a. System and air-handling-unit number.
 - b. Location and zone.
 - c. Traverse air temperature in deg F.
 - d. Duct static pressure in inches wg.
 - e. Duct size in inches.
 - f. Duct area in sq. ft..
 - g. Indicated airflow rate in cfm.
 - h. Indicated velocity in fpm.
 - i. Actual airflow rate in cfm.
 - j. Actual average velocity in fpm.
- I. 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. Airflow rate in cfm.
 - b. Air velocity in fpm.
 - c. Preliminary airflow rate as needed in cfm.

- d. Preliminary velocity as needed in fpm.
 - e. Final airflow rate in cfm.
 - f. Final velocity in fpm.
 - g. Space temperature in deg F.
- J. 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. Airflow rate in cfm.
 - b. Entering-water temperature in deg F.
 - c. Leaving-water temperature in deg F.
 - d. Water pressure drop in feet of head or psig.
 - e. Entering-air temperature in deg F.
 - f. Leaving-air temperature in deg F.
- K. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.20 VERIFICATION OF TAB REPORT

- A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Architect, Owner and Construction Manager.
- B. Architect 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.

- C. 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."
- D. 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.
- E. If TAB work fails, proceed as follows:
 - 1. TAB specialists shall 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.
- F. Prepare test and inspection reports.

3.21 ADDITIONAL TESTS

- A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.
- 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 230593

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply air.
 - 2. Indoor, exposed supply air.
 - 3. Indoor, concealed and exposed return.
 - 4. Indoor, concealed exhaust.
- B. Related Sections:
 - 1. Division 23 Section "HVAC Piping Insulation."
 - 2. Division 23 Section "Metal Ducts".

1.3 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).
- 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 insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.
 - 3. Detail application of field-applied jackets.
 - 4. Detail application at linkages of control devices.
- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of

insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.

- E. Field quality-control reports.

1.4 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 23 Section "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.

1.7 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," and "Aboveground, Outdoor 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. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type I. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; SoftTouch Duct Wrap.
 - b. Johns Manville; Microlite.
 - c. Knauf Insulation; Friendly Feel Duct Wrap.
 - d. Manson Insulation Inc.; Alley Wrap.
 - e. Owens Corning; SOFTR All-Service Duct Wrap.
- G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation without factory-applied jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. CertainTeed Corp.; Commercial Board.
 - b. Fibrex Insulations Inc.; FBX.
 - c. Johns Manville; 800 Series Spin-Glas.
 - d. Knauf Insulation; Insulation Board.

- e. Manson Insulation Inc.; AK Board.
- f. Owens Corning; Fiberglas 700 Series.
- g.

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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 - 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-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
 - 2. For indoor applications, use adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 3. Use adhesive that complies 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," including 2004 Addenda.
- C. 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.
 - d. Mon-Eco Industries, Inc.; 22-25.

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.
- C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
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-30.
 - b. Eagle Bridges - Marathon Industries; 501.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-35.
 - d. Mon-Eco Industries, Inc.; 55-10.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
 3. Service Temperature Range: 0 to 180 deg F.
 4. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
 5. Color: White.
- D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
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; Encacel.
 - b. Eagle Bridges - Marathon Industries; 570.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 60-95/60-96.
 2. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
 3. Service Temperature Range: Minus 50 to plus 220 deg F.

4. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
 5. Color: White.
- E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
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-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.4 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. 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-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
 4. Service Temperature Range: 0 to plus 180 deg F.
 5. Color: White.

2.5 SEALANTS

- A. ASJ Flashing Sealants, and Vinyl and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company;
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

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.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

- A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Chil-Glas No. 5.
- B. 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 ducts.
 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; Mast-A-Fab.
 - b. Vimasco Corporation; Elastafab 894.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 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.

2.10 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; 0.015 inch thick, 1/2 inch wide with wing seal.
 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch] wide with wing 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, 0.106-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, 0.106-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 products:
 - 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, 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 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 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.
- C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- D. Wire: 0.080-inch nickel-copper alloy.
 1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. C & F Wire.

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. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.
- B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct 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. Keep insulation materials dry during application and finishing.
- G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.
- H. Install insulation with least number of joints practical.
- I. 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.
- J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.
- K. 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. 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 duct flanges and fittings.
- L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.
- M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.
- N. 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 Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- B. 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 Division 7 Section "Through-Penetration Firestop Systems" for firestopping and fire-resistive joint sealers.
- C. 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 Division 7 Section "Through-Penetration Firestop Systems."

3.5 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches 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 overcompress 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 from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch 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 at 18-foot 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.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches 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- wide strips of same material used to insulate duct. Secure

on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches 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 50 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 and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches 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 overcompress 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 from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch 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 at 18-foot 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.
 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- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FINISHES

- A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.
 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.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 1. Inspect ductwork, 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 one location 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.

3.8 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 1. Indoor, concealed supply air.

2. Indoor, concealed return located in unconditioned space.

B. Items Not Insulated:

1. Factory-insulated flexible ducts.
2. Factory-insulated plenums and casings.
3. Flexible connectors.
4. Vibration-control devices.
5. Factory-insulated access panels and doors.
6. Exhaust indoor and outdoor ductwork

3.9 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, rectangular, supply-air duct insulation shall be[one of] the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

B. Concealed, rectangular, return-air duct insulation shall be one of the following:

1. Mineral-Fiber Blanket: 2 inches thick and 0.75-lb/cu. ft. nominal density.
2. Mineral-Fiber Board: 2 inches thick and 2-lb/cu. ft. nominal density.

END OF SECTION 230713

SECTION 230719 - HVAC PIPING INSULATION

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. Section includes insulating the following HVAC piping systems:
 - 1. Heating hot-water piping, indoors.

1.3 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).
- 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 insulation application at pipe expansion joints for each type of insulation.
 - 3. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
 - 4. Detail removable insulation at piping specialties.
 - 5. Detail application of field-applied jackets.
 - 6. Detail application at linkages of control devices.
- C. Qualification Data: For qualified Installer.
- D. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets, with requirements indicated. Include dates of tests and test methods employed.
- E. 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.

1.5 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.

1.6 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping 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.

1.7 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 "Piping Insulation Schedule, General," "Indoor Piping 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. Mineral-Fiber, Preformed Pipe Insulation:
 - 1. Products: Subject to compliance with requirements, provide one of the following:
 - a. Fibrex Insulations Inc.; Coreplus 1200.
 - b. Johns Manville; Micro-Lok.
 - c. Knauf Insulation; 1000-Degree Pipe Insulation.
 - d. Manson Insulation Inc.; Alley-K.
 - e. Owens Corning; Fiberglas Pipe Insulation.
 - 2. 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.

2.2 INSULATING CEMENTS

- A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Super-Stik.
- B. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

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. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.
 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-127.
 - b. Eagle Bridges - Marathon Industries; 225.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
 - d. Mon-Eco Industries, Inc.; 22-25.
- C. 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. 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.
 - d. Mon-Eco Industries, Inc.; 22-25.

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. 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.
- C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
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-10.
 - b. Eagle Bridges - Marathon Industries; 550.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
 - d. Mon-Eco Industries, Inc.; 55-50.
 - e. Vimasco Corporation; WC-1/WC-5.
 2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
 3. Service Temperature Range: Minus 20 to plus 180 deg F.
 4. Solids Content: 60 percent by volume and 66 percent by weight.
 5. Color: White.

2.5 LAGGING ADHESIVES

- A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. For indoor applications, use lagging adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. 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-50 AHV2.
 - b. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-36.
 - c. Vimasco Corporation; 713 and 714.
 3. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.

4. Service Temperature Range: 0 to plus 180 deg F.
5. Color: White.

2.6 SEALANTS

A. Joint Sealants:

B. FSK and Metal Jacket Flashing Sealants:

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-76.
 - b. Eagle Bridges - Marathon Industries; 405.
 - c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
 - d. Mon-Eco Industries, Inc.; 44-05.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.

C. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.

2.7 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.

- a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- 1) Dow Chemical Company (The); Saran 540 Vapor Retarder Film and Saran 560 Vapor Retarder Film.

2.8 FIELD-APPLIED CLOTHS

- A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd..

- 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Alpha Associates, Inc.; Alpha-Maritex 84215 and 84217/9485RW, Luben 59.

2.9 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.

2.10 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; 0.015 inch thick, 1/2 inch wide with wing seal.
- 3. Aluminum: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 1/2 inch wide with wing 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. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.
- C. Wire: 0.062-inch soft-annealed, stainless steel.
 - 1. 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:
 - a. C & F Wire.

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

3.2 PREPARATION

- A. Surface Preparation: Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
 - 1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
 - 2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for

appropriate coating materials and application methods for operating temperature range.

- B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 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. Cleanouts.

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 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 Division 7 Section "Through-Penetration Firestop Systems" 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 Division 7 Section "Through-Penetration Firestop Systems."
- 3.5 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.

3.6 INSTALLATION OF MINERAL-FIBER 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 glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

3.8 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Division 9 painting Sections.

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 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.

3.10 INDOOR PIPING INSULATION SCHEDULE

- A. Heating-Hot-Water Supply and Return, 200 Deg F and Below:
 - 1. NPS 1-1/4 and Smaller: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I: 2 inches thick.
 - 2. NPS 1-1/2 and Larger: Insulation shall be the following:
 - a. Mineral-Fiber, Preformed Pipe, Type I, 2 inches thick.

3.11 INDOOR, FACTORY-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. Factory-applied ASJ.

END OF SECTION 230719

SECTION 230913 - HVAC INSTRUMENTATION AND CONTROLS (BY OWNER)

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes control equipment for HVAC systems and components, including control components for terminal heating and cooling units not supplied with factory-wired controls.

1.2 DEFINITIONS

- A. DDC: Direct digital control.
- B. I/O: Input/output.
- C. LonWorks: A control network technology platform for designing and implementing interoperable control devices and networks.
- D. MS/TP: Master slave/token passing.
- E. PC: Personal computer.
- F. PID: Proportional plus integral plus derivative.
- G. RTD: Resistance temperature detector.

1.3 SYSTEM PERFORMANCE

- A. Comply with the following performance requirements:
 - 1. Graphic Display: Display graphic with minimum 20 dynamic points with current data within 10 seconds.
 - 2. Graphic Refresh: Update graphic with minimum 20 dynamic points with current data within 8 seconds.
 - 3. Object Command: Reaction time of less than two seconds between operator command of a binary object and device reaction.
 - 4. Object Scan: Transmit change of state and change of analog values to control units or workstation within six seconds.
 - 5. Alarm Response Time: Annunciate alarm at workstation within 45 seconds. Multiple workstations must receive alarms within five seconds of each other.
 - 6. Program Execution Frequency: Run capability of applications as often as five seconds, but selected consistent with mechanical process under control.

7. Performance: Programmable controllers shall execute DDC PID control loops, and scan and update process values and outputs at least once per second.
8. Reporting Accuracy and Stability of Control: Report values and maintain measured variables within tolerances as follows:
 - a. Water Temperature: Plus or minus 1 deg F.
 - b. Water Flow: Plus or minus 5 percent of full scale.
 - c. Water Pressure: Plus or minus 2 percent of full scale.
 - d. Space Temperature: Plus or minus 1 deg F.
 - e. Ducted Air Temperature: Plus or minus 1 deg F.
 - f. Outside Air Temperature: Plus or minus 2 deg F.
 - g. Dew Point Temperature: Plus or minus 3 deg F.
 - h. Temperature Differential: Plus or minus 0.25 deg F.
 - i. Relative Humidity: Plus or minus 5 percent.
 - j. Airflow (Pressurized Spaces): Plus or minus 3 percent of full scale.
 - k. Airflow (Measuring Stations): Plus or minus 5 percent of full scale.
 - l. Airflow (Terminal): Plus or minus 10 percent of full scale.
 - m. Air Pressure (Space): Plus or minus 0.01-inch wg.
 - n. Air Pressure (Ducts): Plus or minus 0.1-inch wg.
 - o. Carbon Monoxide: Plus or minus 5 percent of reading.
 - p. Carbon Dioxide: Plus or minus 50 ppm.
 - q. Electrical: Plus or minus 5 percent of reading.

1.4 SUBMITTALS

- A. Product Data: Include manufacturer's technical literature for each control device. Indicate dimensions, capacities, performance characteristics, electrical characteristics, finishes for materials, and installation and startup instructions for each type of product indicated.
 1. DDC System Hardware: Bill of materials of equipment indicating quantity, manufacturer, and model number. Include technical data for operator workstation equipment, interface equipment, control units, transducers/transmitters, sensors, actuators, valves, relays/switches, control panels, and operator interface equipment.
 2. Control System Software: Include technical data for operating system software, operator interface, color graphics, and other third-party applications.
 3. Controlled Systems: Instrumentation list with element name, type of device, manufacturer, model number, and product data. Include written description of sequence of operation including schematic diagram.
- B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 1. Bill of materials of equipment indicating quantity, manufacturer, and model number.

2. Schematic flow diagrams showing fans, pumps, coils, dampers, valves, and control devices.
 3. Wiring Diagrams: Power, signal, and control wiring.
 4. Details of control panel faces, including controls, instruments, and labeling.
 5. Written description of sequence of operation.
 6. Schedule of dampers including size, leakage, and flow characteristics.
 7. Schedule of valves including flow characteristics.
 8. DDC System Hardware:
 - a. Wiring diagrams for control units with termination numbers.
 - b. Schematic diagrams and floor plans for field sensors and control hardware.
 - c. Schematic diagrams for control, communication, and power wiring, showing trunk data conductors and wiring between operator workstation and control unit locations.
 9. Control System Software: List of color graphics indicating monitored systems, data (connected and calculated) point addresses, output schedule, and operator notations.
 10. Controlled Systems:
 - a. Schematic diagrams of each controlled system with control points labeled and control elements graphically shown, with wiring.
 - b. Scaled drawings showing mounting, routing, and wiring of elements including bases and special construction.
 - c. Written description of sequence of operation including schematic diagram.
 - d. Points list.
- C. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with ASHRAE 135.
- D. Data Communications Protocol Certificates: Certify that each proposed DDC system component complies with LonWorks.
- E. Samples for Initial Selection: For each color required, of each type of thermostat or sensor cover with factory-applied color finishes.
- F. Samples for Verification: For each color required, of each type of thermostat or sensor cover.
- G. Software and Firmware Operational Documentation: Include the following:
1. Software operating and upgrade manuals.
 2. Program Software Backup: On a magnetic media or compact disc, complete with data files.
 3. Device address list.
 4. Printout of software application and graphic screens.
 5. Software license required by and installed for DDC workstations and control systems.

- H. Software Upgrade Kit: For Owner to use in modifying software to suit future systems revisions or monitoring and control revisions.
- I. Qualification Data: For Installer and manufacturer.
- J. Operation and Maintenance Data: For HVAC instrumentation and control system to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Maintenance instructions and lists of spare parts for each type of control device.
 - 2. Interconnection wiring diagrams with identified and numbered system components and devices.
 - 3. Keyboard illustrations and step-by-step procedures indexed for each operator function.
 - 4. Inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.
 - 5. Calibration records and list of set points.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Automatic control system manufacturer's authorized representative who is trained and approved for installation of system components required for this Project.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- C. Comply with ASHRAE 135 for DDC system components.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Factory-Mounted Components: Where control devices specified in this Section are indicated to be factory mounted on equipment, arrange for shipping of control devices to equipment manufacturer.
- B. System Software: Update to latest version of software at Project completion.

1.7 COORDINATION

- A. Coordinate location of thermostats, humidistats, and other exposed control sensors with plans and room details before installation.

- B. Coordinate equipment with Division 26 Section "Lighting Control Devices" to achieve compatibility with equipment that interfaces with that system.
- C. Coordinate equipment with Division 28 Section "Digital, Addressable Fire Alarm System" to achieve compatibility with equipment that interfaces with that system.
- D. Coordinate supply of conditioned electrical branch circuits for control units and operator workstation.
- E. Coordinate equipment with Division 26 Section "Electrical Power Monitoring and Control" to achieve compatibility of communication interfaces.
- F. Coordinate equipment with Division 26 Section "Panelboards" to achieve compatibility with starter coils and annunciation devices.
- G. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03 Section "Cast-in-Place Concrete."

1.8 EXTRA MATERIALS

- A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Replacement Materials: One replacement diaphragm or relay mechanism for each unique valve motor, controller, thermostat and positioning relay.
 - 2. Maintenance Materials: One thermostat adjusting key.
 - 3. Maintenance Materials: One pneumatic thermostat test kit.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
- B. Furnish and install a complete control system as specified herein. The following manufacturers are acceptable contingent upon their compliance with this specification:
 - 1. Automated Logic Corporation.

2.2 CONTROL SYSTEM

- A. Control system shall consist of sensors, indicators, actuators, final control elements, interface equipment, other apparatus, accessories, and software connected to distributed controllers operating in multiuser, multitasking environment on token-passing network and programmed to control mechanical systems. An operator workstation permits interface with the network via dynamic color graphics with each mechanical system, building floor plan, and control device depicted by point-and-click graphics.
- B. System operating setpoints are to be adjustable by owner/operator personnel at the system operator work station.

2.3 DDC EQUIPMENT

- A. Operator Workstation: All new digital controls shall be interconnected with and shall be fully compatible with the existing Hospital ALC workstation.
- B. Control Units: Modular, comprising processor board with programmable, nonvolatile, random-access memory; local operator access and display panel; integral interface equipment; and backup power source.
 - 1. Units monitor or control each I/O point; process information; execute commands from other control units, devices, and operator stations; and download from or upload to operator workstation or diagnostic terminal unit.
 - 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 - d. Software applications, scheduling, and alarm processing.
 - e. Testing and developing control algorithms without disrupting field hardware and controlled environment.
 - 3. Standard Application Programs:
 - a. Electric Control Programs: Demand limiting, duty cycling, automatic time scheduling, start/stop time optimization, night setback/setup, on-off control with differential sequencing, staggered start, antishort cycling, PID control, DDC with fine tuning, and trend logging.
 - b. HVAC Control Programs: Optimal run time, supply-air reset, and enthalpy switchover.
 - c. Programming Application Features: Include trend point; alarm processing and messaging; weekly, monthly, and annual scheduling; energy calculations; run-time totalization; and security access.
 - d. Remote communications.
 - e. Maintenance management.
 - f. Units of Measure: Inch-pound and SI (metric).

4. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 5. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 6. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- C. Local Control Units: Modular, comprising processor board with electronically programmable, nonvolatile, read-only memory; and backup power source.
1. Units monitor or control each I/O point, process information, and download from or upload to operator workstation or diagnostic terminal unit.
 2. Stand-alone mode control functions operate regardless of network status. Functions include the following:
 - a. Global communications.
 - b. Discrete/digital, analog, and pulse I/O.
 - c. Monitoring, controlling, or addressing data points.
 3. Local operator interface provides for download from or upload to operator workstation or diagnostic terminal unit.
 4. ASHRAE 135 Compliance: Control units shall use ASHRAE 135 protocol and communicate using ISO 8802-3 (Ethernet) datalink/physical layer protocol.
 5. LonWorks Compliance: Control units shall use LonTalk protocol and communicate using EIA/CEA 709.1 datalink/physical layer protocol.
- D. I/O Interface: Hardwired inputs and outputs may tie into system through controllers. Protect points so that shorting will cause no damage to controllers.
1. Binary Inputs: Allow monitoring of on-off signals without external power.
 2. Pulse Accumulation Inputs: Accept up to 10 pulses per second.
 3. Analog Inputs: Allow monitoring of low-voltage (0- to 10-V dc), current (4 to 20 mA), or resistance signals.
 4. Binary Outputs: Provide on-off or pulsed low-voltage signal, selectable for normally open or normally closed operation with three-position (on-off-auto) override switches and status lights.
 5. Analog Outputs: Provide modulating signal, either low voltage (0- to 10-V dc) or current (4 to 20 mA) with status lights, two-position (auto-manual) switch, and manually adjustable potentiometer.
 6. Tri-State Outputs: Provide two coordinated binary outputs for control of three-point, floating-type electronic actuators.
 7. Universal I/Os: Provide software selectable binary or analog outputs.
- E. Power Supplies: Transformers with Class 2 current-limiting type or overcurrent protection; limit connected loads to 80 percent of rated capacity. DC power supply shall match output current and voltage requirements and be full-wave rectifier type with the following:
1. Output ripple of 5.0 mV maximum peak to peak.
 2. Combined 1 percent line and load regulation with 100-mic.sec. response time for 50 percent load changes.

3. Built-in overvoltage and overcurrent protection and be able to withstand 150 percent overload for at least 3 seconds without failure.
- F. Power Line Filtering: Internal or external transient voltage and surge suppression for workstations or controllers with the following:
1. Minimum dielectric strength of 1000 V.
 2. Maximum response time of 10 nanoseconds.
 3. Minimum transverse-mode noise attenuation of 65 dB.
 4. Minimum common-mode noise attenuation of 150 dB at 40 to 100 Hz.

2.4 UNITARY CONTROLLERS

- A. Unitized, capable of stand-alone operation with sufficient memory to support its operating system, database, and programming requirements, and with sufficient I/O capacity for the application.
1. Configuration: Local keypad and display; diagnostic LEDs for power, communication, and processor; wiring termination to terminal strip or card connected with ribbon cable; memory with bios; and 72-hour battery backup.
 2. Operating System: Manage I/O communication to allow distributed controllers to share real and virtual object information and allow central monitoring and alarms. Perform scheduling with real-time clock. Perform automatic system diagnostics; monitor system and report failures.
 3. ASHRAE 135 Compliance: Communicate using read (execute and initiate) and write (execute and initiate) property services defined in ASHRAE 135. Reside on network using MS/TP datalink/physical layer protocol and have service communication port for connection to diagnostic terminal unit.
 4. LonWorks Compliance: Communicate using EIA/CEA 709.1 datalink/physical layer protocol using LonTalk protocol.
 5. Enclosure: Dustproof rated for operation at 32 to 120 deg F.

2.5 Enclosure: Waterproof rated for operation at 40 to 150 deg F

2.6 ELECTRONIC SENSORS

- A. Description: Vibration and corrosion resistant; for wall, immersion, or duct mounting as required.
- B. Thermistor Temperature Sensors and Transmitters:
1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. Ebtron, Inc.
 - c. Heat-Timer Corporation.
 - d. I.T.M. Instruments Inc.
 - e. MAMAC Systems, Inc.

- f. RDF Corporation.
 - 2. Accuracy: Plus or minus 0.5 deg F at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, 8 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 - 5. Averaging Elements in Ducts: 72 inches long, flexible; use where prone to temperature stratification or where ducts are larger than 10 sq. ft..
 - 6. Insertion Elements for Liquids: Brass or stainless-steel socket with minimum insertion length of 2-1/2 inches.
 - 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Exposed.
 - c. Thermometer: Concealed.
 - d. Color: off-white
 - e. Orientation: Horizontal.
 - 8. Outside-Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- C. RTDs and Transmitters:
- 1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. MAMAC Systems, Inc.
 - c. RDF Corporation.
 - 2. Accuracy: Plus or minus 0.2 percent at calibration point.
 - 3. Wire: Twisted, shielded-pair cable.
 - 4. Insertion Elements in Ducts: Single point, 18 inches long; use where not affected by temperature stratification or where ducts are smaller than 9 sq. ft..
 - 5. Averaging Elements in Ducts: 48 inches long, rigid; use where prone to temperature stratification or where ducts are larger than 9 sq. ft.; length as required.
 - 6. Insertion Elements for Liquids: Brass socket with minimum insertion length of 2-1/2 inches.
 - 7. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Exposed.
 - c. Thermometer: Concealed.
 - d. Color: off-white.
 - e. Orientation: Horizontal.
 - 8. Air Sensors: Watertight inlet fitting, shielded from direct sunlight.
- D. Humidity Sensors: Bulk polymer sensor element.
- 1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.

- f. Vaisala.
 - 2. Accuracy: 2 percent full range with linear output.
 - 3. Room Sensor Range: 20 to 80 percent relative humidity.
 - 4. Room Sensor Cover Construction: Manufacturer's standard locking covers.
 - a. Set-Point Adjustment: Concealed.
 - b. Set-Point Indication: Concealed.
 - c. Color: off-white.
 - d. Orientation: Horizontal.
 - 5. Duct Sensor: 20 to 80 percent relative humidity range with element guard and mounting plate.
 - 6. Outside-Air Sensor: 20 to 80 percent relative humidity range with mounting enclosure, suitable for operation at outdoor temperatures of 32 to 120 deg F.
 - 7. Duct and Sensors: With element guard and mounting plate, range of 0 to 100 percent relative humidity.
- E. Pressure Transmitters/Transducers:
- 1. Available Manufacturers:
 - a. BEC Controls Corporation.
 - b. General Eastern Instruments.
 - c. MAMAC Systems, Inc.
 - d. ROTRONIC Instrument Corp.
 - e. TCS/Basys Controls.
 - f. Vaisala.
 - 2. Static-Pressure Transmitter: Nondirectional sensor with suitable range for expected input, and temperature compensated.
 - a. Accuracy: 2 percent of full scale with repeatability of 0.5 percent.
 - b. Output: 4 to 20 mA.
 - c. Building Static-Pressure Range: 0- to 0.25-inch wg.
 - d. Duct Static-Pressure Range: 0- to 5-inch wg.
 - 3. Water Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure; linear output 4 to 20 mA.
 - 4. Water Differential-Pressure Transducers: Stainless-steel diaphragm construction, suitable for service; minimum 150-psig operating pressure and tested to 300-psig; linear output 4 to 20 mA.
 - 5. Differential-Pressure Switch (Air or Water): Snap acting, with pilot-duty rating and with suitable scale range and differential.
 - 6. Pressure Transmitters: Direct acting for gas or liquid service; range suitable for system; linear output 4 to 20 mA.
- F. Room Sensor Cover Construction: Manufacturer's standard locking covers.
- 1. Set-Point Adjustment: Concealed.
 - 2. Set-Point Indication: Exposed.
 - 3. Thermometer: Concealed.
 - 4. Color: off-white.
 - 5. Orientation: Horizontal.

- G. Room sensor accessories include the following:
 - 1. Insulating Bases: For sensors located on exterior walls.
 - 2. Adjusting Key: As required for calibration and cover screws.

2.7 STATUS SENSORS

- A. Status Inputs for Fans: Differential-pressure switch with pilot-duty rating and with adjustable range of 0- to 5-inch wg.
- B. Status Inputs for Electric Motors: Comply with ISA 50.00.01, current-sensing fixed- or split-core transformers with self-powered transmitter, adjustable and suitable for 175 percent of rated motor current.
- C. Voltage Transmitter (100- to 600-V ac): Comply with ISA 50.00.01, single-loop, self-powered transmitter, adjustable, with suitable range and 1 percent full-scale accuracy.
- D. Power Monitor: 3-phase type with disconnect/shorting switch assembly, listed voltage and current transformers, with pulse kilowatt hour output and 4- to 20-mA kW output, with maximum 2 percent error at 1.0 power factor and 2.5 percent error at 0.5 power factor.
- E. Current Switches: Self-powered, solid-state with adjustable trip current, selected to match current and system output requirements.
- F. Electronic Valve/Damper Position Indicator: Visual scale indicating percent of travel and 2- to 10-V dc, feedback signal.

2.8 FLOW MEASURING STATIONS

- A. Duct Airflow Station: Ebtron Gold Series.

2.9 THERMOSTATS

- A. Remote-Bulb Thermostats: On-off or modulating type, liquid filled to compensate for changes in ambient temperature; with copper capillary and bulb, unless otherwise indicated.
 - 1. Bulbs in water lines with separate wells of same material as bulb.
 - 2. Bulbs in air ducts with flanges and shields.
 - 3. Averaging Elements: Copper tubing with either single- or multiple-unit elements, extended to cover full width of duct or unit; adequately supported.
 - 4. Scale settings and differential settings are clearly visible and adjustable from front of instrument.
 - 5. On-Off Thermostat: With precision snap switches and with electrical ratings required by application.

6. Modulating Thermostats: Construct so complete potentiometer coil and wiper assembly is removable for inspection or replacement without disturbing calibration of instrument.
 - B. Fire-Protection Thermostats: Listed and labeled by an NRTL acceptable to authorities having jurisdiction; with fixed or adjustable settings to operate at not less than 75 deg F above normal maximum operating temperature, and the following:
 1. Reset: Manual.
 2. Reset: Automatic, with control circuit arranged to require manual reset at central control panel; with pilot light and reset switch on panel labeled to indicate operation.
 - C. Airstream Thermostats: Two-pipe, fully proportional, single-temperature type; with adjustable set point in middle of range, adjustable throttling range, plug-in test fitting or permanent pressure gage, remote bulb, bimetal rod and tube, or averaging element.
 - D. Electric, Low-Limit Duct Thermostat: Snap-acting, single-pole, single-throw, manual- or automatic-reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below set point.
 1. Bulb Length: Minimum 20 feet.
 2. Quantity: One thermostat for every 20 sq. ft. of coil surface.
- 2.10 HUMIDISTATS
- A. Manufacturers:
 1. MAMAC Systems, Inc.
 2. ROTRONIC Instrument Corp.
 - B. Duct-Mounting Humidistats: Electric insertion, 2-position type with adjustable, 2 percent throttling range, 20 to 80 percent operating range, and single- or double-pole contacts.
- 2.11 ROOM PRESSURE MONITORS
- A. Manufacturers
 1. Dywer Model RSM or approved equivalent
 - B. Room Pressure Monitors for Isolation Rooms, Operating Rooms and Clean Rooms:
 1. Provide Room Pressure Monitors for critical low differential pressure applications that require stringent pressure monitoring and alarming.
 - a. Configurable for monitoring positive or negative pressure in protected environments and hospital isolation rooms per CDC guidelines.
 - b. Range: Positive pressure for OR's: 0 to + 0.05" WC
 - c. Range: Negative pressure for Isolation Rooms: 0 to -0.05" WC

- d. Provide a complete system that includes a backlit RGB LCD display with a graphic user interface which enables access to pressure, security, calibration, and alarm setup.
 - e. A touch-screen shall be provided to display menus that guide the user through setup, as well as setting up password protection.
 - f. Red and green LED's and a local audible alarm (with time delay feature) shall be provided to alert personnel to system status.
 - g. A NEMA 1 (IP20) rated fire retardant plastic shall be provided for indoor applications.
 - h. True differential pressure shall be displayed with a resolution of 0.001 in w.c using a very low pressure capacitance which is dead ended and avoids the potential for cross contamination of the room and reference space to eliminate drift that results from fouling of flow based sensors.
 - i. Provide two levels of password protection available
 - j. Provide BACnet MSTP communication for use with the Building Control System by Alerton.
 - k. Provide a calibration certificate with every unit.
2. Specifications:
- a. Service: Air or nonconductive, nonexplosive gases.
 - b. Accuracy: $\pm 0.5\%$ FS.
 - c. Temperature Limits: 32 to 120°F (0 to 50°C).
 - d. Humidity Limits: 5 to 95% relative humidity (non-condensing).
 - e. Altitude: 6561 ft (2000 meters) max.
 - f. Thermal Effects: $\pm 0.03\%$ FS/ °F ($\pm 0.05\%$ FS/ °C).
 - g. Pressure Limits: ± 15 in w.c. (± 3.7 kPa).
 - h. Supply Voltage: Order Code A (24 VAC): 18-32 VAC, 50-60 Hz. Order Code B (120 VAC): 85-265VAC, 50-60 Hz. Main supply voltage fluctuations up to 10%.
 - i. Power Consumption (voltage output): 5 W.
 - j. Output Signal: Selectable 4-20 mA (2-wire), 0-5 VDC (3-wire), or 0-10 VDC (3-wire).
 - k. Switch Type: SPST.
 - l. Loop Resistance (4-20 mA output): 0-510 Ω .
 - m. Electrical Connection: Removable terminal block.
 - n. Process Connections: Barbed fittings for 3/16" ID tubing.
 - o. Enclosure Rating: NEMA 1 (IP20) rated for indoor applications.
 - p. Housing: Fire retardant plastic.
 - q. Mounting: Mount to standard double gang metal electrical box using 4x4" plaster ring adapter.
 - r. Communication: BACnet MSTP ASC optional.
 - s. Agency Approval: CE, CSA.

2.12 ACTUATORS

- A. Electric Motors: Size to operate with sufficient reserve power to provide smooth modulating action or two-position action.
 - 1. Comply with requirements in Division 23 Section "Common Motor Requirements for HVAC Equipment."
 - 2. Permanent Split-Capacitor or Shaded-Pole Type: Gear trains completely oil immersed and sealed. Equip spring-return motors with integral spiral-spring mechanism in housings designed for easy removal for service or adjustment of limit switches, auxiliary switches, or feedback potentiometer.
 - 3. Nonspring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 - 4. Spring-Return Motors for Valves Larger Than NPS 2-1/2: Size for running and breakaway torque of 150 in. x lbf.
 - 5. Nonspring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running torque of 150 in. x lbf and breakaway torque of 300 in. x lbf.
 - 6. Spring-Return Motors for Dampers Larger Than 25 Sq. Ft.: Size for running and breakaway torque of 150 in. x lbf.
- B. Electronic Actuators: Direct-coupled type designed for minimum 60,000 full-stroke cycles at rated torque.
 - 1. Manufacturers:
 - a. Belimo Aircontrols (USA), Inc.
 - 2. Valves: Size for torque required for valve close off at maximum pump differential pressure.
 - 3. Dampers: Size for running torque calculated as follows:
 - a. Parallel-Blade Damper with Edge Seals: 7 inch-lb/sq. ft. of damper.
 - b. Opposed-Blade Damper with Edge Seals: 5 inch-lb/sq. ft. of damper.
 - c. Parallel-Blade Damper without Edge Seals: 4 inch-lb/sq. ft. of damper.
 - d. Opposed-Blade Damper without Edge Seals: 3 inch-lb/sq. ft. of damper.
 - e. Dampers with 2- to 3-Inch wg of Pressure Drop or Face Velocities of 1000 to 2500 fpm: Increase running torque by 1.5.
 - f. Dampers with 3- to 4-Inch wg of Pressure Drop or Face Velocities of 2500 to 3000 fpm: Increase running torque by 2.0.
 - 4. Coupling: V-bolt and V-shaped, toothed cradle.
 - 5. Overload Protection: Electronic overload or digital rotation-sensing circuitry.
 - 6. Fail-Safe Operation: Mechanical, spring-return mechanism. Provide external, manual gear release on nonspring-return actuators.
 - 7. Power Requirements (Two-Position Spring Return): 24-V ac.
 - 8. Power Requirements (Modulating): Maximum 10 VA at 24-V ac or 8 W at 24-V dc.
 - 9. Proportional Signal: 2- to 10-V dc or 4 to 20 mA, and 2- to 10-V dc position feedback signal.
 - 10. Temperature Rating: Minus 22 to plus 122 deg F.
 - 11. Temperature Rating (Smoke Dampers): Minus 22 to plus 250 deg F.
 - 12. Run Time: 12 seconds open, 5 seconds closed.

2.13 CONTROL VALVES

- A. Manufacturers:
 - 1. Danfoss Inc.; Air Conditioning & Refrigeration Div.
 - 2. Erie Controls.
 - 3. Hayward Industrial Products, Inc.
 - 4. Magnatrol Valve Corporation.
 - 5. Neles-Jamesbury.
 - 6. Parker Hannifin Corporation; Skinner Valve Division.
 - 7. Pneuline Controls.
 - 8. Sauter Controls Corporation.
 - 9. Belimo Valves
- B. Control Valves: Factory fabricated, of type, body material, and pressure class based on maximum pressure and temperature rating of piping system, unless otherwise indicated.
- C. Hydronic system globe valves shall have the following characteristics:
 - 1. NPS 2 and Smaller: Class 125 bronze body, bronze trim, rising stem, renewable composition disc, and screwed ends with back seating capacity repackable under pressure.
 - 2. NPS 2-1/2 and Larger: Class 125 iron body, bronze trim, rising stem, plug-type disc, flanged ends, and renewable seat and disc.
 - 3. Internal Construction: Replaceable plugs and stainless-steel or brass seats.
 - a. Single-Seated Valves: Cage trim provides seating and guiding surfaces for plug on top and bottom.
 - b. Double-Seated Valves: Balanced plug; cage trim provides seating and guiding surfaces for plugs on top and bottom.
 - 4. Sizing: 5-psig maximum pressure drop at design flow rate or the following:
 - a. Two Position: Line size.
 - b. Two-Way Modulating: Either the value specified above or twice the load pressure drop, whichever is more.
 - c. Three-Way Modulating: Twice the load pressure drop, but not more than value specified above.
 - 5. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.
 - 6. Close-Off (Differential) Pressure Rating: Combination of actuator and trim shall provide minimum close-off pressure rating of 150 percent of total system (pump) head for two-way valves and 100 percent of pressure differential across valve or 100 percent of total system (pump) head.
 - 7.
- D. Butterfly Valves: 200-psig, 150-psig maximum pressure differential, ASTM A 126 cast-iron or ASTM A 536 ductile-iron body and bonnet, extended neck, stainless-steel stem, field-replaceable EPDM or Buna N sleeve and stem seals.
 - 1. Body Style: Lug.

2. Disc Type: Aluminum bronze.
3. Sizing: 1-psig maximum pressure drop at design flow rate.

- E. Terminal Unit Control Valves: Bronze body, bronze trim, two or three ports as indicated, replaceable plugs and seats, and union and threaded ends.
1. Rating: Class 125 for service at 125 psig and 250 deg F operating conditions.
 2. Sizing: 3-psig maximum pressure drop at design flow rate, to close against pump shutoff head.
 3. Flow Characteristics: Two-way valves shall have equal percentage characteristics; three-way valves shall have linear characteristics.

2.14 DAMPERS

- A. Available Manufacturers:
1. Air Balance Inc.
 2. Don Park Inc.; Autodamp Div.
 3. TAMCO (T. A. Morrison & Co. Inc.).
 4. United Enertech Corp.
 5. Vent Products Company, Inc.
- B. Dampers: AMCA-rated, opposed-blade design; 0.108-inch- minimum thick, galvanized-steel or 0.125-inch- minimum thick, extruded-aluminum frames with holes for duct mounting; damper blades shall not be less than 0.064-inch- thick galvanized steel with maximum blade width of 8 inches and length of 48 inches.
1. Secure blades to 1/2-inch- diameter, zinc-plated axles using zinc-plated hardware, with oil-impregnated sintered bronze blade bearings, blade-linkage hardware of zinc-plated steel and brass, ends sealed against spring-stainless-steel blade bearings, and thrust bearings at each end of every blade.
 2. Operating Temperature Range: From minus 40 to plus 200 deg F.
 3. Edge Seals, Standard Pressure Applications: Closed-cell neoprene.
 4. Edge Seals, Low-Leakage Applications: Use inflatable blade edging or replaceable rubber blade seals and spring-loaded stainless-steel side seals, rated for leakage at less than 10 cfm per sq. ft. of damper area, at differential pressure of 4-inch wg when damper is held by torque of 50 in. x lbf; when tested according to AMCA 500D.

2.15 CONTROL CABLE

- A. Electronic and fiber-optic cables for control wiring are specified in Division 16 Section "Voice and Data Communication Cabling."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditioned power supply is available to control units and operator workstation.
- B. Verify that pneumatic piping and duct-, pipe-, and equipment-mounted devices are installed before proceeding with installation.
- C. Verify the existence and configuration of the operator workstation currently serving the area within the scope of this project. In the event of an absence of an operator workstation within compliance of this specification, the contractor is to provide as specified herein.

3.2 INSTALLATION

- A. Verify location of thermostats, humidistats, and other exposed control sensors with Drawings and room details before installation. Install devices 48 inches above the floor.
 - 1. Install averaging elements in ducts and plenums in crossing or zigzag pattern.
- B. Install guards on thermostats in the following locations:
 - 1. Entrances.
 - 2. Public areas.
 - 3. Where indicated.
- C. Install automatic dampers according to Division 23 Section "Duct Accessories."
- D. Install damper motors on outside of duct in warm areas, not in locations exposed to outdoor temperatures.
- E. Install labels and nameplates to identify control components according to Division 15 Section "Mechanical Identification."
- F. Install hydronic instrument wells, valves, and other accessories according to Division 15 Section "Hydronic Piping."
- G. Install duct volume-control dampers according to Division 15 Sections specifying air ducts.
- H. Install electronic and fiber-optic cables according to Division 16 Section "Voice and Data Communication Cabling."

3.3 ELECTRICAL WIRING AND CONNECTION INSTALLATION

- A. Install raceways, boxes, and cabinets according to Division 16 Section "Raceways and Boxes."
- B. Install building wire and cable according to Division 16 Section "Conductors and Cables."
- C. Install signal and communication cable according to Division 16 Section "Voice and Data Communication Cabling."
 - 1. Conceal cable, except in mechanical rooms and areas where other conduit and piping are exposed.
 - 2. Install exposed cable in raceway.
 - 3. Install concealed cable in raceway.
 - 4. Bundle and harness multiconductor instrument cable in place of single cables where several cables follow a common path.
 - 5. Fasten flexible conductors, bridging cabinets and doors, along hinge side; protect against abrasion. Tie and support conductors.
 - 6. Number-code or color-code conductors for future identification and service of control system, except local individual room control cables.
 - 7. Install wire and cable with sufficient slack and flexible connections to allow for vibration of piping and equipment.
- D. Connect manual-reset limit controls independent of manual-control switch positions. Automatic duct heater resets may be connected in interlock circuit of power controllers.
- E. Connect hand-off-auto selector switches to override automatic interlock controls when switch is in hand position.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections, and to assist in field testing. Report results in writing.
- B. Perform the following field tests and inspections and prepare test reports:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation. Remove and replace malfunctioning units and retest.
 - 2. Test and adjust controls and safeties.
 - 3. Test calibration of controllers by disconnecting input sensors and stimulating operation with compatible signal generator.
 - 4. Test each point through its full operating range to verify that safety and operating control set points are as required.
 - 5. Test each control loop to verify stable mode of operation and compliance with sequence of operation. Adjust PID actions.

6. Test each system for compliance with sequence of operation.
7. Test software and hardware interlocks.

C. DDC Verification:

1. Verify that instruments are installed before calibration, testing, and loop or leak checks.
2. Check instruments for proper location and accessibility.
3. Check instrument installation for direction of flow, elevation, orientation, insertion depth, and other applicable considerations.
4. Check instrument tubing for proper fittings, slope, material, and support.
5. Check pressure instruments, piping slope, installation of valve manifold, and self-contained pressure regulators.
6. Check temperature instruments and material and length of sensing elements.
7. Check control valves. Verify that they are in correct direction.
8. Check air-operated dampers. Verify that pressure gages are provided and that proper blade alignment, either parallel or opposed, has been provided.
9. Check DDC system as follows:
 - a. Verify that DDC controller power supply is from emergency power supply, if applicable.
 - b. Verify that wires at control panels are tagged with their service designation and approved tagging system.
 - c. Verify that spare I/O capacity has been provided.
 - d. Verify that DDC controllers are protected from power supply surges.

- D. Replace damaged or malfunctioning controls and equipment and repeat testing procedures.

3.5 ADJUSTING

A. Calibrating and Adjusting:

1. Calibrate instruments.
2. Make three-point calibration test for both linearity and accuracy for each analog instrument.
3. Calibrate equipment and procedures using manufacturer's written recommendations and instruction manuals. Use test equipment with accuracy at least double that of instrument being calibrated.
4. Control System Inputs and Outputs:
 - a. Check analog inputs at 0, 50, and 100 percent of span.
 - b. Check analog outputs using milliamper meter at 0, 50, and 100 percent output.
 - c. Check digital inputs using jumper wire.
 - d. Check digital outputs using ohmmeter to test for contact making or breaking.
 - e. Check resistance temperature inputs at 0, 50, and 100 percent of span using a precision-resistant source.

5. Flow:
 - a. Set differential pressure flow transmitters for 0 and 100 percent values with 3-point calibration accomplished at 50, 90, and 100 percent of span.
 - b. Manually operate flow switches to verify that they make or break contact.
6. Pressure:
 - a. Calibrate pressure transmitters at 0, 50, and 100 percent of span.
 - b. Calibrate pressure switches to make or break contacts, with adjustable differential set at minimum.
7. Temperature:
 - a. Calibrate resistance temperature transmitters at 0, 50, and 100 percent of span using a precision-resistance source.
 - b. Calibrate temperature switches to make or break contacts.
8. Stroke and adjust control valves and dampers without positioners, following the manufacturer's recommended procedure, so that valve or damper is 100 percent open and closed.
9. Stroke and adjust control valves and dampers with positioners, following manufacturer's recommended procedure, so that valve and damper is 0, 50, and 100 percent closed.
10. Provide diagnostic and test instruments for calibration and adjustment of system.
11. Provide written description of procedures and equipment for calibrating each type of instrument. Submit procedures review and approval before initiating startup procedures.

B. Adjust initial temperature and humidity set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to three visits to Project during other than normal occupancy hours for this purpose.

3.6 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC instrumentation and controls. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION 230913

SECTION 230993 - SEQUENCE OF OPERATIONS FOR HVAC DDC

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes control sequences for DDC for HVAC systems, subsystems, and equipment.
- B. Related Requirements:
 - 1. Section 230913 "HVAC Instruments and Controls" for control equipment.
 - 2. Section 237313 "Custom Central Station Air Handling Units"

1.2 SUPPLY FAN INTERLOCKS

- A. ELEVATOR HOISTWAY
 - 1. Elevator hoistway supply fan SF-1 shall be started automatically upon smoke detection in the Elevator Hoistway through the fire alarm system. Upon activation of the Supply Fan, the motorized outdoor air damper shall open and the Supply Fan speed shall be controlled by the BMS through the Variable Frequency Drive to maintain a 0.15" WC Differential Pressure in the Elevator Hoistway. The BMS shall monitor the status of the Supply Fan, Fan Speed, Elevator Hoistway Differential pressure and Outdoor air damper.
 - 2. Elevator hoistway ventilation exhaust EF-3 shall be started if the temperature at the top of the Elevator hoistway exceeds 95 deg F. Upon activation of the Exhaust fan, the motorized exhaust damper shall open and the Exhaust Fan shall run until the hoistway temperature drops below 85 deg F. The BMS shall monitor the Exhaust Fan status, and exhaust damper.

1.3 EXHAUST FANS

- A. Exhaust fans shall be interlocked through the BMS to operate with the associated Air Handling Unit. When the Air Handling unit is started, the exhaust fan motorized damper shall open and the exhaust fan shall start automatically. The BMS shall monitor the Exhaust fan status through the current switch on the fan motor.
- B. ISOLATION EXHAUST FANS shall run continuously. The BMS shall monitor the Isolation Exhaust Fan status through a current switch on the fan motor.

1.4 AIR-HANDLING-UNIT CONTROL SEQUENCES

A. GENERAL

B. The sequence of operation applicable for Air Handling Units AHU-1 and AHU-2:

1. Air handling unit shall have multiple supply fans and return fans as indicated in fan schedule interlocked to run when return air fans is started.
2. Before the return fans can start, the return air damper, all smoke dampers or combination fire/smoke dampers located in ductwork of associated Air Handling System shall open.
3. Provide time delay relays between return fans and supply fans. Time delay relays to be adjustable and shall be set to give 30 seconds separation in starting time of each fan in the system requiring delay.
4. Unit return air fans shall start first, and then the supply fans shall start.
5. A fan array controller for the supply fans and for the return fans shall determine the number of fans operating in the fan array based on the airflow requirements. Should any fan, motor or VFD fail, the remaining fans shall speed up to maintain the airflow requirements and an alarm shall be generated at the BMS Operator workstation indicating that a fan failure occurred. .
6. The air handler fans discharge fire/smoke damper, unit return air damper and return air control/smoke damper shall be in the full open position, and minimum CFM outside air damper and relief damper in the full closed positions before the supply fan will start. Dampers shall be quick to open and slow to close. The smoke dampers shall have end switches to prevent AHU from starting if damper is closed. Provide end switch on minimum CFM outside air intake and return air dampers to prevent supply fan start if both dampers are in closed position.
7. On normal unit shut-down, the supply fan discharge damper, minimum CFM outside air dampers, and relief air damper shall be closed after the return fan has completely stopped.
8. Provide a control valve in the chilled water return piping from the cooling coil. The control valve shall be 2-way normally closed. Maintain a minimum flow of 20% through the coil below 45 degrees F for coil freeze protection.
9. Provide a high limit and low limit static pressure switch to cut the unit off if high limit or low limit static pressure in the main ductwork is exceeded.
10. Provide a 2-way, normally open control valve in hot water return piping from heating coil. When outside temperature drops below 40 degrees F, heating coil pump shall be energized. Provide positive shut off above 45 degrees F.
11. Economizer control shall be through enthalpy logic that compares signals from dry bulb temperature and relative humidity sensors in the return air in the outside air. The enthalpy logic shall determine which source has the lowest total heat content if outside air has lowest heat content, the maximum CFM outside air dampers, return air dampers, and relief air dampers shall be modulated by discharge air controller T-1. If return air has the lowest heat content, maximum CFM outside air and relief air dampers close, minimum outside damper and return air damper opens fully.

12. Provide a discharge controller T-1 with averaging element located in discharge duct. T-1 shall maintain its setting by modulating economizer dampers (outside, return and relief), and modulating chilled water valve in primary cooling coil
13. Provide for Air Handling Unit an Emergency Stop Switch to be located on a floor serviced by AHU. Switch shall have a Red Color. Emergency Stop Switches shall be mushroom type. Switches shall be as manufactured by Ellenco at occupied areas only. An engraved sign shall be placed above switch at central location stating "EMERGENCY SWITCH TO CUT OFF BED TOWER AIR HANDLING UNIT -1 (-2)". Signal shall be sent to the control center to indicate that this switch was activated and a light shall indicate activation at control panel.
14. Provide a manometer gauge to show pressure drop across filter bank. Gauge shall be marked to indicate point requiring filter change. BMS shall monitor the differential pressure across each filter bank and generate an alarm at the BMS when the final filter pressure drop has been reached.
15. Provide for each unit a low limit freeze stat where shown on AHU control diagram. Set at 38 dg F.(adjustable). On a signal from freeze stat, the supply fan and return fan shall shut down operations and all related dampers shall close. At same time allow full water flow through both chill water coils. Controller shall activate an audible alarm and illuminate a freeze pilot light on DDC control panel.
16. The mechanical fire emergency system for building air delivery systems shall be designed as follows:

C. Shut Down System:

1. Upon detection of smoke by smoke detectors located in the Air Handling Unit discharge, return air ductwork or upon receipt of a signal from building Fire Alarm Signal, the following shall occur:
 - a. The Supply Fans and the Return Fans will ramp down and shut down
 - b. Return Air Damper shall open, Relief Air, and Outside Air Dampers shall close
 - c. AHU discharge and return air fire/smoke dampers shall close
 - d. Remote duct mounted smoke dampers shall close. Dampers shall be installed so that upon loss of control power, dampers will close.
 - e. Supply and Return Fans shall require manual restart when duct detectors in AHU discharge or return air involved.
 - f. Upon loss of control power, fans shall stop and dampers close.
2. The Fire Alarm System will transmit a signal to AHU control panel so that any alarm triggered by a Fire Alarm System device (i.e., area smoke detector, heat detector, pull station) will cause AH Unit associated with fire zone in alarm mode to shut down as described in the sequence listed above. A shut down command initiated by the Fire Alarm System will not require a manual restart of the AHU system.

1.5 VARIABLE AIR VOLUME SYSTEM CONTROL FOR AHU-1 and AHU-2.

- A. VAV controls system shall be fully operational upon completion of Bed Tower.

1. Provide for each variable volume system controls that shall maintain the system static pressure. All major components shall be industry standard control quality.
 2. Control System shall provide system static control capacity of supply and return fans. The system shall perform the following functions :
 - a. Supply fans capacity by system demand.
 - b. Continues monitoring of supply and return fans capacities.
 - c. Continues monitoring of supply system static pressure.
 3. Controls shall include but not to be limited to the following:
 - a. Static pressure regulators (controllers)
 - b. System Static Gauges
 - c. Supply and return air CFM
 - d. Cabinet with a hinged front
 4. Controls shall modulate variable speed controllers, for the supply fans and for return air fans to control the system static pressure and system capacity within acceptable limits.
 5. The supply and return fans capacities monitoring system shall be sized to fit where indicated on drawings.
 6. Pressure regulators input pressure signals must be stable and representative of the measured variables. Regulators must be sensitive, accurate and have adjustable set points.
- B. Supply Fans Variable-Volume Control:
1. Provide supply duct static pressure regulators, with sensors on supply air at the inlet cone of each fan and constant reference pressure points. The regulators shall drive supply fan modulating devices vary the supply fans speed to maintain supply air volume commensurate with variable volume system requirements.
 2. All of individual variable boxes on the system served by AHU shall be monitored. The static pressure set point will be reset lower until at least one variable volume box on system has a damper position at 90% (adjustable) open.
 3. Output of regulators to match the system speed controllers specified. This Contractor shall coordinate the proper signal with variable speed equipment manufacturer if provided.
 4. Set variable-frequency drive to minimum speed when fan is stopped.
- C. System controls of operation:
1. Control contractor and T & B contractor shall coordinate their efforts and set required air flow quantities for supply and return fan to assure of the constantly maintained minimum air flow of outside air in normal (not economizer) operation.
 2. Readings of minimum supply air cfm's of AHU shall be monitored by BAS
 3. A shielded mixed air static pressure sensor shall be installed in AHU mixed air plenum near the filters to provide stable control of mixed air plenum pressure . Sensor shall constantly compare plenum pressure set at negative 0.05 " of W.G. (adjustable) relative to outside. Control system shall modulate AHU return air damper to maintain 0.05" W.G. plenum pressure, allowing constant ,set amount of outside air enter mixed air plenum.

4. AHU relief damper shall be positioned to produce the appropriate amount of relief air during normal (not economizer) operation. There shall be one space to ambient differential pressure sensors for each AHU. The relief damper shall be modulated to keep space pressures at 0.05" W.G. relative to outside.
 5. Set variable-frequency drive to minimum speed when fan is stopped.
- D. Installation:
1. When system is started, adjust controls to eliminate excessive hunting and cycling of fans.
- E. Final Adjustments:
1. Provide the services of a representative of the air flow control system supplier for field calibration and adjustment of the air control components and settings control set points.
 2. Control contractor shall coordinate and assist T & B contractor in the testing, operation and balancing of the air flow control systems.
- F. Performance Test:
1. After final calibration and adjustment is made, demonstrate operation of all systems to provide operation satisfactory to Owner and Architect
- G. Performance Test:
1. After final calibration and adjustment is made, demonstrate operation of all systems to provide operation satisfactory to Owner and Architect.
- 1.6 HUMIDIFIERS.
- A. Main AHU Humidifier
1. A duct mounted sensor in the return air duct shall be used to control humidifier humidity level set point.
 2. A high limit humidity controller located in the duct ten feet downstream of humidifier shall maintain a setting of 75 % relative humidity by operating humidifier control valve.
 3. Provide an automatic steam shut-off valve that shall prevent humidifier from operating unless air handler unit supplying air to humidifier is operating.
 4. Humidifier shall not operate if any of cooling coil is operating.
- 1.7 HIGH LIMIT FIRESTATS AND LOW LIMIT FREEZSTATS
- A. Fire-stats shall be set at 125 degrees F and shall stop fans associated with high limit fire-stats. Low limit freezstats shall be set at 38 degrees F(adjustable). At this temperature, freezstat shall shut down supply and return fan associated with freezstat and shall close all AHU dampers.

- 1.8 ADDITIONAL INTERLOCKS. In addition to electrical control interlocks specified elsewhere, this contractor shall furnish and install the following items:
- A. HIGH AND LOW PRESSURE LIMIT SWITCHES:
 - 1. Interlock Supply fan and Return fan to stop in the event that the High or Low Pressure limit switches indicate a pressure exceeding the safe operating limit.
 - B. H-O-A Switch:
 - 1. Exhaust supply fan and return fan of each system shall be provide with a "HAND-OFF-AUTO" switch so each fan can be tested or run in Automatic position. WHAN "H.O.A. is in the "HAND" POSITION, NO SAFETY CONTROL SHALL BE BY-PASSED.
 - C. Fire/Smoke dampers:
 - 1. See AHU's shut down sequence.
 - D. Smoke Detectors:
 - E. Duct smoke detectors shall be provided in installed by Electrical Contractor as specified in Division 26 of Specifications.
 - F. Mechanical Contractor shall be responsible for all duct smoke detectors testing tubes and hardware installation in ductwork.
 - 1. Smoke detectors shall be interlocked and wired as specified in this specification. Mechanical Contractor shall be responsible for all required coordination work in connection with duct detectors operation with Fire Alarm Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 232113 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes piping, special-duty valves, and hydronic specialties for hot-water heating, chilled-water cooling, makeup water for these systems; blowdown drain lines; and condensate drain piping.
- B. See Division 23 Section "Basic Mechanical Materials and Methods" for general piping materials and installation requirements.
- C. See Division 23 Section "HVAC Instrumentation and Controls" for temperature-control valves and sensors.

1.2 SUBMITTALS

- A. Product Data: For each type of the following:
 - 1. Pressure-seal fittings.
 - 2. Valves. Include flow and pressure drop curves based on manufacturer's testing for calibrated-orifice balancing valves and automatic flow-control valves.
 - 3. Air control devices.
 - 4. Chemical treatment.
 - 5. Hydronic specialties.
- B. Shop Drawings: Detail, at 1/4 scale, the piping layout, fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to the building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
- C. Grooved joint products shall be shown on drawings and product submittals and shall be specifically identified with the applicable manufacturer style or series number.
- D. Operation and Maintenance Data: For air control devices, hydronic specialties, and special-duty valves to include in emergency, operation, and maintenance manuals.

1.3 QUALITY ASSURANCE

- A. ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the

appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

- B. All grooved joint couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.
 - 1. All castings used for coupling housings, fittings, valve bodies, etc., shall be date stamped for quality assurance and traceability.

1.4 EXTRA MATERIALS

- A. Differential Pressure Meter: For each type of balancing valve and automatic flow control valve, include flowmeter, probes, hoses, flow charts, and carrying case.

1.5 COORDINATION

- A. Coordinate pipe sleeve installations for foundation wall penetrations.
- B. Coordinate piping installation with roof curbs, equipment supports, and roof penetrations. Roof specialties are specified in Division 7 Sections.
- C. Coordinate pipe fitting pressure classes with products specified in related Sections.

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

- A. Drawn-Temper Copper Tubing: ASTM B 88, Type L.
- B. Annealed-Temper Copper Tubing: ASTM B 88, Type K.
- C. DWV Copper Tubing: ASTM B 306, Type DWV.
- D. Wrought-Copper Fittings: ASME B16.22.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Victaulic Company.
 - 2. Grooved-End Copper Fittings: ASME B16.22 wrought copper and ASTM B 75, copper tube or ASME B16.18 and ASTM B 584, bronze casting.

3. Grooved-End-Tube Couplings: Rigid pattern with offsetting angle-pattern bolt pads at copper tube dimensions, unless otherwise indicated; gasketed fitting. Ductile-iron housing with keys matching copper tube and fitting grooves, prelubricated EPDM-HP gasket rated for minimum 250 deg F for use with housing, and electroplated steel bolts and nuts.

- E. Wrought-Copper Unions: ASME B16.22.

2.2 STEEL PIPE AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel with plain ends; type, grade, and wall thickness as indicated in Part 3 "Piping Applications" Article.
- B. Cast-Iron Threaded Fittings: ASME B16.4; Classes 125 and 250 as indicated in Part 3 "Piping Applications" Article.
- C. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300 as indicated in Part 3 "Piping Applications" Article.
- D. Malleable-Iron Unions: ASME B16.39; Classes 150, 250, and 300 as indicated in Part 3 "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 Part 3 "Piping Applications" Article.
- F. Wrought-Steel Fittings: ASTM A 234/A 234M, wall thickness to match adjoining pipe.
- G. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 1. Material Group: 1.1.
 2. End Connections: Butt welding.
 3. Facings: Raised face.
- H. Grooved Mechanical-Joint Fittings and Couplings:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Anvil International, Inc.
 - b. Central Sprinkler Company; a division of Tyco Fire & Building Products.
 - c. National Fittings, Inc.
 - d. Victaulic Company.

2. Joint Fittings: ASTM A 536, Grade 65-45-12 ductile iron; ASTM A 53/A 53M, Type F, E, or S, Grade B factory-fabricated steel; or ASTM A 234, Grade WPB 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.
3. Couplings: Two ductile-iron housing and synthetic rubber gasket of central cavity pressure-responsive design; with ASTM A449 electroplated steel nuts and bolts, to secure grooved pipe and fittings.
 - a. Rigid: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1 and B31.9. Installation-Ready, for direct stab installation without field disassembly.
 - b. Flexible: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source.
 - c. AGS Series two-segment couplings with lead-in chamfer on housing key and wide-width Flush Seal gasket.
- I. Steel Pipe Nipples: ASTM A 733, made of same materials and wall thicknesses as pipe in which they are installed.

2.3 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 maximum thickness unless thickness or specific material is 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. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- D. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.
- E. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

- F. Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.
- G. Grooved Joint lubricant: Lubricate gaskets with lubricant supplied by the coupling manufacturer in accordance with published installation instructions, and approved for the gasket elastomer and system media.

2.4 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. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Central Plastics Company.
 - c. Hart Industries International, Inc.
 - d. Jomar International Ltd.
 - e. Matco-Norca, Inc.
 - f. McDonald, A. Y. Mfg. Co.
 - g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - h. Wilkins; a Zurn company.
 - 2. Description:
 - a. Standard: ASSE 1079.
 - b. Pressure Rating: 125 psig minimum at 180 deg F.
 - c. End Connections: Solder-joint copper alloy and threaded ferrous.
- C. Dielectric Flanges:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Capitol Manufacturing Company.
 - b. Matco-Norca, Inc.
 - c. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - d. Wilkins; a Zurn company.
 - 2. Description:
 - a. Standard: ASSE 1079.

- b. Factory-fabricated, bolted, companion-flange assembly.
- c. Pressure Rating: 125 psig minimum at 180 deg F.
- d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Pipeline Seal and Insulator, Inc.
- 2. Description:
 - a. Nonconducting materials for field assembly of companion flanges.
 - b. Pressure Rating: 150 psig.
 - c. Gasket: Neoprene or phenolic.
 - d. Bolt Sleeves: Phenolic or polyethylene.
 - e. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

- 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Elster Perfection.
 - b. Grinnell Mechanical Products.
 - c. Matco-Norca, Inc.
 - d. Precision Plumbing Products, Inc.
 - e. Victaulic Company.
- 2. Description:
 - a. Standard: IAPMO PS 66
 - b. Electroplated steel nipple. Complying with ASTM F 1545.
 - c. Dielectric Waterway: Copper silicon casting conforming to UNS C87850 with grooved and/or threaded ends.
 - d. Pressure Rating: 300 psig at 225 deg F.
 - e. End Connections: Male threaded or grooved.
 - f. Lining: Inert and noncorrosive, propylene.

2.5 VALVES

- A. Gate, Globe, Check, Ball, and Butterfly Valves: Comply with requirements specified in Division 23 Section "General-Duty Valves for HVAC Piping."
- B. Automatic Temperature-Control Valves, Actuators, and Sensors: Comply with requirements specified in Division 23 Section "Instrumentation and Control for HVAC."
- C. Diaphragm-Operated, Pressure-Reducing Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - d. Conbraco Industries, Inc.
 - e. Spence Engineering Company, Inc.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Body: Bronze or brass.
 - 3. Disc: Glass and carbon-filled PTFE.
 - 4. Seat: Brass.
 - 5. Stem Seals: EPDM O-rings.
 - 6. Diaphragm: EPT.
 - 7. Low inlet-pressure check valve.
 - 8. Inlet Strainer: Wire Mesh, removable without system shutdown.
 - 9. Valve Seat and Stem: Noncorrosive.
 - 10. Valve Size, Capacity, and Operating Pressure: Selected to suit system in which installed, with operating pressure and capacity factory set and field adjustable.
- D. Diaphragm-Operated Safety Valves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Amtrol, Inc.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett Domestic Pump; a division of ITT Industries.
 - d. Conbraco Industries, Inc.
 - e. Spence Engineering Company, Inc.
 - f. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
 - 2. Body: Bronze or brass.
 - 3. Disc: Glass and carbon-filled PTFE.
 - 4. Seat: Brass.
 - 5. Stem Seals: EPDM O-rings.

6. Diaphragm: EPT.
7. Wetted, Internal Work Parts: Brass and rubber.
8. Inlet Strainer: Wire Mesh, removable without system shutdown.
9. Valve Seat and Stem: Noncorrosive.
10. 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.

E. Automatic Flow-Control Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Flow Design Inc.
 - b. Griswold Controls.
 - c. Nexus Valve.
 - d. Victaulic Company.
2. Body: Brass or ferrous metal.
3. Piston and Spring Assembly: Stainless steel, tamper proof, self cleaning, and removable.
4. Combination Assemblies: Include bronze or brass-alloy ball valve.
5. Identification Tag: Marked with zone identification, valve number, and flow rate.
6. Size: Same as pipe in which installed.
7. Performance: Maintain constant flow, plus or minus 5 percent over system pressure fluctuations.
8. Minimum CWP Rating: 175 psig.
9. Maximum Operating Temperature: 200 deg F.

2.6 AIR CONTROL DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Amtrol, Inc.
2. Armstrong Pumps, Inc.
3. Bell & Gossett Domestic Pump; a division of ITT Industries.
4. Taco.

B. Manual Air Vents:

1. Body: Bronze.
2. Internal Parts: Nonferrous.
3. Operator: Screwdriver or thumbscrew.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/8.

6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 225 deg F.

C. Automatic Air Vents:

1. Body: Bronze or cast iron.
2. Internal Parts: Nonferrous.
3. Operator: Noncorrosive metal float.
4. Inlet Connection: NPS 1/2.
5. Discharge Connection: NPS 1/4.
6. CWP Rating: 150 psig.
7. Maximum Operating Temperature: 240 deg F.

2.7 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 and smaller; flanged ends for NPS 2-1/2 and larger.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

B. Stainless-Steel Bellow, Flexible Connectors:

1. Body: Stainless-steel bellows with woven, flexible, bronze, wire-reinforcing protective jacket.
2. End Connections: Threaded or flanged to match equipment connected.
3. Performance: Capable of 3/4-inch misalignment.
4. CWP Rating: 150 psig.
5. Maximum Operating Temperature: 250 deg F.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

- A. Hot-water heating piping, aboveground, NPS 2 and smaller, shall be either of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.

2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- B. Hot-water heating piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- C. Hot-water heating piping installed belowground and within slabs shall be the following:
1. Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.
- D. Chilled-water piping, aboveground, NPS 2 and smaller, shall be either of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 2. Schedule 40 steel pipe; Class 125, cast-iron fittings; cast-iron flanges and flange fittings; and threaded joints.
- E. Chilled-water piping, aboveground, NPS 2-1/2 and larger, shall be any of the following:
1. Type L, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
 2. Schedule 40 steel pipe, wrought-steel fittings and wrought-cast or forged-steel flanges and flange fittings, and welded and flanged joints.
 3. Schedule 40 steel pipe; grooved, mechanical joint coupling and fittings; and grooved, mechanical joints.
- F. Chilled-water piping installed belowground and within slabs shall be the following:
1. Type K, annealed-temper copper tubing, wrought-copper fittings, and soldered joints. Use the fewest possible joints.
- G. Condensate-Drain Piping: Type DWV, drawn-temper copper tubing, wrought-copper fittings, and soldered joints.
- H. Air-Vent Piping:
1. Inlet: Same as service where installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.
 2. Outlet: Type K, annealed-temper copper tubing with soldered or flared joints.

- I. Safety-Valve-Inlet and -Outlet Piping for Hot-Water Piping: Same materials and joining methods as for piping specified for the service in which safety valve is installed with metal-to-plastic transition fittings for plastic piping systems according to the piping manufacturer's written instructions.

3.2 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 in the return pipe of each heating or cooling terminal.

3.3 PIPING INSTALLATIONS

- A. Install drains, consisting of a tee fitting, NPS 3/4 ball valve, and short NPS 3/4 threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.
- B. Install piping at a uniform grade of 0.2 percent upward in direction of flow.
- C. Reduce pipe sizes using eccentric reducer fitting installed with level side up.
- D. Unless otherwise indicated, install branch connections to mains using tee fittings in main pipe, with the takeoff coming out the bottom of the main pipe. For up-feed risers, install the takeoff coming out the top of the main pipe.
- E. Install strainers on supply side of each control valve, pressure-reducing valve, solenoid valve, in-line pump, and elsewhere as indicated. Install NPS 3/4 nipple and ball valve in blowdown connection of strainers NPS 2 and larger. Match size of strainer blowoff connection for strainers smaller than NPS 2.
- F. Anchor piping for proper direction of expansion and contraction.

3.4 HANGERS AND SUPPORTS

- A. Hanger, support, and anchor devices are specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment." Comply with the following requirements for maximum spacing of supports.
- B. Seismic restraints are specified in Division 23 Section "Vibration and Seismic Controls for HVAC Piping and Equipment."
- C. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal piping less than 20 feet long.
 2. Adjustable roller hangers and spring hangers for individual horizontal piping 20 feet or longer.
 3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet 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.
- D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 4. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 5. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 6. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 7. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.
 8. NPS 6: Maximum span, 17 feet; minimum rod size, 1/2 inch.
 9. NPS 8: Maximum span, 19 feet; minimum rod size, 5/8 inch.
- E. Install hangers for drawn-temper copper piping with the following maximum spacing and minimum rod sizes:
1. NPS 3/4: Maximum span, 5 feet; minimum rod size, 1/4 inch.
 2. NPS 1: Maximum span, 6 feet; minimum rod size, 1/4 inch.
 3. NPS 1-1/2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 4. NPS 2: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 5. NPS 2-1/2: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 6. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
- F. Support vertical runs at roof, at each floor, and at 10-foot intervals between floors.

3.5 PIPE JOINT CONSTRUCTION

- A. Join pipe and fittings according to the following requirements and Division 23 Sections specifying piping systems.
- B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

- D. 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.
- E. 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.
- F. 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.
- G. Welded Joints: Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.
- H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- I. 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. A factory trained representative (direct employee) of the coupling manufacturer shall provide on-site training for contractor's field personnel in the use of grooving tools, application of groove, and product installation. The representative shall periodically visit the job site and review installation to ensure best practices in grooved joint installation are being followed. Contractor shall remove and replace any improperly installed products.
- J. Mechanically Formed, Copper-Tube-Outlet Joints: Use manufacturer-recommended tool and procedure, and brazed joints.

3.6 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.
 - 1. Install automatic air vents in mechanical equipment rooms only at high points of system piping, at heat-transfer coils, and elsewhere as required for system air venting.

3.7 TERMINAL EQUIPMENT CONNECTIONS

- A. Size for supply and return piping connections shall be same as for equipment connections.
- B. Install control valves in accessible locations close to connected equipment.
- C. Install bypass piping with globe valve around control valve. If multiple, parallel control valves are installed, only one bypass is required.
- D. Install ports for pressure and temperature gages at coil inlet connections.

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 "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.

3.9 ADJUSTING

A. Mark calibrated nameplates of pump discharge valves after hydronic system balancing has been completed, to permanently indicate final balanced position.

B. Perform these adjustments before operating the system:

1. Open valves to fully open position. Close coil bypass valves.
2. Check air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
3. Set temperature controls so all coils are calling for full flow.
4. Check operation of automatic bypass valves.
5. Check and set operating temperatures of boilers, chillers, and cooling towers to design requirements.

3.10 CLEANING

A. Flush hydronic piping systems with clean water. Remove and clean or replace strainer screens.

END OF SECTION 232113

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 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Double-wall rectangular ducts and fittings.
3. Single-wall round ducts and fittings.
4. Double-wall round ducts and fittings.
5. Sheet metal materials.
6. Sealants and gaskets.
7. Hangers and supports.
8. Seismic-restraint devices.

- B. Related Sections:

1. Division 23 Section "Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.
2. Division 23 Section "Testing, Adjusting, and Balancing" for testing, adjusting, and balancing requirements for metal ducts.

1.3 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Duct hangers, 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."
- B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4 SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.
7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.
5. Design Calculations: Calculations, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation for selecting hangers, supports and seismic restraints.

D. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.

6. Items penetrating finished ceiling including the following:

- a. Lighting fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.
- f. Perimeter moldings.

E. Welding certificates.

F. Field quality-control reports.

1.5 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 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

- 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."

2.2 DOUBLE-WALL RECTANGULAR DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. McGill AirFlow LLC.
 - 2. Sheet Metal Connectors, Inc.
- B. Rectangular Ducts: Fabricate ducts with indicated dimensions for the inner duct.
- C. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
- D. 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."
- E. 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."
- F. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - 1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - 2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
 - 3. Coat insulation with antimicrobial coating.
 - 4. Cover insulation with polyester film complying with UL 181, Class 1.
- G. Inner Duct: Minimum 0.028-inch solid sheet steel.
- H. Formed-on Transverse Joints (Flanges): 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."

- I. 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."

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 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 in diameter with butt-welded longitudinal seams.
 2. Fabricate flat-oval ducts larger than 72 inches 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 DOUBLE-WALL ROUND DUCTS AND FITTINGS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lindab Inc.
 2. McGill AirFlow LLC.
 3. SEMCO Incorporated.
 4. Sheet Metal Connectors, Inc.
- B. Outer Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on static-pressure class unless otherwise indicated.
1. 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."
 - a. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.
 2. 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."
 - a. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
 - b. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.
 3. 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."
- C. Inner Duct: Minimum 0.028-inch solid sheet steel.
- D. Interstitial Insulation: Fibrous-glass liner complying with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.

2. Install spacers that position the inner duct at uniform distance from outer duct without compressing insulation.
3. Coat insulation with antimicrobial coating.
4. Cover insulation with polyester film complying with UL 181, Class 1.

2.5 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.
 2. Finishes for Surfaces Exposed to View: Mill phosphatized.
- C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.
- D. Factory- or Shop-Applied Antimicrobial Coating:
 1. Apply to the surface of sheet metal that will form the interior surface of the duct. An untreated clear coating shall be applied to the exterior surface.
 2. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 3. Coating containing the antimicrobial compound shall have a hardness of 2H, minimum, when tested according to ASTM D 3363.
 4. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
 5. Shop-Applied Coating Color: White.
 6. Antimicrobial coating on sheet metal is not required for duct containing liner treated with antimicrobial coating.
- E. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
 1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.6 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.
 - 3. Sealant: Modified styrene acrylic.
 - 4. Water resistant.
 - 5. Mold and mildew resistant.
 - 6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
 - 7. Service: Indoor and outdoor.
 - 8. Service Temperature: Minus 40 to plus 200 deg F.
 - 9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
- 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, 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.
- D. Solvent-Based Joint and Seam Sealant:
 - 1. Application Method: Brush on.
 - 2. Base: Synthetic rubber resin.
 - 3. Solvent: Toluene and heptane.
 - 4. Solids Content: Minimum 60 percent.
 - 5. Shore A Hardness: Minimum 60.
 - 6. Water resistant.
 - 7. Mold and mildew resistant.
 - 8. VOC: Maximum 395 g/L.
 - 9. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
 - 10. Service: Indoor or outdoor.

11. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.
- E. 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.
- F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- G. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg 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.

2.7 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. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."
- D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
- E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
- F. 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.
- G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.
- H. 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.

2.8 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. Vibration Eliminator Company.
 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 or ASTM A 492, stainless-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: Reinforcing steel angle clamped 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, 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.
- K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Division 15 Section "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. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
 - 3. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 4. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
 - 5. Conditioned Space, Exhaust Ducts: Seal Class B.

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 thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches 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, "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 of each elbow and within 48 inches 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.

- 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 o.c., and longitudinal supports a maximum of 80 feet o.c.
 - 2. Brace a change of direction longer than 12 feet.
- 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 Architect 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. 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 Division 23 Section "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 PAINTING

- A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Division 9 painting Sections.

3.7 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 of 2-Inch wg or Higher: Test representative duct sections, totaling no less than 25 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.

3.8 DUCT CLEANING

- A. Clean new 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 Division 15 Section "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.

3.9 START UP

- A. Air Balance: Comply with requirements in Division 15 Section "Testing, Adjusting, and Balancing."

3.10 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts Connected to Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
2. Ducts Connected to Variable- Air Volume Air-Handling Units:
 - a. Pressure Class: Positive 4-inch wg.
 - b. Minimum SMACNA Seal Class: A.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
3. Ducts Connected to Equipment Not Listed Above:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.

- c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- B. Return Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 3-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - c. SMACNA Leakage Class for Rectangular: 12.
 - d. SMACNA Leakage Class for Round and Flat Oval: 6.
- C. Exhaust Ducts:
 - 1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
 - a. Pressure Class: Negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
 - c. SMACNA Leakage Class for Rectangular: 6.
 - d. SMACNA Leakage Class for Round and Flat Oval: 3.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - 1. Ducts Connected to Air-Handling Units:
 - a. Pressure Class: Positive or negative 2-inch wg.
 - b. Minimum SMACNA Seal Class: B.
 - 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 or carbon steel coated with zinc-chromate primer.
 - 2. PVC-Coated Ducts:
 - a. Exposed to Airstream: Match duct material.
 - b. Not Exposed to Airstream: Match duct material.
- F. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: 1 inches thick.
- G. Elbow Configuration:

1. 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. 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. 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 or Lower: 0.5 radius-to-diameter ratio and three segments for 90-degree elbow.
 - 2) Velocity 1000 to 1500 fpm: 1.0 radius-to-diameter ratio and four segments for 90-degree elbow.
 - 3) Velocity 1500 fpm 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 and Smaller in Diameter: Stamped or pleated.
 - c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam.

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.
 - b. Rectangular Main to Round Branch: Spin in.
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 or Lower: 90-degree tap.
 - b. Velocity 1000 to 1500 fpm: Conical tap.
 - c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300 - DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Backdraft dampers.
2. Volume dampers.
3. Fire dampers.
4. Ceiling fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.
11. Duct accessory hardware.

B. See Division 23 Section "Fire Alarm" for duct-mounting fire and smoke detectors.

C. See Division 23 Section "HVAC Instrumentation and Controls" for electric and pneumatic damper actuators.

1.2 SUBMITTALS

A. Product Data: For the following:

1. Backdraft dampers.
2. Volume dampers.
3. Fire dampers.
4. Ceiling fire dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Turning vanes.
8. Duct-mounting access doors.
9. Flexible connectors.
10. Flexible ducts.

B. Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1. Special fittings.
2. Manual-volume damper installations.
3. Fire-damper, smoke-damper, and combination fire- and smoke-damper installations, including sleeves and duct-mounting access doors.
4. Wiring Diagrams: Power, signal, and control wiring.

1.3 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

1.4 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

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

2.2 SHEET METAL MATERIALS

- A. Comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods, unless otherwise indicated.
- B. Galvanized Sheet Steel: Lock-forming quality; complying with ASTM A 653/A 653M and having G60 coating designation; ducts shall have mill-phosphatized finish for surfaces exposed to view.
- C. Stainless Steel: ASTM A 480/A 480M.

- D. Aluminum Sheets: ASTM B 209, alloy 3003, temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- E. Extruded Aluminum: ASTM B 221, alloy 6063, temper T6.
- F. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT DAMPERS

- A. Available Manufacturers:
 - 1. Air Balance, Inc.
 - 2. American Warming and Ventilating.
 - 3. CESCO Products.
 - 4. Duro Dyne Corp.
 - 5. Greenheck.
 - 6. Penn Ventilation Company, Inc.
 - 7. Prefco Products, Inc.
 - 8. Ruskin Company.
 - 9. Vent Products Company, Inc.
 - 10. Nailor Industries Inc.
 - 11. SEMCO Incorporated.
 - 12. Louvers and Dampers, Inc.
 - 13. NCA Manufacturing, Inc.
- B. Description: Multiple-blade, parallel action gravity balanced, with center-pivoted blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner with 90-degree stop, steel ball bearings, and axles; adjustment device to permit setting for varying differential static pressure.
- C. Frame: 0.040-inch- thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: 0.050-inch- thick aluminum sheet.
- E. Blade Seals: Extruded vinyl, mechanically locked.
- F. Blade Axles: Galvanized steel.
- G. Tie Bars and Brackets: Galvanized steel.

- H. Return Spring: Adjustable tension.
- I. Bearings: Steel ball or synthetic pivot bushings.

2.4 MANUAL VOLUME DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. American Warming and Ventilating.
3. Flexmaster U.S.A., Inc.
4. McGill AirFlow Corporation.
5. METALAIRE, Inc.
6. Nailor Industries Inc.
7. Penn Ventilation Company, Inc.
8. Ruskin Company.
9. Vent Products Company, Inc.
10. Louvers and Dampers, Inc.
11. Louvers and Dampers, Inc.
12. Portorff: a division of PCI Ind.

B. General Description: Factory fabricated, with required hardware and accessories. Stiffen damper blades for stability. Include locking device to hold single-blade dampers in a fixed position without vibration. Close duct penetrations for damper components to seal duct consistent with pressure class.

C. Standard Volume Dampers: Multiple- or single-blade, parallel- or opposed-blade design as indicated, standard leakage rating, and suitable for horizontal or vertical applications.

1. Steel Frames: Hat-shaped, galvanized sheet steel channels, minimum of 0.064 inch thick, with mitered and welded corners; frames with flanges where indicated for attaching to walls and flangeless frames where indicated for installing in ducts.
2. Roll-Formed Steel Blades: 0.064-inch- thick, galvanized sheet steel.
3. Blade Axles: Galvanized steel.
4. Bearings: Stainless-steel sleeve.
5. Tie Bars and Brackets: Galvanized steel.

D. Damper Hardware: Zinc-plated, die-cast core with dial and handle made of 3/32-inch-thick zinc-plated steel, and a 3/4-inch hexagon locking nut. Include center hole to suit damper operating-rod size. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Greenheck Fan Corporation.
 2. Lloyd Industries, Inc.
 3. Louvers and Dampers, Inc.
 4. McGill AirFlow LLC.
 5. METALAIRE, Inc.
 6. Nailor Industries Inc.
 7. NCA Manufacturing, Inc.
 8. Ruskin Company.
- B. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
- C. Frames:
1. Hat shaped.
 2. Galvanized-steel channels, 0.064 inch thick.
 3. Mitered and welded corners.
- D. Blades:
1. Multiple blade with maximum blade width of 6 inches.
 2. Parallel- and opposed-blade design.
 3. Galvanized steel.
 4. 0.064 inch thick.
 5. Blade Edging: Closed-cell neoprene edging.
 6. Blade Edging: Inflatable seal blade edging, or replaceable rubber seals.
- E. Blade Axles: 1/2-inch diameter; galvanized steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.
1. Operating Temperature Range: From minus 40 to plus 200 deg F.
- F. Bearings:
1. Molded synthetic.
 2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.
 3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Available Manufacturers:

1. Air Balance, Inc.
2. METALAIRE, Inc.
3. Nailor Industries Inc.
4. Prefco Products, Inc.
5. Ruskin Company.
6. Pottorff; a division of PCI Industries, Inc.
7. Safe Air/Dowco, Inc.

B. Fire dampers shall be labeled according to UL 555.

C. Fire Rating: 1-1/2 hour in one and two hour rated walls and 3 hour in three and four hour rated walls.

D. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch- thick galvanized steel; with mitered and interlocking corners.

E. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.040 inch thick as indicated and of length to suit application.
2. Exceptions: Omit sleeve where damper frame width permits direct attachment of perimeter mounting angles on each side of wall or floor, and thickness of damper frame complies with sleeve requirements.

F. Mounting Orientation: Vertical or horizontal as indicated.

G. Blades: Roll-formed, interlocking, 0.034-inch- thick, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors.

H. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

I. Fusible Links: Replaceable, 165 deg F rated.

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Air Balance, Inc.
2. METALAIRE, Inc.

3. Nailor Industries Inc.
 4. Prefco Products, Inc.
 5. Ruskin Company.
 6. Pottorff; a division of PCI Industries, Inc.
 7. Safe Air/Dowco, Inc.
- B. General Requirements: Label according to UL 555S by an NRTL.
- C. Frame: Hat-shaped, 0.064-inch- (2.4-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: One-piece airfoil, 0.064-inch- thick, galvanized sheet steel.
- E. Leakage: Class I.
- F. Rated pressure and velocity to exceed design airflow conditions.
- G. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.
- H. Damper Motors: Two-position action.
- I. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 70 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 115 V, single phase, 60 Hz.
- J. Accessories:
1. Auxiliary switches for signaling fire alarm control panel.

2. Test and reset switches, remote mounted.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Air Balance, Inc.
 2. METALAIR, Inc.
 3. Nailor Industries Inc.
 4. Prefco Products, Inc.
 5. Ruskin Company.
 6. Pottorff; a division of PCI Industries, Inc.
 7. Safe Air/Dowco, Inc.
- B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S by an NRTL.
- C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.
- D. Fire Rating: 1-1/2 hour in one and two hour rated walls and 3 hour in three and four hour rated walls.
- E. Heat-Responsive Device: Electric resettable link and switch package, factory installed, rated.
- F. Frame: Hat-shaped, 0.064-inch- (2.4-mm-) thick, galvanized sheet steel, with welded corners and mounting flange.
- G. Blades: One-piece airfoil, 0.064-inch- thick, galvanized sheet steel.
- H. Leakage: Class I.
- I. Rated pressure and velocity to exceed design airflow conditions.
- J. Mounting Sleeve: Factory-installed, 0.052-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone caulking.
- K. Master control panel for use in dynamic smoke-management systems.
- L. Damper Motors: Two-position action.

- M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Division 23 Section "Common Motor Requirements for HVAC Equipment."
1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Division 23 Section "Instrumentation and Control for HVAC." and Division 26 Sections.
 3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
 4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
 5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
 6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
 7. Electrical Connection: 115 V, single phase, 60 Hz.
- N. Accessories:
1. Auxiliary switches for signaling fire alarm control panel.
 2. Test and reset switches, remote mounted.

2.9 FLANGE CONNECTORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Ductmate Industries, Inc.
 2. Nexus PDQ; Division of Shilco Holdings Inc.
 3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.
- B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.10 TURNING VANES

- A. Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible" for vanes and vane runners. Vane runners shall automatically align vanes.
- B. Manufactured Turning Vanes: Fabricate 1-1/2-inch- wide, single-vane, curved blades of galvanized sheet steel set 3/4 inch o.c.; support with bars perpendicular to blades set 2 inches o.c.; and set into vane runners suitable for duct mounting.
 - 1. Available Manufacturers:
 - a. Ductmate Industries, Inc.
 - b. Duro Dyne Corp.
 - c. METALAIRE, Inc.
 - d. Ward Industries, Inc.
- C. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

2.11 REMOTE DAMPER OPERATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff; a division of PCI Industries, Inc.
 - 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, 2 inches deep.
- F. Wall-Box Cover-Plate Material: Stainless steel.

2.12 DUCT-MOUNTED ACCESS DOORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ductmate Industries, Inc.
 - 2. Greenheck Fan Corporation.

3. McGill AirFlow LLC.
 4. Nailor Industries Inc.
 5. Pottorff; a division of PCI Industries, Inc.
 6. 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, "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 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 Square: No hinges and two sash locks.
 - b. Access Doors up to 18 Inches Square: Two hinges and two sash locks.
 - c. Access Doors up to 24 by 48 Inches: Three hinges and two compression latches.
 - d. Access Doors Larger Than 24 by 48 Inches: Four hinges and two compression latches with outside and inside handles.
- C. Pressure Relief Access Door:
1. Door and Frame Material: Galvanized sheet steel.
 2. Door: Double wall with insulation fill with metal thickness applicable for duct pressure class.
 3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
 4. Factory set at 10-inch wg.
 5. Doors close when pressures are within set-point range.
 6. Hinge: Continuous piano.
 7. Latches: Cam.
 8. Seal: Neoprene or foam rubber.
 9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.13 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. Ventfabrics, Inc.
 - 4. 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 wide attached to 2 strips of 2-3/4-inch- wide, 0.028-inch- thick, galvanized sheet steel or 0.032-inch- 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.
 - 2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
 - 3. Service Temperature: Minus 40 to plus 200 deg F.

2.14 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. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.
- C. Insulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
 - 1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
 - 2. Maximum Air Velocity: 4000 fpm.
 - 3. Temperature Range: Minus 10 to plus 160 deg F.

4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

D. 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, to suit duct size.
2. Non-Clamp Connectors: Adhesive.

2.15 DUCT ACCESSORY HARDWARE

- A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct insulation thickness.
- B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 APPLICATION AND 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. Provide 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 backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.
- D. Install volume dampers in ducts with liner; avoid damage to and erosion of duct liner.
- E. Provide balancing dampers at points on supply, return, and exhaust systems where branches lead from larger ducts as required for air balancing. Install at a minimum of two duct widths from branch takeoff.
- F. Provide test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers, with fusible links, according to manufacturer's UL-approved written instructions.

- H. Install duct access doors to allow for inspecting, adjusting, and maintaining accessories and terminal units as follows:
 - 1. On both sides of duct coils.
 - 2. Downstream from volume dampers and equipment.
 - 3. Adjacent to fire or smoke dampers, providing access to reset or reinstall fusible links.
 - 4. To interior of ducts for cleaning; before and after each change in direction, at maximum 50-foot spacing.
 - 5. On sides of ducts where adequate clearance is available.
- I. Install the following sizes for duct-mounting, rectangular access doors:
 - 1. One-Hand or Inspection Access: 8 by 5 inches.
 - 2. Two-Hand Access: 12 by 6 inches.
 - 3. Head and Hand Access: 18 by 10 inches.
 - 4. Head and Shoulders Access: 21 by 14 inches.
 - 5. Body Access: 25 by 14 inches.
 - 6. Body Plus Ladder Access: 25 by 17 inches.
- J. Install the following sizes for duct-mounting, round access doors:
 - 1. One-Hand or Inspection Access: 8 inches in diameter.
 - 2. Two-Hand Access: 10 inches in diameter.
 - 3. Head and Hand Access: 12 inches in diameter.
 - 4. Head and Shoulders Access: 18 inches in diameter.
 - 5. Body Access: 24 inches in diameter.
- K. Label access doors according to Division 15 Section "Mechanical Identification."
- L. Install flexible connectors immediately adjacent to equipment in ducts associated with fans and motorized equipment supported by vibration isolators.
- M. For fans developing static pressures of 5-inch wg and higher, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect terminal units to supply ducts directly.
- O. Connect diffusers or light troffer boots to low pressure ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.
- P. Connect flexible ducts to metal ducts with draw bands.
- Q. Install duct test holes where indicated and required for testing and balancing purposes.

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. Operate fire, smoke, and combination fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.
5. 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 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. Section Includes:
 - 1. Shutoff, single-duct air terminal units.

1.3 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 SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems" and ASCE/SEI 7.

1.4 SUBMITTALS

- A. Product Data: For each type of the following products, including rated capacities, furnished specialties, sound-power ratings, and accessories.
 - 1. Air terminal units.
 - 2. Liners and adhesives.
 - 3. Sealants and gaskets.
 - 4. Seismic-restraint devices.
- B. Shop Drawings: For air terminal units. Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Wiring Diagrams: For power, signal, and control wiring.

3. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
- C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 1. Ceiling suspension assembly members.
 2. Size and location of initial access modules for acoustic tile.
 3. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
- D. Field quality-control reports.
- E. Operation and Maintenance Data: For air terminal units to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:
 1. Instructions for resetting minimum and maximum air volumes.
 2. Instructions for adjusting software set points.

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."

1.6 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fan-Powered-Unit Filters: Furnish one spare filter(s) for each filter installed.

PART 2 - PRODUCTS

2.1 SHUTOFF, SINGLE-DUCT AIR TERMINAL UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Environmental Technologies, Inc.
 2. Krueger.
 3. METALAIRE, Inc.
 4. Nailor Industries Inc.
 5. Phoenix Controls Corporation.
 6. Price Industries.
 7. Titus.
 8. Trane; a business of American Standard Companies.
 9. Johnson Controls Inc.
- B. Configuration: Volume-damper assembly inside unit casing with control components inside a protective metal shroud.
- C. Casing: 0.034-inch steel, double wall.
1. Casing Lining: Adhesive attached, 1-inch- thick, coated, fibrous-glass duct liner complying with ASTM C 1071, 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.
 - a. Cover liner with nonporous foil.
 2. Air Inlet: Round stub connection or S-slip and drive connections for duct attachment.
 3. Air Outlet: S-slip and drive connections.
 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. Regulator Assembly: System-air-powered bellows section incorporating polypropylene bellows for volume regulation and thermostatic control. Bellows shall operate at temperatures from 0 to 140 deg F, shall be impervious to moisture and fungus, shall be suitable for 10-inch wg static pressure, and shall be factory tested for leaks.
- E. Volume Damper: Galvanized steel with peripheral gasket and self-lubricating bearings.
1. Maximum Damper Leakage: ARI 880 rated, 2 percent of nominal airflow at 3-inch wg inlet static pressure.
 2. Damper Position: Normally open.
- F. Hydronic Coils: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch, and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain valve.

- G. Direct Digital Controls: Bidirectional damper operators and microprocessor-based controller and room sensor. Control devices shall be compatible with temperature controls specified in Division 15 Section "HVAC Instrumentation and Controls" and shall have the following features:
1. Damper Actuator: 24 V, powered closed, powered open.
 2. Terminal Unit Controller: Pressure-independent, variable-air-volume controller with electronic airflow transducer with multipoint velocity sensor at air inlet, factory calibrated to minimum and maximum air volumes, and having the following features:
 - a. Remote reset of airflow or temperature set points.
 - b. Adjusting and monitoring with portable terminal.
 3. Room Sensor: Wall mounted with temperature set-point adjustment and access for connection of portable operator terminal.
- H. Control Sequence:
1. Suitable for operation with duct pressures between 0.25- and 3.0-inch wg inlet static pressure.
 2. System-powered, wall-mounted thermostat.

2.2 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.

2.3 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: Reinforcing steel angle clamped 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.

2.4 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 thick.
 - 4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes and for slabs less than 4 inches 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 SMACNA's "Seismic Restraint Manual: Guidelines for Mechanical Systems."
- 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 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. 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 Division 23 Section "Hydronic Piping," 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 Division 15 Section "Metal Ducts."
- D. Make connections to air terminal units with flexible connectors complying with requirements in Division 23 Section "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 Division 15 Section "Identification for HVAC Piping and Equipment" for equipment labels and warning signs and labels.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- 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. 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.

E. Air terminal unit will be considered defective if it does not pass tests and inspections.

F. 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.

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 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. Section Includes:

1. Rectangular and square ceiling diffusers.
2. Louver face diffusers.
3. Linear bar diffusers.
4. Linear slot diffusers.
5. Adjustable bar registers and grilles.
6. Fixed face registers and grilles.
7. Linear bar grilles.

- B. Related Sections:

1. Division 10 Section "Louvers and Vents" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Division 15 Section "Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 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 Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

- C. Samples for Verification: For diffusers, registers, and grilles, in manufacturer's standard sizes to verify color selected.
- D. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Ceiling suspension assembly members.
 - 2. Method of attaching hangers to building structure.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Duct access panels.
- E. Source quality-control reports.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

- A. Louver Face Diffuser:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
 - 2. Material: Aluminum.
 - 3. Finish: Baked enamel, white.
 - 4. Mounting: Surface or T-bar.
 - 5. Pattern: Four-way or Adjustable core style.
 - 6. Dampers: Radial opposed blade.
 - 7. Accessories:
 - a. Square to round neck adaptor.
 - b. Adjustable pattern vanes.
 - c. Throw reducing vanes.
 - d. Equalizing grid.
 - e. Plaster ring.
 - f. Safety chain.

- g. Wire guard.
- h. Sectorizing baffles.
- i. Operating rod extension.

2.2 CEILING LINEAR SLOT OUTLETS

A. Linear Bar Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.
4. Finish: Baked enamel, white.
5. Narrow Core Spacing Arrangement: 3/32-inch- thick blades spaced 1/4 inch apart, 15-degree deflection.
6. Frame: 3/4 inch wide.

B. Linear Slot Diffuser:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
2. Material - Shell: Aluminum, insulated.
3. Material - Pattern Controller and Tees: Aluminum.
4. Finish - Face and Shell: Baked enamel, black.
5. Finish - Pattern Controller: Baked enamel, black.
6. Finish - Tees: Baked enamel, white.
7. Slot Width: See Equipment Schedule.
8. Number of Slots: See Equipment Schedule.
9. Length: 48 inches.

2.3 REGISTERS AND GRILLES

A. Adjustable Bar Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Horizontal spaced 3/4 inches apart.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Vertical spaced 3/4 inches wide.
7. Frame: 1-1/4 inches wide.
8. Mounting: Concealed or Lay in.
9. Damper Type: Adjustable opposed blade.
10. Accessories:
 - a. Rear-blade gang operator.
 - b. Filter.

B. Adjustable Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. METALAIRE, Inc.
 - d. Nailor Industries Inc.
 - e. Price Industries.
 - f. Titus.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
5. Core Construction: Removable.
6. Rear-Blade Arrangement: Vertical spaced 3/4 inch apart.
7. Frame: 1-1/4 inches wide.
8. Mounting: Concealed or Lay in.

C. Fixed Face Register:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. Nailor Industries Inc.
 - d. Price Industries.
 - e. Titus.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
5. Core Construction: Removable.
6. Frame: 1-1/4 inches wide.
7. Mounting: Concealed or Lay in.
8. Damper Type: Adjustable opposed blade.
9. Accessory: Filter.

D. Fixed Face Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. Nailor Industries Inc.
 - d. Price Industries.
 - e. Titus.
2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
5. Core Construction: Removable.
6. Frame: 1-1/4 inches wide.
7. Mounting: Concealed or Lay in.
8. Accessory: Filter.

E. Linear Bar Grille:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carnes.
 - b. Krueger.
 - c. METALAIR, Inc.

- d. Nailor Industries Inc.
- e. Price Industries.
- f. Titus.
- 2. Material: Aluminum.
- 3. Finish: Baked enamel, white.
- 4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
- 5. Distribution plenum.
 - a. Internal insulation.
 - b. Inlet damper.
- 6. Frame: 1-1/4 inches wide.
- 7. Mounting: Concealed or Lay in.
- 8. Damper Type: Adjustable opposed blade.

2.4 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 EXAMINATION

- A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 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.

3.3 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 260519 - 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. Copper building wire rated 600 V or less.
 - 2. Health Care Facilities Metal-clad cable, Type HCFMC, rated 600 V or less.
 - 3. Connectors, splices, and terminations rated 600 V and less.
- B. Related Requirements:
 - 1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.
 - 2. Section 271313 "Communications Copper Backbone Cabling" for twisted pair cabling used for data circuits.
 - 3. Section 271513 "Communications Copper Horizontal Cabling" for twisted pair cabling used for data circuits.

1.3 DEFINITIONS

- A. PV: Photovoltaic.
- B. RoHS: Restriction of Hazardous Substances.
- C. VFC: Variable-frequency controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency and manufacturer's authorized service representative.
- B. Field quality-control reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Acceptable manufacturers are:

1. Alcan Products Corporation-Alcan Cable Division
2. American Insulated Wire Corp. A Leviton Company
3. General Cable Technologies Corporation
4. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 496 for stranded conductors.

E. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

F. Shield:

2.2 ALUMINUM BUILDING WIRE

A. Description: Flexible, insulated and uninsulated, drawn aluminum current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Aluminum conductors are allowed for use on circuit 200 amperes and greater and is not allowed for any circuits less than 200 amperes which shall be copper only.

C. Acceptable manufacturers are:

1. Alcan Products Corporation-Alcan Cable Division

2. American Insulated Wire Corp. A Leviton Company
3. General Cable Technologies Corporation
4. Southwire Company

D. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. RoHS compliant.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

E. Conductors: Aluminum, complying with ASTM B 800 and ASTM B 801.

F. Conductor Insulation:

1. Type THHN and Type THWN-2: Comply with UL 83.

2.3 HEALTH CARE FACILITIES METAL-CLAD CABLE, TYPE HCFMC

A. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

B. Acceptable manufacturers are:

1. Alcan Products Corporation-Alcan Cable Division
2. American Insulated Wire Corp. A Leviton Company
3. General Cable Technologies Corporation
4. Southwire Company

C. Standards:

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. RoHS compliant.
4. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:

1. Single circuit and multi-circuit with color-coded conductors.

E. Conductors: Copper, complying with ASTM B 3 for bare annealed copper and with ASTM B 8 for stranded conductors.

F. Ground Conductors: Bare conductor between the outer shield and the conductors wrapping. Insulated conductors with the phase and neutral conductors.

G. Conductor Insulation:

- 1. Type TFN/THHN/THWN-2: Comply with UL 83.
- H. Armor: Aluminum, interlocked.
- I. Jacket: PVC applied over armor.

2.4 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Acceptable manufacturers:
 - 1. 3M Electrical Products.
 - 2. O-Z/Gedney; Aa brand of Emerson Industrial Automation.
 - 3. Tyco Electronics Corp.
- C. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.
- D. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
 - 1. Material: Copper for all circuits less than 200 amperes and Aluminum for circuits 200 amperes and greater.
 - 2. Type: One hole with standard barrel unless the connection requires long barrels.
 - 3. Termination: Compression.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper for feeders on circuits smaller than 200 ampere and copper for circuits less than 200 amperes. Conductors shall be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. VFC Output Circuits Cable: Extra-flexible stranded for all sizes.
- D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

3.2 CONDUCTOR INSULATION AND HEALTH CARE FACILITIES MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Branch Circuits: Type THHN/THWN-2, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway in ceilings, Health Care Facilities Metal-clad cable, Type HCFMC is allowed for installation in wall cavities for normal power circuits only.
- D. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- E. VFC Output Circuits: Type XHHW-2 in metal conduit.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- B. 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.
- C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

3.4 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. Splices shall be kept to a minimum and all splices shall be installed in an readably accessible junction code sized junction box.
 - 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.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 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 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 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 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.
 - 2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) A low-resistance ohmmeter.
 - 2) Calibrated torque wrench.
 - 3) Thermographic survey.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable for a one-minute duration.

- g. Continuity test on each conductor and cable.
 - h. Uniform resistance of parallel conductors.
- 3. NFPA 99 requires testing of the grounding in each patient care space to assure the grounding and integrity of the installed conductors. See the grounding specification section for additional information concerning this testing.
- 4. Initial Infrared Scanning: After Substantial Completion, but before 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. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
 - b. Record of Infrared Scanning: Prepare a certified report that identifies switches checked and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.
- 5. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each switch 11 months after date of Substantial Completion.
- C. Conductors and HFCMC cables will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports 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.

END OF SECTION 260519

SECTION 260526 - 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.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Grounding arrangements and connections for separately derived systems.
- B. Qualification Data: For testing agency and testing agency's field supervisor.
- C. 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 017823 "Operation and Maintenance Data," include the following:
 - a. Plans showing as-built, dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1) Grounding arrangements and connections for separately derived systems.
 - b. Instructions for periodic testing and inspection of grounding features at rounding connections for separately derived systems.

- 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. Testing Agency Qualifications: Certified by NETA.

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 ACCEPTABLE MANUFACTURERS:

1. Cooper Industries -Cooper power Systems Division.
2. Copper Weld Bimetalics, LLC.
3. ERICO International Corporation.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 1. Solid Conductors: ASTM B 3.
 2. Stranded Conductors: ASTM B 8.
 3. Tinned Conductors: ASTM B 33.
 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch (6 mm) in diameter.
 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
 7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches (41 mm) wide and 1/16 inch (1.6 mm) thick.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inches (6.3 by 100 mm) by 24 inches 600 mm length 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. Grounding bus shall be provided in each telecommunications room and in each electrical room.

2.4 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. Bus-Bar Connectors: Compression type, copper or copper alloy, with two wire terminals.
- C. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- D. Cable-to-Cable Connectors: Compression type, copper or copper alloy.
- E. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- F. Conduit Hubs: Mechanical type, terminal with threaded hub.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Grounding Bus: Install in electrical equipment rooms and telecommunications rooms, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2 inches (50 mm) minimum from wall, 24 inches (600 mm) above finished floor unless otherwise indicated.
- C. Conductor Terminations and Connections:
 - 1. All panel boards providing electrical service to patient care spaces shall have their grounding buses interconnected and shall be connected to the ground bus in every electrical room.
 - 2. The grounding in telecommunications rooms shall serve for telecommunications equipment and cabling grounding in accordance with BICSI and telecommunications as required by NFPA 70, NFPA 99 and other regulations as required by those regulations.
 - 3. Connections to building structural steel in electrical rooms for all stepdown transformers.

3.2 GROUNDING SEPARATELY DERIVED SYSTEMS

- A. Stepdown transformers: Grounding for every stepdown transformer shall be to the room ground bus and to building structural steel. See grounding detail on contract drawings.

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. 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: Cables: Install a separate insulated equipment grounding conductor to each electric water heater. Bond conductor to heater units, piping, connected equipment, and components.
- E. 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.

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. Grounding and Bonding for Piping:

1. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.
- C. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. 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 to assure compliance with NFPA70 and in accordance with NFPA 99 for all patient care spaces. NFPA 99 Chapter 6 article 6.3.3 "Performance Criteria and Testing" provides the necessary testing requirements. Results of the NFPA 99 testing shall be submitted to the Architect for review and acceptance before patient care spaces are placed into use. All patient care spaces tested that do not comply with NFPA 99 Chapter 6 and in specific section 6.3.3 "Performance Criteria and Testing" and shall have corrective action taken by the contractor at the contractor's expense and time to correct the issue. Once the issue or issues are corrected the system shall be retested to show new results that are in compliance with all of Chapter 6 of 2018 edition of NFPA 99.
- C. Grounding system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

END OF SECTION 260526

SECTION 260529 - 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. Steel slotted support systems.
2. Aluminum slotted support systems.
3. Nonmetallic slotted support systems.
4. Conduit and cable support devices.
5. Support for conductors in vertical conduit.
6. Structural steel for fabricated supports and restraints.
7. Mounting, anchoring, and attachment components, including powder-actuated fasteners, mechanical expansion anchors, concrete inserts, clamps, through bolts, toggle bolts, and hanger rods.
8. Fabricated metal equipment support assemblies.

- 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. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Sockets.
 - e. Eye nuts.
 - f. Fasteners.
 - g. Anchors.
 - h. Saddles.

- i. Brackets.
- 2. Include rated capacities and furnished specialties and accessories.
- B. Shop Drawings: Signed and sealed by a qualified licensed professional engineer. For fabrication and installation details for electrical hangers and support systems.
 - 1. Hangers. Include product data for components.
 - 2. Slotted support systems.
 - 3. Equipment supports.
 - 4. 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 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 minimum scale shall be ¼ inch equals 1 foot 0 inches, 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. Ductwork, piping, fittings, and supports.
 - 3. Structural members to which hangers and supports will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:
 - a. Luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Projectors.
 - g. Fire alarm system smoke and heat detectors.
- B. Seismic Qualification Data: 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 the following:
 - 1. AWS D1.1/D1.1M.
 - 2. AWS D1.2/D1.2M.

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 supported equipment and systems 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: Preformed steel channels and angles with minimum **13/32-inch- (10-mm-)** diameter holes at a maximum of **8 inches (200 mm)** o.c. in at least one surface.
 - 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 - 2. Material for Channel, Fittings, and Accessories: Galvanized steel.
 - 3. Channel Width: Selected for applicable load criteria.
 - 4. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- 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 nonarmored electrical conductors or cables 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 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, zinc-coated 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. Toggle Bolts: All-steel springhead type.
 - 7. Hanger Rods: Threaded steel manufactured and rated for load capacity by the manufacturer.

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 055000 "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with the following standards for application and installation requirements of hangers and supports, except where requirements on Drawings or in this Section are stricter:
 - 1. NECA 1.

2. NECA 101

- B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
- C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, and RMC as required by NFPA 70. Minimum rod size shall be **1/4 inch (6 mm)** in diameter.
- E. Multiple Raceways or Cables: 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 to supports with two-bolt conduit clamps.
- F. 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, EMT and RMC may be supported by openings through structure members, according to NFPA 70.
- C. 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)**.
- D. 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 slotted-channel racks attached to substrate by means that comply with seismic-restraint strength and anchorage requirements.

- E. 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 033053 "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 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 zinc rich galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 260529

SECTION 260533 - 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 and fittings.
 - 2. Metal wireways and auxiliary gutters.
 - 3. Surface raceways.
 - 4. Boxes, enclosures, and cabinets.

- B. Related Requirements:

- 1. Section 078413 "Penetration Firestopping" for firestopping at conduit and box entrances.
 - 2. Section 270528 "Pathways for Communications Systems" for conduits, wireways, surface pathways, innerduct, boxes, faceplate adapters, enclosures, cabinets, and handholes serving communications systems.

1.3 DEFINITIONS

- A. GRC: Galvanized rigid steel conduit.

1.4 ACTION SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, and attachment details.
- C. Samples: For wireways and surface 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 minimum scale shall be $\frac{1}{4}$ inch equals 1 foot 0 inches, 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 Data: 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 AND FITTINGS

- A. Metal Conduit:
 - 1. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. GRC: Comply with ANSI C80.1 and UL 6.
 - 3. EMT: Comply with ANSI C80.3 and UL 797.
 - 4. FMC: Comply with UL 1; zinc-coated steel.
 - 5. LFMC: Flexible steel conduit with PVC jacket and complying with UL 360.
- B. Metal Fittings:
 - 1. Comply with NEMA FB 1 and UL 514B.
 - 2. Listing and Labeling: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 3. Fittings, General: Listed and labeled for type of conduit, location, and use.
 - 4. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 1203 and NFPA 70.
 - 5. Fittings for EMT:

- a. Material: Steel.
 - b. Type: Setscrew.
- 6. Expansion Fittings: Steel to match conduit type, complying with UL 651, rated for environmental conditions where installed, and including flexible external bonding jumper.
- C. Joint Compound for GRC: 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 METAL WIREWAYS AND AUXILIARY GUTTERS

- A. Description: Sheet metal, complying with UL 870 and NEMA 250, Type 1 for indoor use and Type 3R for outdoor use 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: Screw-cover type flanged-and-gasketed type unless otherwise indicated.
- D. Finish: Manufacturer's standard enamel finish.

2.3 SURFACE RACEWAYS

- A. Listing and Labeling: Surface 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: Galvanized steel with snap-on covers complying with UL 5. Manufacturer's standard enamel finish in color selected by Architect.

2.4 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, ferrous alloy, Type FD, with gasketed cover.
- D. 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.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Box extensions used to accommodate new building finishes shall be of same material as recessed box.
- G. Device Box Dimensions: 4 inches square by 2-1/8 inches deep (100 mm square by 60 mm deep).
- H. Gangable boxes are prohibited.
- I. Hinged-Cover Enclosures: Comply with UL 50 and NEMA 250, Type 1 with continuous-hinge cover with flush latch unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
 - 2. Interior Panels: Steel; all sides finished with manufacturer's standard enamel.
- J. Cabinets:
 - 1. NEMA 250, Type 1 galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below unless otherwise indicated:
 - 1. Exposed Conduit: GRC.
 - 2. Concealed Conduit, Aboveground: GRC.
 - 3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 4. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- 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: GRC.
 3. Exposed and Subject to Severe Physical Damage: **GRC**. Raceway locations include the following:
 - a. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: EMT for all emergency power circuits and EMT above ceilings for normal power circuits and in walls and partitions with the exception of where on normal power the contractor selects to use HCFMC only in walls and partitions for normal power only. HCFMC is not allowed for installation above ceilings.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: GRC.
 7. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4 in institutional and commercial kitchens and damp or wet locations.
- 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 Steel Conduit: Use threaded rigid steel conduit fittings unless otherwise indicated. Comply with NEMA FB 2.10.
 2. EMT: Use setscrew, 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 surface raceways only where indicated on Drawings.

3.2 INSTALLATION

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
- B. Comply with NECA 1 and NECA 101 for installation requirements except where requirements on Drawings or in this article are stricter. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
- C. Do not install raceways or electrical items on any "explosion-relief" walls or rotating equipment.
- D. Do not fasten conduits onto the bottom side of a metal deck roof.
- E. 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.
- F. Complete raceway installation before starting conductor installation.

- G. Arrange stub-ups so curved portions of bends are not visible above finished slab.
- H. 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.
- I. Make bends in raceway using large-radius preformed ells. Field bending shall be according to NFPA 70 minimum radii requirements. Use only equipment specifically designed for material and size involved.
- J. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
- K. Support conduit within 12 inches (300 mm) of enclosures to which attached.
- L. Stub-Ups to Above Recessed Ceilings:
 - 1. Use EMT for raceways.
 - 2. Use a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- M. 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.
- 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. Conduit extending from interior to exterior of building.
 3. Conduit extending into pressurized duct and equipment.
 4. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 5. Where otherwise required by NFPA 70.
- W. Expansion-Joint Fittings:
1. Install in each run of aboveground RMC and EMT conduit that is located where environmental temperature change may exceed 100 deg F (55 deg C) and that has straight-run length that exceeds 100 feet (30 m).
 2. Install type and quantity of fittings that accommodate temperature change listed for each of the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F (70 deg C) temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F (86 deg C) temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F (70 deg C) temperature change.
 3. Install expansion fittings at all locations where conduits cross building or structure expansion joints.
 4. 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.
- X. Flexible Conduit Connections: Comply with NEMA RV 3. Use a maximum of 72 inches (1830 mm) of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.

1. Use LFMC in damp or wet locations.
 - Y. 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 top of box unless otherwise indicated.
 - Z. 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.
 - AA. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.
 - BB. Locate boxes so that cover or plate will not span different building finishes.
 - CC. Support boxes of two or more from more than one side by spanning two framing members or mounting on brackets specifically designed for the purpose.
 - DD. Fasten junction and pull boxes to or support from building structure. Do not support boxes by conduits.
- 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 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."
- 3.4 FIRESTOPPING
- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."
- 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.

END OF SECTION 260533

SECTION 260544 - 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 078413 "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.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Wall Sleeves:
 - 1. 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.

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

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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 260544

SECTION 260548.16 - 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 260529 "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 agency acceptable to authorities having jurisdiction.
 - 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 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.
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 agency acceptable to authorities having jurisdiction, 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. Electrical components include:
 1. Control and monitoring panels.
 2. Luminaires.
 3. Panelboards.
 4. Switchboards.
 5. Transformers.
- B. Qualification Data: For professional engineer and testing agency.
- C. Welding certificates.
- D. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated and that is acceptable to authorities having jurisdiction.
- B. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."
- D. Seismic-restraint devices shall have horizontal and vertical load testing and analysis. They shall bear anchorage preapproval from OSHPD in addition to 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.
- E. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Wind-Restraint Loading:
 - 1. Building Classification Category: See structural drawings.
 - 2. Minimum 10 lb/sq. ft. (48.8 kg/sq. m) multiplied by maximum area of component projected on vertical plane normal to wind direction and 45 degrees either side of normal.
- B. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC: See structural drawings.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC: See structural drawings.
 - a. Component Importance Factor: See structural drawings
 - b. Component Response Modification Factor: See structural drawings.
 - c. Component Amplification Factor: See structural drawings.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second): See structural drawings.
 - 4. Design Spectral Response Acceleration at 1.0-Second Period: See structural drawings.

2.2 RESTRAINT CHANNEL BRACINGS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. 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. Acceptable manufacturers are:
 - 1. Amber/Booth Company, Inc.
 - 2. Cooper B-Line, Inc.
 - 3. Hilti, Inc.
- B. Restraint Cables: ASTM A 603 galvanized-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. Acceptable manufacturers are:
 - 1. Amber/Booth Company, Inc.
 - 2. Cooper B-Line, Inc.
 - 3. Hilti, Inc.
- B. Hanger-Rod Stiffener: Reinforcing steel angle clamped to hanger rod.
- C. Hinged and Swivel Brace Attachments: Multifunctional steel connectors for attaching hangers to rigid channel bracings and restraint cables.
- D. 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.
- E. 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.
- F. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

2.5 MECHANICAL ANCHOR BOLTS

- A. Acceptable manufacturers are:
 - 1. Amber/Booth Company, Inc.
 - 2. Cooper B-Line, Inc.
 - 3. Hilti, Inc.
- B. 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. Acceptable manufacturers are:

1. Amber/Booth Company, Inc.
 2. Cooper B-Line, Inc.
 3. Hilti, Inc.
- B. 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 033053 "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, and cable trays 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. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

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 post connection 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.
- C. Seismic controls will be considered defective if they do not pass tests and inspections.
- D. 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 260548.16

SECTION 260553 - 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. Color and legend requirements for raceways, conductors, and warning labels and signs.
 - 2. Labels.
 - 3. Bands and tubes.
 - 4. Tapes and stencils.
 - 5. Tags.
 - 6. Signs.
 - 7. Cable ties.
 - 8. Paint for identification.
 - 9. Fasteners for labels and signs.

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. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.
- G. 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. Raceways and Cables Carrying Circuits at 600 V or Less:
 - 1. Black letters on an orange field.
 - 2. Legend: Indicate voltage and system or service type.
- B. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded feeder and branch-circuit conductors.
 - 1. Color shall be factory applied.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 240-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - 4. Colors for 480/277-V Circuits:

- a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
- 5. Color for Neutral: White.
- 6. Color for Equipment Grounds: Green.
- C. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- D. 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 36 INCHES (915 MM)."
- E. Equipment Identification Labels:
 - 1. Black letters on a white field for normal power equipment.
 - 2. Red letters on a white field for essential power equipment.

2.3 LABELS

- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil- (0.08-mm-) thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Acceptable manufacturers:
 - a. Brady Corporation
 - b. Carlton Industries, Inc.
 - c. Ideal Industries, Inc.
 - 2. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.

2.4 SIGNS

- A. Metal-Backed Butyrate Signs:
 - 1. Acceptable manufacturers:
 - a. Brady Corporation
 - b. Carlton Industries, Inc.
 - c. Ideal Industries, Inc.

2. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs, with 0.0396-inch (1-mm) galvanized-steel backing, punched and drilled for fasteners, and with colors, legend, and size required for application.
3. 1/4-inch (6.4-mm) grommets in corners for mounting.
4. Nominal Size: 10 by 14 inches (250 by 360 mm).

2.5 CABLE TIES

Acceptable manufacturers:

- a. Brady Corporation
 - b. Carlton Industries, Inc.
 - c. Ideal Industries, Inc.
- B. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black, except where used for color-coding.
- C. UV-Stabilized Cable Ties: Fungus inert, designed for continuous exposure to exterior sunlight, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.
1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 12,000 psi (82.7 MPa).
 3. Temperature Range: Minus 40 to plus 185 deg F (Minus 40 to plus 85 deg C).
 4. Color: Black.
- D. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.
1. Minimum Width: 3/16 inch (5 mm).
 2. Tensile Strength at 73 Deg F (23 Deg C) according to ASTM D 638: 7000 psi (48.2 MPa).
 3. UL 94 Flame Rating: 94V-0.
 4. Temperature Range: Minus 50 to plus 284 deg F (Minus 46 to plus 140 deg C).
 5. Color: Black.

2.6 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. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
- H. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- I. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
- J. Vinyl Wraparound Labels:

1. Secure tight to surface of raceway or cable at a location with high visibility and accessibility.
 2. Attach labels that are not self-adhesive type with clear vinyl tape, with adhesive appropriate to the location and substrate.
- K. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.
- L. Self-Adhesive Labels:
1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 2. 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.
- M. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.
- O. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- P. Metal-Backed Butyrate Signs:
1. Attach signs that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
 2. 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 sign; where two lines of text are required, use labels 2 inches (50 mm) high.
- Q. Cable Ties: General purpose, for attaching tags, except as listed below:
1. Outdoors: UV-stabilized nylon.
 2. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. 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.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

- C. Accessible Raceways and Health Care Facilities Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than 30 and 120 V or more to Ground: Identify with self-adhesive vinyl tape applied in bands.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 25-foot (7.6-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- D. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self-adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
 - 2. "POWER."
- E. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use vinyl wraparound labels to identify the phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 25-foot (7.6-m) maximum intervals in straight runs, and at 25-foot (7.6-m) maximum intervals in congested areas.
- F. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- G. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- H. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source.
- I. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- J. Workspace Indication: Apply **floor marking tape or tape and stencil** to finished surfaces only in electrical rooms and unfinished spaces not in public spaces. 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.
- K. Instructional Signs: Self-adhesive labels, including the color code for grounded and ungrounded conductors.

- L. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Metal-backed, butyrate warning signs.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Controls with external control power connections.
- M. Arc Flash Warning Labeling: Self-adhesive labels.
- N. Operating Instruction Signs: Metal-backed, butyrate warning signs.
- O. Equipment Identification Labels:
 - 1. Indoor Equipment: Metal-backed butyrate signs.
 - 2. Outdoor Equipment: Metal-backed butyrate signs 4 inches (100 mm) high.
 - 3. Equipment to Be Labeled:
 - a. Panelboards: Panel board directories shall be in Excel format using a program that will be provided to the contractor at the award of the contract. Excel produced panel board directory shall be installed in every panel board. A digital copy of the completed Excel spread sheet shall be provide to the owner in the close out documents. Panelboard identification shall be in the form of an engraved, laminated acrylic or melamine label.
 - b. Enclosures and electrical cabinets.
 - c. Access doors and panels for concealed electrical items.
 - d. Switchboards.
 - e. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
 - f. Emergency system boxes and enclosures.
 - g. Enclosed switches.
 - h. Enclosed circuit breakers.
 - i. Enclosed controllers.
 - j. Variable-speed controllers.
 - k. Push-button stations.
 - l. Contactors.
 - m. Remote-controlled switches, dimmer modules, and control devices.
 - n. Battery-inverter units.
 - o. Battery racks.
 - p. Monitoring and control equipment.
 - q. UPS equipment.

END OF SECTION 260553

SECTION 260573.13 - SHORT-CIRCUIT STUDIES

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. This project is for the build out of an empty floor in an existing building and the majority of the electrical system is existing. This study requires the total electrical system analysis including the total power system for the bed tower.

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 and salvaged, or removed and reinstalled. Existing to remain items shall remain functional throughout the construction period.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that 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.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- G. SCCR: Short-circuit current rating.
- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form in addition to printed form.
 - a. Short-circuit study input data, including completed computer program input data sheets.
 - b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
 - 1) Submit study report for action prior to receiving final approval of 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 selection of devices and associated characteristics is satisfactory.
 - 2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

- B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
2. The following are from the Short-Circuit Study Report:
 - a. Final one-line diagram.
 - b. Final Short-Circuit Study Report.
 - c. Short-circuit study data files.
 - d. Power system data.

1.7 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
 - 1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- D. Power Systems Analysis Specialist Qualifications: Professional engineer 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.
- E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- F. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Acceptable manufacturers:
 - 1. EDSA Micro Corporation
 - 2. ESA Inc.
 - 3. SKM Systems Analysis, Inc.
- B. Comply with IEEE 399 and IEEE 551.
 - 1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, 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 and ratings.
 - 6. Derating factors and environmental conditions.
 - 7. Any revisions to electrical equipment required by the study.
- D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.
- E. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to available short-circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 - 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 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:
 - 1. One-line diagram of system being studied.
 - 2. Power sources available.
 - 3. Manufacturer, model, and interrupting rating of protective devices.
 - 4. Conductors.
 - 5. Transformer data.
- G. Short-Circuit Study Output Reports:
 - 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 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the study.
 1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
 3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.
- B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line

diagram. 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 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-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:

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. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

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 device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 2. Include 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. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- H. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 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.
- I. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 260573.13

SECTION 260573.16 - COORDINATION STUDIES

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. This project is for the build out of an empty floor in an existing building with the majority of the electrical system is existing. This study requires the total electrical system analysis including the total power system for the bed tower.
 - 1. Study results shall be used to determine coordination of series-rated 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. Existing to remain items shall remain functional throughout the construction period.
- B. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that 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.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- G. SCCR: Short-circuit current rating.

- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.
 - 2. Submit the following after the approval of system protective devices submittals. Submittals may be in digital form in addition to printed form.
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. 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 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 selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power System Analysis Software Developer.
 - 2. For Power Systems Analysis Specialist.
 - 3. For 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 overcurrent protective devices to include in emergency, operation, and maintenance manuals.
 - 1. The following are from the Coordination Study Report:
 - a. Final one-line diagram.
 - b. Final protective device coordination study.
 - c. Coordination study data files.

- d. List of all protective device settings.
- e. Time-current coordination curves.
- f. Power system data.

1.7 QUALITY ASSURANCE

- A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications:
 - 1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer 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.
- F. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Acceptable manufacturers:
 - 1. EDSA Micro Corporation
 - 2. ESA Inc.
 - 3. 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 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, 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.
 - 6. Any revisions to electrical equipment required by the study.
 - 7. Study Input Data: As described in "Power System Data" Article.
 - a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- D. 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, and 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.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. 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. Maintain selectivity for tripping currents caused by overloads.
 - 6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
 - 7. Provide adequate time margins between device characteristics such that selective operation is achieved.
 - 8. 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 of the Work. 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 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the overcurrent protective device study.
 - 1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
 - 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
 - 3. For equipment that is existing to remain, obtain required electrical distribution system data by field investigation and surveys, conducted by qualified technicians and engineers. Qualifications of technicians and engineers shall be as defined by NFPA 70E.
- B. Gather and tabulate all required input data to support the coordination study. 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 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-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
 - 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, size, 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, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
17. Data sheets to supplement electrical distribution system one-line 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 root mean square (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. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
 - k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 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. Base study on device characteristics supplied by device manufacturer.
- D. Extent of electrical power system to be studied is indicated on Drawings.
- E. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
 - 2. Include 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. Motor Protection:
 - 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 - 2. Select protection for motors served at voltages more than 600 V according to IEEE 620.
- I. 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.

- J. Generator Protection: Select protection according to manufacturer's written instructions and to IEEE 242.
- K. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.
- L. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 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.
- M. 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. Include in the report identification of any protective device applied outside its capacity.

3.4 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 load buses.
 - 3. Prepare 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.

3.5 MOTOR-STARTING STUDY

- A. Perform a motor-starting study to analyze the transient effect of system's voltage profile during motor starting. Calculate significant motor-starting voltage profiles and analyze the effects of motor starting on the power system stability.
- B. Prepare the motor-starting study report, noting light flicker for limits proposed by IEEE 141 and voltage sags so as not to affect operation of other utilization equipment on system supplying the motor.

3.6 FIELD ADJUSTING

- A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of 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-Certified Technician Level III or NICET Electrical Power Testing Level III certification.
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.7 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
 - 1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
 - 2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
 - 3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 260573.16

SECTION 260573.19 - ARC-FLASH HAZARD ANALYSIS

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, 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. This project is for the build out of an empty floor in an existing bed tower. The majority of the electrical system is existing. This study requires the total electrical system analysis including the power system for the bed tower.

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. Field Adjusting Agency: An independent electrical testing agency with full-time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- C. One-Line Diagram: A diagram that 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.
- D. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- E. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- F. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- G. SCCR: Short-circuit current rating.

- H. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- I. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals may be in digital form in addition to printed form.
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
 - 3. Submit study report for action prior to receiving final approval of 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 selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
 - 2. 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.

1.7 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software 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. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash 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.
- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- G. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Acceptable manufacturers:
 - 1. EDSA Micro Corporation
 - 2. ESA Inc.
 - 3. 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 of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.
- D. Study Input Data: As described in "Power System Data" Article.
- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- G. Arc-Flash Study Output Reports:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
 - 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. Restricted approach boundary.
 6. Limited approach boundary.
 7. Working distance.
 8. Incident energy.
 9. Hazard risk category.
 10. 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 computer printout.

2.3 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch (76-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
- B. 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. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 4. Arc flash PPE category.
 5. Required minimum arc rating of PPE in Cal/cm squared.
 6. Available incident energy.
 7. Working distance.
 8. 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: Perform the Short-Circuit and Protective Device Coordination prior to starting the Arc-Flash Hazard Analysis.
 - 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
 - 2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."
- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 - 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
 - 3. Calculate arc-flash energy at 38 percent of maximum short-circuit current according to NFPA 70E recommendations.
 - 4. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.
- D. Calculate the arc-flash protection boundary and incident energy at locations in 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. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- 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 shall not be considered beyond three to five cycles.
 - 2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for 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 conduct of the arc-flash hazard analysis.
 1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
 2. For new equipment, use characteristics from approved submittals under 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-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
 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 or available short circuit current 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. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
13. Motor horsepower and NEMA MG 1 code letter designation.
14. Low-voltage conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
15. Medium-voltage conductor sizes, lengths, conductor material, conductor construction and metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).

3.4 LABELING

- A. Apply one arc-flash label on the front cover of each section of the equipment and on side or rear covers with accessible live parts and hinged doors or removable plates for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
 1. Motor-control center.
 2. Low-voltage switchboard.
 3. Switchgear.
 4. Medium-voltage switch.
 5. Medium voltage transformers
 6. Low voltage transformers
 7. Panelboard and safety switch over 250 V.
 8. Applicable panelboard and safety switch under 250 V.
 9. Control panel.
- C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
 1. Indicate arc-flash energy.
 2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 260573.19

SECTION 262200 - LOW-VOLTAGE TRANSFORMERS

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: **[Distribution] [and] [buck-boost]**, dry-type transformers rated 600 V and less, with capacities up to 1500 kVA.

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 each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 2. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For transformers, 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.

- B. Qualification Data: For testing agency.
- C. Source quality-control reports.
- D. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- 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. Transformers Rated 15 kVA and Larger: Comply with NEMA TP 1 energy-efficiency levels as verified by testing according to NEMA TP 2.
- D. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
- E. Coils: Continuous windings without splices except for taps.
 - 1. Internal Coil Connections: Brazed or pressure type.
 - 2. Coil Material: **[Aluminum] [Copper]**.
- F. Encapsulation: Transformers smaller than 30 kVA shall have core and coils completely resin encapsulated.
- G. Shipping Restraints: Paint or otherwise color code bolts, wedges, blocks, and other restraints that are to be removed after installation and before energizing. Use fluorescent colors that are easily identifiable inside the transformer enclosure.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with NFPA 70, and list and label as complying with UL 1561.
- B. Provide transformers that are constructed to withstand seismic forces specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- C. Cores: One leg per phase.
- D. Enclosure: **[Ventilated] [Totally enclosed, nonventilated]**.
 - 1. NEMA 250, **[Type 2] [Type 3R] [Type 4X, Stainless Steel]**: Core and coil shall be encapsulated within resin compound **[utilizing a vacuum pressure impregnation process]** to seal out moisture and air.
 - 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
- E. Enclosure: **[Ventilated] [Totally enclosed, nonventilated]**.
 - 1. NEMA 250, **[Type 3R] [Type 4X, Stainless Steel]**: Core and coil shall be encapsulated within resin compound, sealing out moisture and air.
- F. Transformer Enclosure Finish: Comply with NEMA 250.
 - 1. Finish Color: **[Gray] [NSF/ANSI 49 gray] [NSF/ANSI 61 gray]**.
- G. Taps for Transformers 3 kVA and Smaller: **[None] [One 5 percent tap above normal full capacity]**.
- H. Taps for Transformers 7.5 to 24 kVA: **[One 5 percent tap above and one 5 percent tap below normal full capacity] [Two 5 percent taps below rated voltage]**.

- I. Taps for Transformers 25 kVA and Larger: **[Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity] [Two 2.5 percent taps above and four 2.5 percent taps below normal full capacity]**.
- J. Insulation Class, Smaller than 30 kVA: 185 deg C, UL-component-recognized insulation system with a maximum of 115-deg C rise above 40-deg C ambient temperature.
- K. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of **[150] [115] [80]**-deg C rise above 40-deg C ambient temperature.
- L. K-Factor Rating: Transformers indicated to be K-factor rated shall comply with UL 1561 requirements for nonsinusoidal load current-handling capability to the degree defined by designated K-factor.
 - 1. Unit shall not overheat when carrying full-load current with harmonic distortion corresponding to designated K-factor.
 - 2. Indicate value of K-factor on transformer nameplate.
 - 3. Unit shall meet requirements of NEMA TP 1 when tested according to NEMA TP 2 with a K-factor equal to one.
- M. Electrostatic Shielding: Each winding shall have an independent, single, full-width copper electrostatic shield arranged to minimize interwinding capacitance.
 - 1. Arrange coil leads and terminal strips to minimize capacitive coupling between input and output terminals.
 - 2. Include special terminal for grounding the shield.
- N. Neutral: Rated 200 percent of full load current for K-factor rated transformers.
- O. Wall Brackets: **[Manufacturer's standard brackets] [Wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer]**.
- P. Fungus Proofing: Permanent fungicidal treatment for coil and core.
- Q. Low-Sound-Level Requirements: Maximum sound levels when factory tested according to IEEE C57.12.91, as follows:
 - 1. 9 kVA and Less: **<Insert dBA>**.
 - 2. 30 to 50 kVA: **<Insert dBA>**.
 - 3. 51 to 150 kVA: **<Insert dBA>**.
 - 4. 151 to 300 kVA: **<Insert dBA>**.
 - 5. 301 to 500 kVA: **<Insert dBA>**.
 - 6. 501 to 750 kVA: **<Insert dBA>**.
 - 7. 751 to 1000 kVA: **<Insert dBA>**.
 - 8. 1001 to 1500 kVA: **<Insert dBA>**.

2.4 BUCK-BOOST TRANSFORMERS

- A. Description: Self-cooled, two-winding dry type, rated for continuous duty and with wiring terminals suitable for connection as autotransformer. Transformers shall be listed and labeled as complying with UL 506 or UL 1561.
1. Standard impedance at 60Hz: 2 percent to 5 percent (up to 10 kVA), 4 percent to 6.5 percent (above 10 kVA).
 2. Nameplate Rating: Linear load, 60Hz.
 3. Insulation Class: **[220 deg C] [200 deg C] <Insert temperature value> system.**
 4. Temperature Rise: **[150 deg C] [130 deg C] [115 deg C] [80 deg C].**
 5. Core Construction: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 6. Coil Conductors: Continuous **[aluminum] [copper]** windings, with terminations brazed, welded, or bolted.
 7. Coil Impregnation: Vacuum impregnated with polyester resin.
 8. Sound Level: Not exceeding values listed above for distribution transformers.
 9. Enclosure: Ventilated, **[NEMA 250, Type 3R] [NEMA 250, Type 4] [NEMA 250, Type 4X] [NEMA 250, Type 12] <Insert other NEMA 250 rating>.**
 10. Terminations: Transformer coils shall terminate in mounting pads. Mounting lugs shall be provided on all units up to and including 270 A ratings.
 11. Antivibration pads or isolators shall be used between the transformer core and coil and the enclosure.
 12. Ground core and coil assembly to enclosure with a flexible copper grounding strap or equivalent.
 13. Mounting:
 - a. Ventilated Units up to 750 lb (340 kg): Suitable for wall, floor, or ceiling mounting (drip plate required).
 - b. Ventilated Units over 750 lb (340 kg): Suitable for floor mounting only.
 - c. Encapsulated Units up to 285 lb (130 kg): Suitable for wall or floor mounting.
 - d. Encapsulated Units over 285 lb (130 kg): Suitable for floor mounting only.
 14. Seismic: Floor-mounted units comply with Earthquake Loads Section of International Building Code with site-specific parameters of **[Occupancy Category III and Site Profile Type SD with the seismic forces defined as Spectral Acceleration for Short Periods equal to 1.0 g] <Insert other seismic parameters>.**
- B. Enclosure: **[Ventilated] [Encapsulated], [NEMA 250, Type 2] [NEMA 250, Type 3R] [NEMA 250, Type 4] [NEMA 250, Type 4X] [NEMA 250, Type 12] [Insert other NEMA 250 rating].**
1. Finish Color: **[Gray] [NSF/ANSI 49 gray] [NSF/ANSI 61 gray].**

2.5 IDENTIFICATION DEVICES

- A. Nameplates: Engraved, laminated-plastic or metal nameplate for each **[distribution]** **[buck-boost]** transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."

2.6 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
 - 1. Resistance measurements of all windings at the rated voltage connections and at all tap connections.
 - 2. Ratio tests at the rated voltage connections and at all tap connections.
 - 3. Phase relation and polarity tests at the rated voltage connections.
 - 4. No load losses, and excitation current and rated voltage at the rated voltage connections.
 - 5. Impedance and load losses at rated current and rated frequency at the rated voltage connections.
 - 6. Applied and induced tensile tests.
 - 7. Regulation and efficiency at rated load and voltage.
 - 8. Insulation Resistance Tests:
 - a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
 - 9. Temperature tests.
- B. Factory Sound-Level Tests: **[Conduct sound-level tests on equipment for this Project]** **[Conduct prototype sound-level tests on production-line products]**.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met. Maximum ground resistance shall be 5 ohms at location of transformer.

- E. Environment: Enclosures shall be rated for the environment in which they are located. Covers for NEMA 250, Type 4X enclosures shall not cause accessibility problems.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with **[wall brackets fabricated by transformer manufacturer] [wall brackets fabricated from design drawings signed and sealed by a licensed structural engineer]**.
 - 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
 - 2. Brace wall-mounted transformers as specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- B. Install transformers level and plumb on a concrete base with vibration-dampening supports. Locate transformers away from corners and not parallel to adjacent wall surface.
- C. Construct concrete bases according to **[Section 033000 "Cast-in-Place Concrete"] [or] [Section 033053 "Miscellaneous Cast-in-Place Concrete"]** and anchor floor-mounted transformers according to manufacturer's written instructions[, **seismic codes applicable to Project,**] and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 - 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- D. Secure transformer to concrete base according to manufacturer's written instructions.
- E. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- F. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. 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.

- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- B. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- D. Perform tests and inspections[**with the assistance of a factory-authorized service representative**].
- E. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS for dry-type, air-cooled, low-voltage transformers. Certify compliance with test parameters.
- F. Remove and replace units that do not pass tests or inspections and retest as specified above.
- G. Infrared Scanning: Two months after Substantial Completion, perform an infrared scan of transformer connections.
 - 1. Use an infrared-scanning device designed to measure temperature or detect significant deviations from normal values. Provide documentation of device calibration.
 - 2. Perform two follow-up infrared scans of transformers, one at four months and the other at 11 months after Substantial Completion.
 - 3. Prepare a certified report identifying transformer checked and describing results of scanning. Include notation of deficiencies detected, remedial action taken, and scanning observations after remedial action.
- H. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.

- B. Connect buck-boost transformers to provide nameplate voltage of equipment being served, plus or minus 5 percent, at secondary terminals.
- C. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 262200

SECTION 262416 - 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.
 - 3. Load centers.
 - 4. Electronic-grade panelboards.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of panelboard.
 - 1. Include materials, switching and overcurrent protective devices, external 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 external of each panelboard.
7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include wiring diagrams for power, signal, and control wiring.
9. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graph paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: Panel board schedules shall be in Excel format using an Excel spread sheet that will be provide to contractor awarded the contract for the project. A printed color copy Excel generated panel schedule shall be installed in each panel board. The Excel spread digital and paper sheet files of all panel boards shall be submitted to the Architect and owner at the completion of the construction.

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 017823 "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.

2. Circuit Breakers Including GFCI and GFEP Types: Two spares for each panelboard.
3. 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.
4. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.
- B. 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 in writing using owner provided form no less than 30 days prior to proposed interruption of electrical service include the proposed start date and duration of the outage in the request.
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: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Section 260548.16 "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: Recessed in wall unless installed in electrical room or utility type spaces where panel boards shall be surface-mounted, dead-front cabinets.
 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1
 2. Height: 84 inches (2.13 m) maximum.

3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for recessed-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
4. 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.
5. Finishes:
 - a. Panels and Trim: galvanized steel, 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.
2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

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. 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. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

- J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
 - 1. Percentage of Future Space Capacity: Ten percent.
- K. 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 as shown on Drawings, 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 as shown on Drawings, but not less than 14,000 A rms symmetrical.

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."
- B. Surge Suppression: Surge suppressors shall not be factory installed but shall be installed external to each panel board. Surge suppressors shall comply with UL 1449 SPD Type 2.

2.3 POWER PANELBOARDS

- A. Acceptable manufacturers:
 - 1. Eaton Electrical Inc., Cutler Hammer Business Unit
 - 2. Square D; by Schneider Electric
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
 - 1. For doors more than 36 inches (914 mm) high, provide two latches, keyed alike.
- D. Mains: Mains shall be as indicated on the drawings.
- E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers but can be Plug-in circuit breakers where individual

positive-locking device requires mechanical release for removal if required by the panel board manufacturer.

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Acceptable manufacturers:
 - 1. Eaton Electrical Inc., Cutler Hammer Business Unit
 - 2. Square D; by Schneider Electric
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Mains shall be as indicated on the drawings.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- F. 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 ELECTRONIC-GRADE PANELBOARDS

- A. Acceptable manufacturers:
 - 1. Eaton Electrical Inc., Cutler Hammer Business Unit
 - 2. Square D; by Schneider Electric
- B. Panelboards: NEMA PB 1; with external SPD; labeled by an NRTL for compliance with UL 67 and UL 1449 after installing SPD.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
- D. Main Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- E. Branch Overcurrent Protective Devices: Bolt-on thermal-magnetic circuit breakers.
- F. SPD. See specification section 264313 "Surge Protection for Low Voltage Electrical Power Circuits" for information concerning the SPD's for all panel boards.
- G. Buses:
 - 1. Copper phase and neutral buses; 100 percent capacity neutral bus and lugs.
 - 2. Copper equipment and isolated ground buses.

2.6 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Acceptable manufacturers:
 - 1. Eaton Electrical Inc., Cutler Hammer Business Unit
 - 2. 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. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 5. Subfeed Circuit Breakers: Vertically mounted.
 - 6. 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. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in off position only where designated on the drawings.

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. Panel board schedule shall be in Excel format as defined earlier in this specification section.
 - 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

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 and as required by the National Electrical Code.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
 - 2. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- E. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- F. Mount top of trim at the height where the top of the top most circuit breaker in every panel board is not higher than 72 inches AFF.
- G. Mount panelboard cabinet plumb and rigid without distortion of box.
- H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

- I. Mount surface-mounted panelboards to steel slotted supports 5/8 inch (16 mm) in depth. Orient steel slotted supports vertically.
- J. 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.
- K. 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.
- L. Install filler plates in unused spaces.
- M. Stub four 1-inch (25 mm) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (25 mm) empty conduits into raised floor space or below slab not on grade.
- N. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "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 260553 "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 260553 "Identification for Electrical Systems."
- E. Install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems" identifying source of remote circuit.

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.

C. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

D. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. 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.

E. Panelboards will be considered defective if they do not pass tests and inspections.

F. 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 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

3.6 PROTECTION

- A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 262416

SECTION 262726 - 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. USB receptacles.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Hospital-grade receptacles, 125 V, 20 A.
 - 4. Twist-locking receptacles.
 - 5. Pendant cord-connector devices.
 - 6. Cord and plug sets.
 - 7. Toggle switches, 120/277 V, 20 A.
 - 8. Decorator-style devices, 20 A.
 - 9. Occupancy sensors.
 - 10. Digital timer light switches.
 - 11. Wall-box dimmers.
 - 12. Wall plates.
 - 13. Poke-through assemblies.
 - 14. Prefabricated multioutlet assemblies.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: List of legends and description of materials and process used for premarking wall plates.
- C. Samples: One for each type of device and wall plate specified, in each color specified.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 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.

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. Poke-Through, Fire-Rated Closure Plugs: One for every five floor service outlets installed, but no fewer than two.

PART 2 - PRODUCTS

2.1 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 use.
- B. Comply with NFPA 70.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- F. Device Color:

1. Wiring Devices Connected to Normal Power System: White unless otherwise indicated or required by NFPA 70 or device listing.
 2. Wiring Devices Connected to Essential Electrical System: Red.
- G. Wall Plate Color: For plastic covers, match device color.
- H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 HOSPITAL-GRADE RECEPTACLES, 125 V, 20 A

- A. Hospital-Grade, Single Receptacles, 125 V, 20 A:
1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- B. Hospital-Grade, Duplex Receptacles, 125 V, 20 A:
1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Two pole, three wire, and self-grounding.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Standards: Comply with UL 498 Supplement sd and FS W-C-596.
 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- C. Hospital-Grade, Tamper-Resistant, Duplex Receptacles, 125 V, 20 A:
1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 2. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, and FS W-C-596.
 5. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.
- D. Hospital-Grade, Tamper-Resistant, Duplex (125 V, 20 A) and USB Charging Receptacles:
1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand

2. Description: Single-piece, rivetless, nickel-plated, all-brass grounding system. Nickel-plated, brass mounting strap. Integral shutters that operate only when a plug is inserted in the line voltage receptacle.
3. Line Voltage Receptacles: Two pole, three wire, and self-grounding, NEMA Configuration 5-20R.
4. USB Receptacles: Dual, USB Type A, 5 V dc, and 2.1 A per receptacle (minimum).
5. Standards: Comply with NEMA WD 1, UL 498 Supplement sd, UL 1310, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

E. Hospital-Grade, Duplex GFCI Receptacles, 125 V, 20 A:

1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Single-piece, rivetless, nickel-plated, all-brass grounding system.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

F. Hospital-Grade, Tamper-Resistant, Duplex GFCI Receptacles, 125 V, 20 A:

1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Single-piece, rivetless, nickel-plated, all-brass grounding system.
3. Configuration: NEMA WD 6, Configuration 5-20R.
4. Type: Non-feed through.
5. Standards: Comply with UL 498 supplement sd, UL 943 Class A, and FS W-C-596.
6. Marking: Listed and labeled as complying with NFPA 70, "Health Care Facilities" Article.

2.3 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector, heavy-duty grade.

1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand

- B. Configuration: NEMA WD 6, Configurations L5-20P and L5-20R.
- C. Body: Nylon, with screw-open, cable-gripping jaws and provision for attaching external cable grip.
- D. 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.
- E. Standards: Comply with FS W-C-596.

2.4 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. 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.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.5 TOGGLE SWITCHES, 120/277 V, 20 A

- A. Single-Pole Switches, 120/277 V, 20 A:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 - 2. Standards: Comply with UL 20 and FS W-S-896.
- B. Two-Pole Switches, 120/277 V, 20 A:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 - 2. Comply with UL 20 and FS W-S-896.
- C. Three-Way Switches, 120/277 V, 20 A:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 - 2. Comply with UL 20 and FS W-S-896.
- D. Four-Way Switches, 120/277 V, 20 A:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 - 2. Standards: Comply with UL 20 and FS W-S-896.

- E. Single-Pole, Double-Throw, Momentary-Contact, Center-off Switches, 120/277 V, 20 A:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/Legrand
 - 2. Description: For use with mechanically held lighting contactors.
 - 3. Standards: Comply with NEMA WD 1, UL 20, and FS W-S-896.

2.6 OCCUPANCY SENSORS

- A. Wall Switch Sensor Light Switch, Dual Technology:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Wattstopper/Legrand
 - 2. Description: Switchbox-mounted, combination lighting-control sensor and conventional switch lighting-control unit using dual (ultrasonic and passive infrared) technology.
 - 3. Standards: Comply with UL 20.
 - 4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 5. Adjustable time delay of five to 20 minutes.
 - 6. Able to be locked to Automatic-On mode.
 - 7. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
- B. Wall Sensor Light Switch, Passive Infrared:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Wattstopper/Legrand
 - 2. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using passive infrared technology.
 - 3. Standards: Comply with UL 20.
 - 4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 5. Integral relay for connection to BAS.
 - 6. Adjustable time delay of five to 20 minutes.
 - 7. Able to be locked to Automatic-On mode.
 - 8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).
- C. Wall Sensor Light Switch, Ultrasonic:
 - 1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Wattstopper/LeGrand
 - 2. Description: Switchbox-mounted, combination, lighting-control sensor and conventional switch lighting-control unit using ultrasonic technology.
 - 3. Standards: Comply with UL 20.
 - 4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
 - 5. Integral relay for connection to BAS.
 - 6. Adjustable time delay of five to 20 minutes.
 - 7. Able to be locked to Automatic-On mode.

8. Automatic Light-Level Sensor: Adjustable from 2 to 200 fc (21.5 to 2152 lux).

2.7 TIMER LIGHT SWITCH

A. Digital Timer Light Switch:

1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/LeGrand
2. Description: Switchbox-mounted, combination digital timer and conventional switch lighting-control unit, with backlit digital display, with selectable time interval in 10 minute increments.
3. Standards: Comply with UL 20.
4. Rated 960 W at 120 V ac for tungsten lighting, 10 A at 120 V ac or 10 A at 277 V ac for fluorescent or LED lighting, and 1/4 hp at 120 V ac.
5. Integral relay for connection to BAS.

2.8 DIMMERS

A. Wall-Box Dimmers:

1. Acceptable manufacturers:
 - a. Leviton Mfg. Company Inc.
 - b. Pass & Seymour/LeGrand
2. Description: Modular, full-wave, solid-state dimmer switch with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
3. Control: Continuously adjustable slider; with single-pole or three-way switching.
4. Standards: Comply with UL 1472.
5. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimmer ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 20 percent of full brightness.
6. LED Lamp Dimmer Switches: Modular; compatible with LED lamps; trim potentiometer to adjust low-end dimming; capable of consistent dimming with low end not greater than 20 percent of full brightness.

2.9 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. 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: Smooth, high-impact thermoplastic.
 3. Material for Unfinished Spaces: Smooth, high-impact thermoplastic.
 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant **thermoplastic** with lockable cover.

2.10 FLOOR SERVICE FITTINGS

2.11 POKE-THROUGH ASSEMBLIES

- A. Description: Factory-fabricated and -wired assembly of below-floor junction box with multichanneled, through-floor raceway/firestop unit and detachable matching floor service-outlet assembly.
- B. Wiremold/Legrand
- C. Standards: Comply with scrub water exclusion requirements in UL 514.
- D. Service-Outlet Assembly: as called for on the drawings, complying with the requirements in Section 271513 "Communications Copper Horizontal Cabling."
- E. Size: Selected to fit nominal **4-inch (100-mm)** cored holes in floor and matched to floor thickness.
- F. Fire Rating: Unit is listed and labeled for fire rating of floor-ceiling assembly.
- G. Closure Plug: Arranged to close unused **4-inch (100-mm)** cored openings and reestablish fire rating of floor.
- H. Wiring Raceways and Compartments: For a minimum of four No. 12 AWG conductors and a minimum of four, four-pair cables that comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."

2.12 PREFABRICATED MULTIOUTLET ASSEMBLIES

- A. Description: Two-piece surface metal raceway, with factory-wired multioutlet harness.
- B. Wiremold
- C. Components shall be products from single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.
- D. Raceway Material: Metal, with manufacturer's standard finish.
- E. Multioutlet Harness:
 - 1. Receptacles: 15-A, 125-V, NEMA WD 6 Configuration 5-15R receptacles complying with NEMA WD 1, UL 498, and FS W-C-596.
 - 2. Receptacle Spacing: **12 inches (300 mm)**.

3. Wiring: No. 12 AWG solid, Type THHN copper, two circuit, connecting alternating receptacles.

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 comply with 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 hospital-grade receptacles in patient-care areas with the ground pin or neutral blade at the top.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan-speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device, listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through 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. See specification section 260553 concerning colors and labeling details.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification as required in specification section 2670553 and per details on the drawings.

3.4 FIELD QUALITY CONTROL

- A. Test Instruments: Use instruments that comply with UL 1436.
- B. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. In healthcare facilities, prepare reports that comply with NFPA 99 chapter 6 and in section 6.3.3. Submit written report of testing and corrective actions taken to the Architect before building is placed in use.
 - 2. Test Instruments: Use instruments that comply with UL 1436.
 - 3. Test Instrument for Receptacles: Digital wiring analyzer with digital readout or illuminated digital-display indicators of measurement.
- D. Tests for 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.
- E. Test straight-blade convenience outlets in patient-care areas for compliance with chapter 6 of NFPA 99 and test the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).
- F. Wiring device will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

END OF SECTION 262726

SECTION 262813 - 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 the following:
 - a. Control circuits.
 - b. Motor-control centers.
 - c. Enclosed controllers.
 - d. Enclosed switches.
 - 2. Spare-fuse cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, 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. Current-limitation curves for fuses with current-limiting characteristics.
 - 4. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse. Submit in PDF format.
 - 5. Coordination charts and tables and related data.

6. 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 017700 "Closeout Procedures," include the following:
 1. Ambient temperature adjustment information.
 2. Current-limitation curves for fuses with current-limiting characteristics.
 3. Time-current coordination curves (average melt) and current-limitation curves (instantaneous peak let-through current) for each type and rating of fuse used on the Project. Submit in PDF format.
 4. 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 FIELD 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.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable manufacturers:
 1. Bussmann, an Eaton Business
 2. Littelfuse, Inc.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC.
 2. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
- 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. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

2.3 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. Motor Branch Circuits: Class RK5, time delay.
 - 2. Control Transformer Circuits: Class CC, time delay, control transformer duty.
 - 3. Provide open-fuse indicator fuses or fuse covers with open fuse indication.

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) in location shown on the Drawings or as indicated in the field by Owner.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 262813

SECTION 262816 - 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. Shunt trip switches.
 - 4. Molded-case circuit breakers (MCCBs).
 - 5. Molded-case switches.
 - 6. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, 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. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
 - 5. 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. Provide in PDF electronic format.

- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.
- B. Seismic Qualification Data: 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.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - b. 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. Provide in PDF electronic format.

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. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 FIELD 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).

1.10 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 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."

2.2 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. 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.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- D. Comply with NFPA 70.

2.3 FUSIBLE SWITCHES

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>
- B. Type HD, Heavy Duty:
 - 1. Single throw.
 - 2. Three pole.
 - 3. 600-V ac.
 - 4. 1200 A and smaller.
 - 5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified and indicated fuses.
 - 6. 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. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
 - 4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 208-V ac.
 - 5. Hookstick Handle: Allows use of a hookstick to operate the handle only where indicated on drawings..
 - 6. Lugs: Mechanical type, suitable for number, size, and conductor material.
 - 7. Service-Rated Switches: Labeled for use as service equipment.

2.4 NONFUSIBLE SWITCHES

- A. Acceptable manufacturers:
 - 1. Eaton Cutler Hammer.
 - 2. Square D; by Schneider Electric
- B. Type HD, Heavy Duty, Three Pole, Single Throw, 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. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Auxiliary Contact Kit: One NO/NC (Form "C") auxiliary contact(s), arranged to activate before switch blades open. Contact rating - 208-V ac.
5. Hookstick Handle: Allows use of a hookstick to operate the handle only where indicated on drawings.
6. Lugs: Mechanical type, suitable for number, size, and conductor material.
7. Service-Rated Switches: Labeled for use as service equipment.

2.5 MOLDED-CASE CIRCUIT BREAKERS

- A. Acceptable manufacturers:
 1. Eaton Cutler Hammer.
 2. Square D; by Schneider Electric
- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit-breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100 percent rated or series rated as indicated on the Drawings.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 167 deg F (75 deg C) rated wire.
- G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal 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.

- I. Electronic Trip Circuit Breakers for circuit breakers 400 ampere and larger or as required by coordination study: 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-squared t response.
- J. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller, and let-through ratings less than NEMA FU 1, RK-5.
- K. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
- L. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mA trip).
- M. 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 for circuit breakers indicated on the drawings as requiring shunt trip.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 1, 3R, 12).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.

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.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

- A. 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 in writing using owner provided form no less than 30 days prior to proposed interruption of electrical service include the proposed start date and duration of the outage in the request.
 - 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.

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.

3.4 INSTALLATION

- 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.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.

- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

- A. Comply with requirements 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 metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Tests and Inspections for Switches:
 - 1. Visual and Mechanical Inspection:
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, grounding, and clearances.
 - c. Verify that the unit is clean.
 - d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
 - e. Verify that fuse sizes and types match the Specifications and Drawings.
 - f. Verify that each fuse has adequate mechanical support and contact integrity.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

- a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
 - i. Verify correct phase barrier installation.
 - j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.
2. Electrical Tests:
- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Measure contact resistance across each switchblade fuseholder. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - c. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - d. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - e. Perform ground fault test according to NETA ATS 7.14 "Ground Fault Protection Systems, Low-Voltage."

C. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:
- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, grounding, and clearances.
 - d. Verify that the unit is clean.
 - e. Operate the circuit breaker to ensure smooth operation.
 - f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those

of similar bolted connections by more than 50 percent of the lowest value.

- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

- a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.

- g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.

2. Electrical Tests:

- a. Perform resistance measurements through bolted connections with a low-resistance ohmmeter. Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - b. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with circuit breaker closed, and across each open pole. Apply voltage in accordance with manufacturer's published data. In the absence of manufacturer's published data, use Table 100.1 from the NETA ATS. Investigate values of insulation resistance less than those published in Table 100.1 or as recommended in manufacturer's published data.
 - c. Perform a contact/pole resistance test. Drop values shall not exceed the high level of the manufacturer's published data. If manufacturer's published data are not available, investigate values that deviate from adjacent poles or similar switches by more than 50 percent of the lowest value.
 - d. Perform insulation resistance tests on all control wiring with respect to ground. Applied potential shall be 500-V dc for 300-V rated cable and 1000-V dc for 600-V rated cable. Test duration shall be one minute. For units with solid state components, follow manufacturer's recommendation. Insulation resistance values shall be no less than two megohms.
 - e. Determine the following by primary current injection:
 - 1) Long-time pickup and delay. Pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 2) Short-time pickup and delay. Short-time pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.
 - 3) Ground-fault pickup and time delay. Ground-fault pickup values shall be as specified. Trip characteristics shall not exceed manufacturer's published time-current characteristic tolerance band, including adjustment factors.

- 4) Instantaneous pickup. Instantaneous pickup values shall be as specified and within manufacturer's published tolerances.
 - f. Test functionality of the trip unit by means of primary current injection. Pickup values and trip characteristics shall be as specified and within manufacturer's published tolerances.
 - g. Perform minimum pickup voltage tests on shunt trip and close coils in accordance with manufacturer's published data. Minimum pickup voltage of the shunt trip and close coils shall be as indicated by manufacturer.
 - h. Verify correct operation of auxiliary features such as trip and pickup indicators; zone interlocking; electrical close and trip operation; trip-free, anti-pump function; and trip unit battery condition. Reset all trip logs and indicators. Investigate units that do not function as designed.
 - i. Verify operation of charging mechanism. Investigate units that do not function as designed.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 4. 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.
 5. 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.
1. Test procedures used.
 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 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 260573.16 "Coordination Studies."

END OF SECTION 262816

SECTION 262913.03 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

1. Section Includes:
 1. Manual motor controllers.
 2. Enclosed full-voltage magnetic motor controllers.
 3. Combination full-voltage magnetic motor controllers.
 4. Enclosures.
 5. Accessories.
 6. Identification.

1.3 DEFINITIONS

1. CPT: Control power transformer.
2. MCCB: Molded-case circuit breaker.
3. MCP: Motor circuit protector.
4. NC: Normally closed.
5. OCPD: Overcurrent protective device.
6. SCCR: Short-circuit current rating.
7. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

1. Product Data: For each type of product.
 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
2. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
 2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
 3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
 4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
3. Product Schedule: List the following for each enclosed controller:
1. Each installed magnetic controller type.
 2. NRTL listing.
 3. Factory-installed accessories.
 4. Nameplate legends.
 5. SCCR of integrated unit.
 6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.
 - a. Listing document proving Type 2 coordination.

1.5 INFORMATIONAL SUBMITTALS

1. Qualification Data: For testing agency.
2. Seismic Qualification Data: Certificates, for magnetic controllers, 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.
3. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

1. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.
 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:

- a. Routine maintenance requirements for magnetic controllers and installed components.
- b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
- c. Manufacturer's written instructions for setting field-adjustable overload relays.
- 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 MAINTENANCE MATERIAL SUBMITTALS

1. 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. Indicating Lights: Two of each type and color installed. Indicating lights shall be LED type.
 4. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
 5. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 QUALITY ASSURANCE

1. Testing Agency Qualifications: Accredited by NETA.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

1. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.10 FIELD CONDITIONS

1. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than 23 deg F (minus 5 deg C) and not exceeding 104 deg F (40 deg C).
 2. Altitude: Not exceeding 6600 feet (2010 m) for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.
3. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.
4. Seismic Performance: Magnetic controllers shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the controller will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."
 2. Component Importance Factor: 1.5.

2.2 MANUAL MOTOR CONTROLLERS

1. Motor-Starting Switches (MSS): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off or on.
 1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
 2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
 3. Configuration: Nonreversing.
 4. Flush in mounted in finished spaces and Surface in mounted in unfinished spaces.
 5. Red running light and Green stopped pilot light.
 6. Pilot lights shall be LED type.
2. Fractional Horsepower Manual Controllers (FHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.

1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
 2. Configuration: Nonreversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 4. Pilot Light: Red running light and green stopped light.
-
3. Integral Horsepower Manual Controllers (IHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
 2. Configuration: Nonreversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.
 4. Overload Relays: NEMA ICS 2, bimetallic class as scheduled on Drawings.

2.3 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

1. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.
 1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
3. Configuration: Nonreversing.
4. Contactor Coils: Pressure-encapsulated type.
 1. Operating Voltage: Manufacturer's standard, unless indicated.
5. Control Power:
 1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. Spare CPT Capacity as Indicated on Drawings: 100 VA.
 2. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.

- c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - d. Class II ground-fault protection shall comply with UL 1053 to interrupt low-level ground faults. The ground-fault detection system shall include circuitry that will prevent the motor controller from tripping when the fault current exceeds the interrupting capacity of the controller. Equip with start and run delays to prevent nuisance trip on starting, and a trip indicator.
6. Digital communication module, using RS-485 Modbus, RTU protocol, 4-wire connection to host devices with a compatible port to transmit the following to the LAN:
- 1. Instantaneous rms current each phase, and 3-phase average.
 - 2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
 - 3. Active Energy (kWh): 3-phase total.

2.4 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

- 1. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.
 - 1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
- 2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
- 3. Configuration: Nonreversing.
- 4. Contactor Coils: Pressure-encapsulated type.
 - 1. Operating Voltage: Manufacturer's standard, unless indicated.
- 5. Control Power:
 - 1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 - a. Spare CPT Capacity as Indicated on Drawings: 100 VA.
- 6. Overload Relays:
 - 1. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.

7. Digital communication module, using RS-485 Modbus, RTU protocol, 4-wire connection to host devices with a compatible port to transmit the following to the LAN:
 1. Instantaneous rms current each phase, and 3-phase average.
 2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
 3. Active Energy (kWh): 3-phase total.
8. Fusible Disconnecting Means:
 1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
 2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
9. Nonfusible Disconnecting Means:
 1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
10. MCP Disconnecting Means:
 1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.5 ENCLOSED REDUCED-VOLTAGE MAGNETIC MOTOR CONTROLLERS

1. Description: Electrically held; closed-transition; adjustable time delay on transition, 600-V ac or less.
 1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
2. Standard: Comply with NEMA ICS 2, general purpose, Class A.
3. Configuration:
 1. Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
 2. Part-Winding Controller: Separate START and RUN contactors, field-selectable for 1/2- or 2/3-winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
 3. Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.

4. Contactor Coils: Pressure-encapsulated type.
 1. Operating Voltage: Manufacturer's standard, unless indicated.
5. Control Power: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 1. Spare CPT Capacity: 100 VA.
6. Overload Relays:
 1. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
7. Digital Communication Module: RS-485 Modbus, RTU protocol, 4-wire connection to host devices with a compatible port to transmit the following to the LAN:
 1. Instantaneous rms current each phase, and 3-phase average.
 2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
 3. Active Energy (kWh): 3-phase total.

2.6 COMBINATION REDUCED-VOLTAGE MOTOR CONTROLLERS

1. Description: Factory-assembled, combination reduced-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, and SCPD and OCPD, in a single enclosure.
 1. Acceptable manufacturers:
 - a. Eaton Cutler Hammer.
 - b. Square D; by Schneider Electric.
2. Configuration:
 1. Wye-Delta Controller: Four contactors, with a three-phase starting resistor/reactor bank.
 2. Part-Winding Controller: Separate START and RUN contactors, field-selectable for 1/2- or 2/3-winding start mode, with either six- or nine-lead motors; with separate overload relays for starting and running sequences.
 3. Autotransformer Reduced-Voltage Controller: Medium-duty service, with integral overtemperature protection; taps for starting at 50, 65, and 80 percent of line voltage; two START and one RUN contactors.
3. Contactor Coils: Pressure-encapsulated type.

1. Operating Voltage: Manufacturer's standard, unless indicated.
4. Control Power: 120-V ac; obtained from integral CPT, with primary and secondary fuses, with CPT of sufficient capacity to operate integral devices and remotely located pilot, indicating, and control devices.
 1. Spare CPT Capacity: 100 VA.
5. Overload Relays:
 1. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.
 - c. Class 10/20 selectable tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
6. Digital Communication Module: RS-485 Modbus, RTU protocol, 4-wire connection to host devices with a compatible port to transmit the following to the LAN:
 1. Instantaneous rms current each phase, and 3-phase average.
 2. Voltage: L-L for each phase, L-L 3-phase average, L-N each phase and L-N 3-phase average - rms.
 3. Active Energy (kWh): 3-phase total.
7. Fusible Disconnecting Means:
 1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
 2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
8. Nonfusible Disconnecting Means:
 1. NEMA KS 1, heavy-duty, horsepower-rated, nonfusible switch.
 2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
9. MCP Disconnecting Means:
 1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
 2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.
10. MCCB Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse-time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.7 ENCLOSURES

1. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.
2. The construction of the enclosures shall comply with NEMA ICS 6.
3. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.8 ACCESSORIES

1. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.
 - a. Push Buttons: As indicated in the controller schedule.
 - b. Pilot Lights: LED type and as indicated in the controller schedule.
2. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.
 1. Phase-failure.
 2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.
 3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.
3. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.

2.9 IDENTIFICATION

1. Controller Nameplates: Nameplates as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.

2. Arc-Flash Warning Labels:
 1. Comply with requirements in Section 260573.19 "Arc-Flash Hazard Analysis." Produce a 3.5-by-5-inch (89-by-127-mm) self-adhesive equipment label for each work location included in the analysis.
 2. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch (89-by-127-mm) self-adhesive equipment label for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.
 - a. 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.
 - b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

1. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

1. Comply with NECA 1.
2. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height 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" unless otherwise indicated.
3. Floor-Mounted Controllers: Install controllers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033053 "Miscellaneous Cast-in-Place Concrete."

4. Comply with requirements for seismic control devices specified in Section 260548.16 "Seismic Controls for Electrical Systems."
5. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and NFPA 70.
6. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
7. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by NFPA 70 for motors that are high-torque, high-efficiency, and so on.

3.3 IDENTIFICATION

1. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

1. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
2. Perform tests and inspections with the assistance of a factory-authorized service representative.
3. Tests and Inspections:
 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with drawings and specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, and grounding.
 - d. Verify the unit is clean.
 - e. Inspect contactors:
 - 1) Verify mechanical operation.
 - 2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
 - f. Motor-Running Protection:
 - 1) Verify overload element rating is correct for its application.
 - 2) If motor-running protection is provided by fuses, verify correct fuse rating.

- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
3. Electrical Tests:
- a. Perform insulation-resistance tests for one minute on each pole, phase-to-phase and phase-to-ground with switch closed, and across each open pole. Insulation-resistance values shall be according to manufacturer's published data or NETA ATS Table 100.1. In the absence of manufacturer's published data, use Table 100.5. Values of insulation resistance less than those of this table or manufacturer's recommendations shall be investigated and corrected.
 - b. Measure fuse resistance. Investigate fuse-resistance values that deviate from each other by more than 15 percent.
 - c. Test motor protection devices according to manufacturer's published data.
 - d. Test circuit breakers as follows:
 - 1) Operate the circuit breaker to ensure smooth operation.
 - 2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.
 - e. Perform operational tests by initiating control devices.
4. Infrared Inspection: Perform the survey during periods of maximum possible loading. Remove all necessary covers prior to the inspection.
- a. Comply with the recommendations of NFPA 70B, "Testing and Test Methods" Chapter, "Infrared Inspection" Article.
 - b. After Substantial Completion, but not more than 60 days after Final Acceptance, perform infrared inspection of the electrical power connections of each motor controller.
 - c. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each motor controller 11 months after date of Substantial Completion.
 - d. Report of Infrared Inspection: Prepare a certified report that identifies the testing technician and equipment used, and lists the following results:

- 1) Description of equipment to be tested.
 - 2) Discrepancies.
 - 3) Temperature difference between the area of concern and the reference area.
 - 4) Probable cause of temperature difference.
 - 5) Areas inspected. Identify inaccessible and unobservable areas and equipment.
 - 6) Load conditions at time of inspection.
 - 7) Photographs and thermograms of the deficient area.
 - 8) Recommended action.
- e. Equipment: Inspect distribution systems with imaging equipment capable of detecting a minimum temperature difference of 1degree C at 30 degrees C. The equipment shall detect emitted radiation and convert detected radiation to a visual signal.
- f. Act on inspection results and recommended action, and considering the recommendations of NETA ATS, Table 100.18. Correct possible and probable deficiencies as soon as Owner's operations permit. Retest until deficiencies are corrected.
4. Motor controller will be considered defective if it does not pass tests and inspections.
5. Prepare test and inspection reports.

3.5 SYSTEM FUNCTION TESTS

1. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.
 1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
 2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
 3. Verify the correct operation of sensing devices, alarms, and indicating devices.
2. Motor controller will be considered defective if it does not pass the system function tests and inspections.
3. Prepare test and inspection reports.

3.6 DEMONSTRATION

1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchgear.

END OF SECTION 262913.03

SECTION 262923 - VARIABLE-FREQUENCY MOTOR 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 separately enclosed, preassembled, combination VFCs, rated 600 V and less, for speed control of three-phase, squirrel-cage induction motors.
- B. Related Requirements:
 - 1. Section 262419 "Motor-Control Centers" for VFCs installed in motor-control centers.

1.3 DEFINITIONS

- A. CE: Conformance Europeene (European Compliance).
- B. CPT: Control power transformer.
- C. DDC: Direct digital control.
- D. EMI: Electromagnetic interference.
- E. LED: Light-emitting diode.
- F. NC: Normally closed.
- G. NO: Normally open.
- H. OCPD: Overcurrent protective device.
- I. PID: Control action, proportional plus integral plus derivative.
- J. RFI: Radio-frequency interference.
- K. VFC: Variable-frequency motor controller.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and rating of VFC indicated.
 - 1. Include dimensions and finishes for VFCs.
 - 2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each VFC indicated.
 - 1. Include mounting and attachment details.
 - 2. Include details of equipment 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Required working clearances and required area above and around VFCs.
 - 2. Show VFC layout and relationships between electrical components and adjacent structural and mechanical elements.
 - 3. Show support locations, type of support, and weight on each support.
 - 4. Indicate field measurements.
- B. Qualification Data: For testing agency.
- C. Seismic Qualification Data: Certificates, for each VFC, accessories, and components, from manufacturer.
 - 1. Certificate of compliance.
 - 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.
- D. Product Certificates: For each VFC from manufacturer.
- E. Harmonic Analysis Report: Provide Project-specific calculations and manufacturer's statement of compliance with IEEE 519.
- F. Source quality-control reports.
- G. Field quality-control reports.
- H. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For VFCs to include in emergency, operation, and maintenance manuals.
1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting thermal-magnetic circuit breaker and motor-circuit protector trip settings.
 - b. Manufacturer's written instructions for setting field-adjustable overload relays.
 - c. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - d. Manufacturer's written instructions for setting field-adjustable timers, controls, and status and alarm points.
 - e. 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.
 - f. 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 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. Power Fuses: Equal to **[10]** **<Insert number>** percent of quantity installed for each size and type, but no fewer than **[three]** **<Insert number>** of each size and type.
 2. Control Power Fuses: Equal to **[10]** **<Insert number>** percent of quantity installed for each size and type, but no fewer than **[two]** **<Insert number>** of each size and type.
 3. Indicating Lights: **[Two]** **<Insert number>** of each type and color installed.
 4. Auxiliary Contacts: Furnish **[one]** **<Insert number>** spare(s) for each size and type of magnetic controller installed.
 5. Power Contacts: Furnish **[three]** **<Insert number>** spares for each size and type of magnetic contactor installed.
 6. **<Insert extra materials>**.

1.8 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. If stored in space that is not permanently enclosed and air conditioned, remove loose packing and flammable materials from inside controllers and **[install temporary electric heating, with at least 250 W per controller] [connect factory-installed space heaters to temporary electrical service]**.
- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for VFCs, including clearances between VFCs, and adjacent surfaces and other items.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace VFCs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: **[Five]** **<Insert number>** years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. <Double click here to find, evaluate, and insert list of manufacturers and products.>

2.2 SYSTEM DESCRIPTION

- A. General Requirements for VFCs:
 - 1. VFCs and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 2. Comply with NEMA ICS 7, NEMA ICS 61800-2, and **[UL 508A] [UL 508C] <Insert standard>**.
- B. Application: **[Constant torque] [and] [variable torque] <Insert application>**.
- C. VFC Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
 - 1. Units suitable for operation of NEMA MG 1, Design A and Design B motors, as defined by NEMA MG 1, Section IV, Part 30, "Application Considerations for Constant Speed Motors Used on a Sinusoidal Bus with Harmonic Content and

General Purpose Motors Used with Adjustable-Voltage or Adjustable-Frequency Controls or Both."

2. Units suitable for operation of inverter-duty motors as defined by NEMA MG 1, Section IV, Part 31, "Definite-Purpose Inverter-Fed Polyphase Motors."
 3. Listed and labeled for integrated short-circuit current (withstand) rating by an NRTL acceptable to authorities having jurisdiction.
- D. Design and Rating: Match load type, such as fans, blowers, and pumps; and type of connection used between motor and load such as direct or through a power-transmission connection.
- E. Output Rating: Three phase; 10 to **[60 Hz, with voltage proportional to frequency throughout voltage range] [66 Hz, with torque constant as speed changes]**; maximum voltage equals input voltage.
- F. Unit Operating Requirements:
1. Input AC Voltage Tolerance: Plus 10 and minus **[10] [15]** percent of VFC input voltage rating.
 2. Input AC Voltage Unbalance: Not exceeding **[3] [5]** percent.
 3. Input Frequency Tolerance: Plus or minus 3 percent of VFC frequency rating.
 4. Minimum Efficiency: **[96] [97] <Insert number>** percent at 60 Hz, full load.
 5. Minimum Displacement Primary-Side Power Factor: **[96] [98] <Insert number>** percent under any load or speed condition.
 6. Minimum Short-Circuit Current (Withstand) Rating: **[10] [22] [65] [100] <Insert value>** kA.
 7. Ambient Temperature Rating: Not less than 32 deg F (0 deg C) and not exceeding 104 deg F (40 deg C).
 8. Humidity Rating: Less than 95 percent (noncondensing).
 9. Altitude Rating: Not exceeding 3300 feet (1000 m).
 10. Vibration Withstand: Comply with NEMA ICS 61800-2.
 11. Overload Capability: **[1.1] [1.5]** times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
 12. Starting Torque: Minimum 100 percent of rated torque from 3 to 60 Hz.
 13. Speed Regulation: Plus or minus **[5] [10]** percent.
 14. Output Carrier Frequency: Selectable; 0.5 to **[15] <insert number>** kHz.
 15. Stop Modes: Programmable; includes fast, free-wheel, and dc injection braking.
- G. Inverter Logic: Microprocessor based, **[16] [32]** bit, isolated from all power circuits.
- H. Isolated Control Interface: Allows VFCs to follow remote-control signal over a minimum 40:1 speed range.
1. Signal: **[Electrical] [Pneumatic]**.
- I. Internal Adjustability Capabilities:
1. Minimum Speed: 5 to 25 percent of maximum rpm.
 2. Maximum Speed: 80 to 100 percent of maximum rpm.
 3. Acceleration: **[0.1 to 999.9] <Insert range>** seconds.

4. Deceleration: **[0.1 to 999.9] <Insert range>** seconds.
5. Current Limit: 30 to minimum of 150 percent of maximum rating.
6. **<Insert adjustment and parameters>**.

J. Self-Protection and Reliability Features:

1. Surge Suppression: Factory installed as an integral part of the VFC, complying with UL 1449 SPD, Type 1 or Type 2.
 2. Surge Suppression: Field-mounted surge suppressors complying with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits," UL 1449 SPD, Type 2.
 3. Loss of Input Signal Protection: Selectable response strategy, including speed default to a percent of the most recent speed, a preset speed, or stop; with alarm.
 4. Under- and overvoltage trips.
 5. Inverter overcurrent trips.
 6. VFC and Motor-Overload/Overtemperature Protection: Microprocessor-based thermal protection system for monitoring VFCs and motor thermal characteristics, and for providing VFC overtemperature and motor-overload alarm and trip; settings selectable via the keypad.
 7. Critical frequency rejection, with **[three] <Insert number>** selectable, adjustable deadbands.
 8. Instantaneous line-to-line and line-to-ground overcurrent trips.
 9. Loss-of-phase protection.
 10. Reverse-phase protection.
 11. Short-circuit protection.
 12. Motor-overtemperature fault.
 13. **<Insert protection or reliability feature>**.
- K. Automatic Reset/Restart: Attempt three restarts after drive fault or on return of power after an interruption and before shutting down for manual reset or fault correction; adjustable delay time between restart attempts.
- L. Power-Interruption Protection: To prevent motor from re-energizing after a power interruption until motor has stopped, unless "Bidirectional Autospeed Search" feature is available and engaged.
- M. Bidirectional Autospeed Search: Capable of starting VFC into rotating loads spinning in either direction and returning motor to set speed in proper direction, without causing damage to drive, motor, or load.
- N. Torque Boost: Automatically varies starting and continuous torque to at least 1.5 times the minimum torque to ensure high-starting torque and increased torque at slow speeds.
- O. Motor Temperature Compensation at Slow Speeds: Adjustable current fall-back based on output frequency for temperature protection of self-cooled, fan-ventilated motors at slow speeds.

- P. Integral Input Disconnecting Means and OCPD: **[UL 489, instantaneous-trip circuit breaker] [UL 489, molded-case switch, with power fuse block and current-limiting fuses] [UL 489, thermal-magnetic circuit breaker] [NEMA KS 1, nonfusible switch, with power fuse block and current-limiting fuses] [NEMA KS 1, fusible switch]** with pad-lockable, door-mounted handle mechanism.
1. Disconnect Rating: Not less than 115 percent of VFC input current rating.
 2. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFC input current rating, whichever is larger.
 3. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
 4. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 5. **[NC] [NO]** alarm contact that operates only when circuit breaker has tripped.

2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: VFCs shall withstand the effects of earthquake motions determined according to ASCE/SEI 7. The designated VFCs shall be tested and certified by an NRTL as meeting the ICC-ES AC 156 test procedure requirements.
1. The term "withstand" means "the unit will remain in place without separation of any parts when subjected to the seismic forces specified[**and the unit will be fully operational after the seismic event**]."

2.4 CONTROLS AND INDICATION

- A. Status Lights: Door-mounted LED indicators displaying the following conditions:
1. Power on.
 2. Run.
 3. Overvoltage.
 4. Line fault.
 5. Overcurrent.
 6. External fault.
 7. **<Insert condition>**.
- B. Panel-Mounted Operator Station: Manufacturer's standard front-accessible, sealed keypad and plain-English-language digital display; allows complete programming, program copying, operating, monitoring, and diagnostic capability.
1. Keypad: In addition to required programming and control keys, include keys for HAND, OFF, and AUTO modes.
 2. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: View only; view and operate; and view, operate, and service.
 - a. Control Authority: Supports at least four conditions: Off, local manual control at VFC, local automatic control at VFC, and automatic control through a remote source.

C. Historical Logging Information and Displays:

1. Real-time clock with current time and date.
2. Running log of total power versus time.
3. Total run time.
4. Fault log, maintaining last **[four]** **<Insert number>** faults with time and date stamp for each.
5. **<Insert information or display>**.

D. Indicating Devices: Digital display[**and additional readout devices as required,**] mounted flush in VFC door and connected to display VFC parameters including, but not limited to:

1. Output frequency (Hz).
2. Motor speed (rpm).
3. Motor status (running, stop, fault).
4. Motor current (amperes).
5. Motor torque (percent).
6. Fault or alarming status (code).
7. PID feedback signal (percent).
8. DC-link voltage (V dc).
9. Set point frequency (Hz).
10. Motor output voltage (V ac).
11. **<Insert parameter>**.

E. Control Signal Interfaces:

1. Electric Input Signal Interface:
 - a. A minimum of **[two]** **<Insert number>** programmable analog inputs: **[0- to 10-V dc]** **[4- to 20-mA dc]** **[Operator-selectable "x"- to "y"-mA dc]** **<Insert signal parameters>**.
 - b. A minimum of **[six]** **<Insert number>** multifunction programmable digital inputs.
2. Pneumatic Input Signal Interface: 3 to 15 psig (20 to 104 kPa).
3. Remote Signal Inputs: Capability to accept any of the following speed-setting input signals from the DDC system for HVAC or other control systems:
 - a. 0- to 10-V dc.
 - b. 4- to 20-mA dc.
 - c. Potentiometer using up/down digital inputs.
 - d. Fixed frequencies using digital inputs.
 - e. **<Insert signal input>**.
4. Output Signal Interface: A minimum of **[one]** **<Insert number>** programmable analog output signal(s) (**[0- to 10-V dc]** **[4- to 20-mA dc]** **[operator-selectable "x"- to "y"-mA dc]** **<Insert signal parameters>**), which can be configured for any of the following:

- a. Output frequency (Hz).
 - b. Output current (load).
 - c. DC-link voltage (V dc).
 - d. Motor torque (percent).
 - e. Motor speed (rpm).
 - f. Set point frequency (Hz).
 - g. **<Insert indication>**.
5. Remote Indication Interface: A minimum of **[two]** **<Insert number>** programmable dry-circuit relay outputs (120-V ac, 1 A) for remote indication of the following:
 - a. Motor running.
 - b. Set point speed reached.
 - c. Fault and warning indication (overtemperature or overcurrent).
 - d. PID high- or low-speed limits reached.
 - e. **<Insert indication>**.
- F. PID Control Interface: Provides closed-loop set point, differential feedback control in response to dual feedback signals. Allows for closed-loop control of fans and pumps for pressure, flow, or temperature regulation.
 1. Number of Loops: **[One]** **[Two]** **<Insert number>**.
- G. Interface with DDC System for HVAC: Factory-installed hardware and software shall interface with DDC system for HVAC to monitor, control, display, and record data for use in processing reports. VFC settings shall be retained within VFC's nonvolatile memory.
 1. Hardwired Points:
 - a. Monitoring: On-off status, **<Insert monitoring point>**.
 - b. Control: On-off operation, **<Insert control point>**.
 2. Communication Interface: Comply with **[ASHRAE 135]** **<Insert type of interface>**. Communication shall interface with DDC system for HVAC to remotely control and monitor lighting from a DDC system for HVAC operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the DDC system for HVAC.

2.5 LINE CONDITIONING AND FILTERING

- A. Input Line Conditioning: Based on the manufacturer's harmonic analysis study and report, provide input filtering, as required, to limit total demand (harmonic current) distortion and total harmonic voltage demand at the defined point of common coupling to meet IEEE 519 recommendations.
- B. Output Filtering: **<Insert requirements>**.

- C. EMI/RFI Filtering: CE marked; certify compliance with IEC 61800-3 for [Category C2] <Insert category>.
- D. EMI/RFI Filtering: <Insert requirements>.

2.6 BYPASS SYSTEMS

- A. Bypass Operation: Safely transfers motor between power converter output and bypass circuit, manually, automatically, or both. Selector switches set modes and indicator lights indicate mode selected. Unit is capable of stable operation (starting, stopping, and running) with motor completely disconnected from power converter.
- B. Bypass Mode: Manual operation only; requires local operator selection at VFC. Transfer between power converter and bypass contactor, and retransfer shall only be allowed with the motor at zero speed.
- C. Bypass Mode: Field-selectable automatic or manual, allows local and remote transfer between power converter and bypass contactor and retransfer, either via manual operator interface or automatic-control system feedback.
- D. Bypass Controller: Two-contactor-style bypass allows motor operation via the power converter or the bypass controller[; **with input isolating switch and barrier arranged to isolate the power converter and permit safe troubleshooting and testing, both energized and de-energized, while motor is operating in bypass mode**].
 - 1. Bypass Contactor: Load-break, [IEC] [NEMA]-rated contactor.
 - 2. Output Isolating Contactor: Non-load-break, [IEC] [NEMA]-rated contactor.
 - 3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
- E. Bypass Controller: Three-contactor-style bypass allows motor operation via the power converter or the bypass controller[; **with input isolating switch and barrier**] arranged to isolate the power converter input and output and permit safe testing[**and troubleshooting**] of the power converter, both energized and de-energized, while motor is operating in bypass mode.
 - 1. Bypass Contactor: Load-break, [IEC] [NEMA]-rated contactor.
 - 2. Input and Output Isolating Contactors: Non-load-break, [IEC] [NEMA]-rated contactors.
 - 3. Isolating Switch: Non-load-break switch arranged to isolate power converter and permit safe troubleshooting and testing of the power converter, both energized and de-energized, while motor is operating in bypass mode; pad-lockable, door-mounted handle mechanism.
- F. Bypass Contactor Configuration: [Full-voltage (across-the-line)] [Reduced-voltage (autotransformer)] <Insert type> type.

1. NORMAL/BYPASS selector switch.
2. HAND/OFF/AUTO selector switch.
3. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFC while the motor is running in the bypass mode.
4. Contactor Coils: Pressure-encapsulated type[**with coil transient suppressors**].
 - a. Operating Voltage: Depending on contactor NEMA size and line-voltage rating, manufacturer's standard matching control power or line voltage.
 - b. Power Contacts: Totally enclosed, double break, and silver-cadmium oxide; assembled to allow inspection and replacement without disturbing line or load wiring.
5. Control Circuits: [120] <Insert number>-V ac; obtained from [integral CPT, with **primary and secondary fuses**] <Insert source of control power>, with [CPT] [control power source] of sufficient capacity to operate all integral devices and remotely located pilot, indicating, and control devices.
 - a. CPT Spare Capacity: [50] [100] [200] <Insert number> VA.
6. Overload Relays: NEMA ICS 2.
 - a. Melting-Alloy Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) [Class 10] [Class 20] [Class 30] tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - b. Bimetallic Overload Relays:
 - 1) Inverse-time-current characteristic.
 - 2) [Class 10] [Class 20] [Class 30] tripping characteristic.
 - 3) Heaters in each phase matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 - 4) Ambient compensated.
 - 5) Automatic resetting.
 - c. Solid-State Overload Relays:
 - 1) Switch or dial selectable for motor-running overload protection.
 - 2) Sensors in each phase.
 - 3) [Class 10] [Class 20] [Class 10/20 selectable] tripping characteristic selected to protect motor against voltage and current unbalance and single phasing.
 - 4) Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
 - 5) Analog communication module.

- d. [NC] [NO] isolated overload alarm contact.
- e. External overload, reset push button.

2.7 OPTIONAL FEATURES

- A. Multiple-Motor Capability: VFC suitable for variable-speed service to multiple motors. Overload protection shuts down VFC and motors served by it, and generates fault indications when overload protection activates.
 - 1. Configure to allow two or more motors to operate simultaneously at the same speed; separate overload relay for each controlled motor.
 - 2. Configure to allow two motors to operate separately; operator selectable via local or remote switch or contact closures; single overload relay for both motors; separate output magnetic contactors for each motor.
 - 3. Configure to allow two motors to operate simultaneously and in a lead/lag mode, with one motor operated at variable speed via the power converter and the other at constant speed via the bypass controller; separate overload relay for each controlled motor.
- B. Damper control circuit with end-of-travel feedback capability.
- C. Sleep Function: Senses a minimal deviation of a feedback signal and stops the motor. On an increase in speed-command signal deviation, VFC resumes normal operation.
- D. Motor Preheat Function: Preheats motor when idle to prevent moisture accumulation in the motor.
- E. Firefighter's Override (Smoke Purge) Input: On a remote contact closure from **[the firefighter's control station] [smoke-control fan controller] <Insert location>**, this password-protected input:
 - 1. Overrides all other local and external inputs (analog/digital, serial communication, and all keypad commands).
 - 2. Forces VFC to operate motor, without any other run or speed command, at a field-adjustable, preset speed.
 - 3. Forces VFC to transfer to bypass mode and operate motor at full speed.
 - 4. Causes display of override mode on the VFC display.
 - 5. Reset VFC to normal operation on removal of override signal **[automatically] [manually]**.
- F. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- G. Remote digital operator kit.
- H. Communication Port: RS-232 port, USB 2.0 port, or equivalent connection capable of connecting a printer **[and a notebook computer]**.
- I. **<Insert feature>**.

2.8 ENCLOSURES

- A. VFC Enclosures: NEMA 250, to comply with environmental conditions at installed location.
 - 1. Dry and Clean Indoor Locations: **[Type 1]** <Insert type>.
 - 2. Outdoor Locations: **[Type 3R]** **[Type 4X]** <Insert type>.
 - 3. **[Kitchen]** **[Wash-Down]** Areas: **[Type 4X]** <Insert type>, **[stainless steel]** <Insert material>.
 - 4. Other Wet or Damp Indoor Locations: **[Type 4]** <Insert type>.
 - 5. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: Type 12.
 - 6. <Insert enclosure requirements>.
- B. Plenum Rating: UL 1995; NRTL certification label on enclosure, clearly identifying VFC as "Plenum Rated."

2.9 ACCESSORIES

- A. General Requirements for Control-Circuit and Pilot Devices: NEMA ICS 5; factory installed in VFC enclosure cover unless otherwise indicated.
 - 1. Push Buttons: **[Covered]** **[Lockable]** **[Shielded]** **[Unguarded]**.
 - 2. Pilot Lights: Push to test.
 - 3. Selector Switches: **[Rotary]** <Insert description> type.
 - 4. Stop and Lockout Push-Button Station: Momentary-break, push-button station with a factory-applied hasp arranged so padlock can be used to lock push button in depressed position with control circuit open.
- B. **[NC]** **[NO]** **[Reversible NC/NO]** bypass contactor auxiliary contact(s).
- C. Control Relays: Auxiliary and adjustable **[pneumatic]** **[solid-state]** time-delay relays.
- D. 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.
 - 1. Current Transformers: Continuous current rating, basic impulse insulating level (BIL) rating, burden, and accuracy class suitable for connected circuitry. Comply with IEEE C57.13.
- E. Supplemental Digital Meters:
 - 1. Elapsed-time meter.
 - 2. Kilowatt meter.
 - 3. Kilowatt-hour meter.
- F. Breather and drain assemblies, to maintain interior pressure and release condensation in NEMA 250, **[Type 4]** **[Type 4X]** **[Type 12]** <Insert type> enclosures installed

outdoors or in unconditioned interior spaces subject to humidity and temperature swings.

- G. Space heaters, with NC auxiliary contacts, to mitigate condensation in NEMA 250, [Type 3R] [Type 4X] [Type 12] <Insert type> enclosures installed outdoors or in unconditioned interior spaces subject to humidity and temperature swings.
- H. Cooling Fan and Exhaust System: For NEMA 250, [Type 1] [Type 12] <Insert enclosure type>; UL 508 component recognized: Supply fan, with [composite] [stainless-steel] <Insert material> intake and exhaust grills [and filters]; [120] <Insert number>-V ac; obtained from [integral CPT] <Insert source of control power>.
- I. Sun shields installed on fronts, sides, and tops of enclosures installed outdoors and subject to direct and extended sun exposure.
- J. Spare control-wiring terminal blocks[; unwired][; wired].
- K. <Insert accessory>.

2.10 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect VFCs according to requirements in [NEMA ICS 61800-2] <Insert standard>.
 - 1. Test each VFC while connected to [its specified motor] [a motor that is comparable to that for which the VFC is rated].
 - 2. Verification of Performance: Rate VFCs according to operation of functions and features specified.
- B. VFCs will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas, surfaces, and substrates to receive VFCs, with Installer present, for compliance with requirements for installation tolerances, <insert Project-specific conditions,> and other conditions affecting performance of the Work.
- B. Examine VFC before installation. Reject VFCs that are wet, moisture damaged, or mold damaged.
- C. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFC installation.

- D. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not on walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems."
- B. Floor-Mounting Controllers: Install VFCs on 4-inch (100-mm) nominal thickness concrete base. Comply with requirements for concrete base specified in **[Section 033000 "Cast-in-Place Concrete."]** **[Section 033053 "Miscellaneous Cast-in-Place Concrete."]**
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 - 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Roof-Mounting Controllers: Install VFC on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches (2000 mm) above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.
 - 1. Curbs and roof penetrations are specified in Section 077200 "Roof Accessories."
 - 2. Structural-steel channels are specified in Section 260529 "Hangers and Supports for Electrical Systems."
- D. Seismic Bracing: Comply with requirements 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 enclosures and components.
- F. Install fuses in each fusible-switch VFC.
- G. Install fuses in control circuits if not factory installed. Comply with requirements in Section 262813 "Fuses."

- H. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.
- I. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- J. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between VFCs and remote devices[**and facility's central-control system**]. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control devices where applicable.
 - 1. Connect selector switches to bypass only those manual- and automatic-control devices that have no safety functions when switches are in manual-control position.
 - 2. Connect selector switches with control 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.

3.4 IDENTIFICATION

- A. Identify VFCs, 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 VFC with engraved nameplate.
 - 3. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for VFCs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFC units.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: [**Owner will engage**] [**Engage**] a qualified testing agency to 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 tests and inspections[**with the assistance of a factory-authorized service representative**].
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each VFC element, bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Tests and Inspections:
 - 1. Inspect VFC, wiring, components, connections, and equipment installation.[**Test and adjust controllers, components, and equipment.**]
 - 2. Test insulation resistance for each VFC element, component, connecting motor supply, feeder, and control circuits.
 - 3. Test continuity of each circuit.
 - 4. Verify that voltages at VFC locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify **[Architect]** **[Construction Manager]** **[Owner]** before starting the motor(s).
 - 5. Test each motor for proper phase rotation.
 - 6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives 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 VFC. 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 VFC 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.
- F. VFCs will be considered defective if they do not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies the VFC and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

- A. **[Engage a factory-authorized service representative to perform] [Perform]** startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. **<Insert startup steps if any>**.

3.7 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.
- C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 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 **[Architect] [Construction Manager] [Owner]** before increasing settings.
- D. Set the taps on reduced-voltage autotransformer controllers.
- E. Set field-adjustable circuit-breaker trip ranges[**as specified in Section 260573.16 "Coordination Studies."**]
- F. Set field-adjustable pressure switches.

3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace VFCs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

- A. **[Engage a factory-authorized service representative to train] [Train]** Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFCs.

END OF SECTION 262923

SECTION 264313 - SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS

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 field-mounted SPDs for low-voltage (120 to 600 V) power distribution and control equipment.
- B. Related Requirements:
 - 1. Section 262416 "Panelboards". SPDs will not be provided installed in panel boards but shall be installed exterior to the panel board and connected to the panel board through a circuit breaker in the panel board. This specification applies to the SPD to be provided with every panel board. All panel boards shall be provide with a surge protective device.

1.3 DEFINITIONS

- A. Inominal: Nominal discharge current.
- B. MCOV: Maximum continuous operating voltage.
- C. Mode(s), also Modes of Protection: The pair of electrical connections where the VPR applies.
- D. MOV: Metal-oxide varistor; an electronic component with a significant non-ohmic current-voltage characteristic.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short-circuit current rating.
- G. SPD: Surge protective device.
- H. VPR: Voltage protection rating.

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. Copy of UL Category Code VZCA certification, as a minimum, listing the tested values for VPRs, Nominal ratings, MCOVs, type designations, OCPD requirements, model numbers, system voltages, and modes of protection.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For SPDs to include in maintenance manuals.

1.7 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to replace or replace SPDs that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL SPD REQUIREMENTS

- A. SPD with 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. Comply with UL 1449.
- D. MCOV of the SPD shall be the nominal system voltage.

2.2 PANEL SUPPRESSORS

- A. Acceptable manufacturer:
 - 1. Current Technologies

- B. SPDs: Comply with UL 1449, Type 2.
 - 1. Include LED indicator lights for power and protection status.
 - 2. Internal thermal protection that disconnects the SPD before damaging internal suppressor components.
 - 3. Include Form-C contacts rated at 5 A and 250-V ac, one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device.
- C. 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.
- D. Comply with UL 1283.
- E. 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:
 - 1. Line to Neutral: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
 - 2. Line to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
 - 3. Neutral to Ground: 1200 V for 480Y/277 V and 700 V for 208Y/120 V.
 - 4. Line to Line: 2000 V for 480Y/277 V and 1200 V for 208Y/120 V
- F. Protection modes and UL 1449 VPR for 240/120-V, single-phase, three-wire circuits shall not exceed the following:
 - 1. Line to Neutral: 700 V.
 - 2. Line to Ground: 700 V.
 - 3. Neutral to Ground: 700 V.
 - 4. Line to Line: 1200 V.
- G. SCCR: Equal or exceed 100 kA.
- H. Inominal Rating: 20 kA.

2.3 ENCLOSURES

- A. Indoor Enclosures: NEMA 250, Type 1.
- B. Outdoor Enclosures: NEMA 250, Type 3R.

2.4 CONDUCTORS AND CABLES

- A. Power Wiring: Same size as SPD leads, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

- B. Class 2 Control Cables: Multiconductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Class 1 Control Cables: Multiconductor cable with copper conductors not smaller than No. 14 AWG, complying with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install an OCPD or disconnect as required to comply with the UL listing of the SPD.
- C. Install SPDs with conductors between suppressor and points of attachment as short and straight as possible, and adjust circuit-breaker positions to achieve shortest and straightest leads. Do not splice and extend SPD leads unless specifically permitted by manufacturer. Do not exceed manufacturer's recommended lead length. Do not bond neutral and ground.
- D. Use crimped connectors and splices only. Wire nuts are unacceptable.
- E. Wiring:
 - 1. Power Wiring: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 2. Controls: Comply with wiring methods in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative.
 - 1. Compare equipment nameplate data for compliance with Drawings and Specifications.
 - 2. Inspect anchorage, alignment, grounding, and clearances.
 - 3. Verify that electrical wiring installation complies with manufacturer's written installation requirements.
- B. An SPD will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

SECTION 265119 - 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 the following types of LED luminaires:

1. Cylinder.
2. Downlight.
3. Linear industrial.
4. Recessed, linear.
5. Strip light.
6. Surface mount, linear.
7. Surface mount, nonlinear.
8. Suspended, linear.
9. Suspended, nonlinear.

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 IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.

- 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.

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. 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 minimum scale shall be ¼ inch, equal 1 foot 0 inches on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. 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. Fire alarm system detectors.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

- C. Seismic Qualification Data: 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.
 - 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.
- D. Product Certificates: For each type of luminaire.
- E. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.
- F. 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 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.
 - 1. Lamps: Ten 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. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

- D. Mockups: For interior 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."
- C. Ambient Temperature: 5 to 104 deg F (Minus 15 to plus 40 deg C).
1. Relative Humidity: Zero to 95 percent.
- D. Altitude: Sea level to 5000 feet (1500 m).

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. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. 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.
- C. Recessed luminaires shall comply with NEMA LE 4.
- D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- F. California Title 24 compliant.

2.3 Light Fixtures shall be as scheduled in the light fixture schedule on the drawings.

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. Steel:
 - 1. ASTM A 36/A 36M for carbon structural steel.
 - 2. ASTM A 568/A 568M for sheet steel.
- C. Stainless Steel:
 - 1. 1. Manufacturer's standard grade.
 - 2. 2. Manufacturer's standard type, ASTM A 240/240 M.
- D. Galvanized Steel: ASTM A 653/A 653M.

- E. Aluminum: ASTM B 209.

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 SUPPORT

- A. Comply with requirements in Section 260529 "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 gage (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.

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 luminaire installation.
- C. 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. Install lamps in each luminaire.
- D. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 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 a vertical force of 400 percent of luminaire weight.
- E. Flush-Mounted Luminaires:
 - 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.
- F. Wall-Mounted Luminaires:
 - 1. Attached to structural members in walls.
 - 2. Do not attach luminaires directly to gypsum board.
- G. Suspended Luminaires:
 - 1. Ceiling Mount:
 - a. Two 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
 - b. Pendant mount and Four-point pendant mount as require by the fixture being installed with 5/32-inch- (4-mm-) diameter aircraft cable supports adjustable to 10 feet (3 m) in length.
 - c. Hook mount.
 - 2. Pendants and Rods: Where longer than 48 inches (1200 mm), brace to limit swinging.
 - 3. 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.
 - 4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and tubing or rod or wire support for suspension for each unit length of luminaire chassis, including one at each end.

5. 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 260519 "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 260553 "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 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 lamps or 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 265119

SECTION 270536 - CABLE TRAYS FOR COMMUNICATIONS 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. Ladder cable tray.
2. Wire-mesh cable tray.
3. Single-rail cable tray.
4. Warning signs.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of cable tray.

1. Include data indicating dimensions and finishes for each type of cable tray indicated.

- B. Shop Drawings: For each type of cable tray.

1. Show fabrication and installation details of cable trays, including plans, elevations, and sections of components and attachments to other construction elements. Designate components and accessories, including clamps, brackets, hanger rods, splice-plate connectors, expansion-joint assemblies, straight lengths, and fittings.
2. Cable tray layout, showing cable tray route to scale, minimum scale shall be ¼ inch equals 1 foot 0 inches, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
 - a. Vertical and horizontal offsets and transitions.
 - b. Clearances for access above and to sides of cable trays.
 - c. Vertical elevation of cable trays above the floor or bottom of ceiling structure.
 - d. Load calculations to show dead and live loads as not exceeding manufacturer's rating for tray and its support elements.

- C. Delegated-Design Submittal: For seismic restraints.

1. Seismic-Restraint Details: Signed and sealed by a qualified professional engineer, licensed in the state where Project is located, who is responsible for their preparation.
2. Design Calculations: Calculate requirements for selecting seismic restraints.
3. Detail fabrication, including anchorages and attachments to structure and to supported cable trays.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans and sections, drawn to scale with scale of $\frac{1}{4}$ inch equals 1 foot 0 inches, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 1. Scaled cable tray layout and relationships between components and adjacent structural, electrical, and mechanical elements.
 2. Vertical and horizontal offsets and transitions.
 3. Clearances for access above and to side of cable trays.
 4. Vertical elevation of cable trays above the floor or below bottom of ceiling structure.
- B. Seismic Qualification Data: Certificates, for cable trays, 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.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cable tray supports and seismic bracing.
- B. Seismic Performance: Cable trays and supports shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
 1. The term "withstand" means "the cable trays will remain in place without separation of any parts when subjected to the seismic forces specified."
 2. Component Importance Factor: 1.5.

- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes in cable tray installed outdoors.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material.

2.2 GENERAL REQUIREMENTS FOR CABLE TRAYS

- A. Cable Trays and Accessories: Identified as defined in NFPA 70 and marked for intended location, application, and grounding.

1. Source Limitations: Obtain cable trays and components from single manufacturer.

- B. Sizes and Configurations: See the Cable Tray Schedule on Drawings for specific requirements for types, materials, sizes, and configurations.

- C. Structural Performance: See articles for individual cable tray types for specific values for the following parameters:

1. Uniform Load Distribution: Capable of supporting a uniformly distributed load on the indicated support span when supported as a simple span and tested according to NEMA VE 1.
2. Concentrated Load: A load applied at midpoint of span and centerline of tray.
3. Load and Safety Factors: Applicable to both side rails and rung capacities.

2.2 LADDER CABLE TRAY

- A. Acceptable manufacturers:

1. MP Husky USA Cable Tray & Cable Bus.
2. Legrand US.
3. B-Line, an Eaton Business

- B. Description:

1. Configuration: Two longitudinal side rails with transverse rungs swaged or welded to side rails, complying with NEMA VE 1.
2. Width: **18 inches (450 mm)** unless otherwise indicated on Drawings.
3. Minimum Usable Load Depth: **6 inches (150 mm)**.
4. Straight Section Lengths: 10 feet (3.0 m), except where shorter lengths are required to facilitate tray assembly.
5. Rung Spacing: 6 inches (150 mm) o.c.
6. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
7. Minimum Cable-Bearing Surface for Rungs: 7/8-inch (22-mm) width with radius edges.
8. No portion of the rungs shall protrude below the bottom plane of side rails.
9. Structural Performance of Each Rung: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.

10. Fitting Minimum Radius: 12 inches (300 mm).
11. Class Designation: Comply with NEMA VE 1, Class 10AA.
12. Splicing Assemblies: Bolted type using serrated flange locknuts.
13. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

C. Materials and Finishes:

1. Aluminum:
 - a. Materials: Alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 according to ANSI H35.1/H 35.1M for fabricated parts.
 - b. Hardware: Chromium-zinc-plated steel, ASTM F 1136.

2.3 WIRE-MESH CABLE TRAY

A. Acceptable manufacturers:

1. MP Husky USA Cable Tray & Cable Bus.
2. Legrand US.
3. B-Line, an Eaton Business

B. Description:

1. Configuration: Galvanized- steel wire mesh, complying with NEMA VE 1.
2. Width: 18 inches (450 mm) unless otherwise indicated on Drawings.
3. Minimum Usable Load Depth: 6 inches (150 mm).
4. Straight Section Lengths: 10 feet (3.0 m), except where shorter lengths are required to facilitate tray assembly.
5. Structural Performance: Capable of supporting a maximum cable load, with a safety factor of 1.5, plus a 200-lb (90-kg) concentrated load, when tested according to NEMA VE 1.
6. Class Designation: Comply with NEMA VE 1, Class 10AA.
7. Splicing Assemblies: Bolted type using serrated flange locknuts.
8. Splice-Plate Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.

C. Materials and Finishes:

1. Steel:
 - a. Straight Sections and Fittings: Steel complies with the minimum mechanical properties of ASTM A 1008/A 1008M, Grade 33, Type 2.
 - b. Steel Tray Splice Plates: ASTM A 1011/A 1011M, HSLAS, Grade 50, Class 1.
 - c. Fasteners: Steel complies with the minimum mechanical properties of ASTM A 510/A 510M, Grade 1008.
 - d. Finish: Hot-dip galvanized after fabrication, complying with ASTM A123/A123 M, Class B2.

- 1) Hardware: Chromium-zinc plated, ASTM F 1136.
- e. Finish: Hot-dip galvanized after fabrication, complying with ASTM A 653/A 653M, G90 (Z275).
 - 1) Hardware: Chromium-zinc plated, ASTM F 1136.
- f. Finish: Electrogalvanized after fabrication, complying with ASTM B 633.
 - 1) Hardware: Galvanized, ASTM B 633.

2.4 SINGLE-RAIL CABLE TRAY

A. Acceptable manufacturers:

- 1. MP Husky USA Cable Tray & Cable Bus.
- 2. Legrand US.
- 3. B-Line, an Eaton Business

B. Description:

- 1. Configuration: An extruded-aluminum assembly, consisting of a single longitudinal center rail with transverse rungs arranged symmetrically about the center rail complying with NEMA VE 1.
- 2. Construction: Aluminum rungs mechanically connected to aluminum center rail in at least two places, with ends finished to protect installers and cables.
- 3. Width: 18 inches (450 mm) unless otherwise indicated on Drawings.
- 4. Minimum Usable Load Depth: 6 inches (150 mm).
- 5. Straight Section Lengths: 10 feet (3.0 m), except where shorter lengths are required to facilitate tray assembly.
- 6. Rung Spacing: 6 inches (150 mm) o.c.
- 7. Radius-Fitting Rung Spacing: 9 inches (225 mm) at center of tray's width.
- 8. Support Point: Splice fittings shall be hanger support point.
- 9. Support Spacing: Support each section at midpoint. Support wall-mounted sections a maximum of one-sixth of the section length from each end.
- 10. Class Designation: Comply with NEMA VE 1, Class 10AA.
- 11. Unbalanced Loads: Maintain cable tray rungs within six degrees of horizontal under all loading conditions.
- 12. Splicing Assemblies: Bolted type using serrated flange locknuts.
- 13. Splicing Assembly Capacity: Splices located within support span shall not diminish rated loading capacity of cable tray.
- 14. Splices and Connectors: Protect cables from edges of center rail and do not intrude into cable fill area.

C. Materials: Aluminum alloy 6063-T6 according to ANSI H35.1/H 35.1M for extruded components, and Alloy 5052-H32 according to ANSI H35.1/H 35.1M for fabricated parts.

D. Hardware: Chromium-zinc-plated steel, ASTM F 1136.

2.5 CABLE TRAY ACCESSORIES

- A. Fittings: Tees, crosses, risers, elbows, and other fittings as indicated, of same materials and finishes as cable tray.
- B. Barrier Strips: Same materials and finishes as for cable tray.
- C. Cable tray supports and connectors, including bonding jumpers, as recommended by cable tray manufacturer.

2.6 WARNING SIGNS

- A. Comply with requirements for identification in Section 270553 "Identification for Communications Systems."
- B. Lettering: 1-1/2-inch- (40-mm-) high, black letters on yellow background with legend "Warning! Not To Be Used as Walkway, Ladder, or Support for Ladders or Personnel."

2.7 SOURCE QUALITY CONTROL

- A. Testing: Test and inspect cable trays according to NEMA VE 1.

PART 3 - EXECUTION

3.1 CABLE TRAY INSTALLATION

- A. Install cable trays according to NEMA VE 2.
- B. Install cable trays as a complete system, including fasteners, hold-down clips, support systems, barrier strips, adjustable horizontal and vertical splice plates, elbows, reducers, tees, crosses, cable dropouts, adapters, covers, and bonding.
- C. Install cable trays so that the tray is accessible for cable installation and all splices are accessible for inspection and adjustment.
- D. Remove burrs and sharp edges from cable trays.
- E. Join aluminum cable tray with splice plates; use four square neck-carriage bolts and locknuts.
- F. Fasten cable tray supports to building structure and install seismic restraints.
- G. Design fasteners and supports to carry cable tray, the cables, and a concentrated load of 200 lb (90 kg). Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems." Comply with seismic-restraint details according to Section 260548.16 "Seismic Controls for Electrical Systems."

- H. Place supports so that spans do not exceed maximum spans on schedules and provide clearances shown on Drawings. Install intermediate supports when cable weight exceeds the load-carrying capacity of the tray rungs.
- I. Construct supports from channel members, threaded rods, and other appurtenances furnished by cable tray manufacturer. Arrange supports in trapeze or wall-bracket form as required by application.
- J. Support cable tray assembly to prevent twisting from eccentric loading.
- K. Install center-hung supports for single-rail trays designed for 60 versus 40 percent eccentric loading condition, with a safety factor of 3.
- L. Locate and install supports according to NEMA VE 2. Do not install more than one cable tray splice between supports.
- M. Support center support hangers for wire-basket trays with 3/8-inch- (10-mm-) diameter rods.
- N. Install expansion connectors where cable trays cross building expansion joints and in cable tray runs that exceed dimensions recommended in NEMA VE 2. Space connectors and set gaps according to applicable standard.
- O. Make changes in direction and elevation using manufacturer's recommended fittings.
- P. Make cable tray connections using manufacturer's recommended fittings.
- Q. Seal penetrations through fire and smoke barriers. Comply with requirements in Section 078413 "Penetration Firestopping."
- R. Install capped metal sleeves for future cables through firestop-sealed cable tray penetrations of fire and smoke barriers.
- S. Install cable trays with enough workspace to permit access for installing cables.
- T. Install warning signs in visible locations on or near cable trays after cable tray installation.

3.2 CABLE TRAY GROUNDING

- A. Ground cable trays according to NFPA 70 unless additional grounding is specified. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Cable trays shall be bonded together with splice plates listed for grounding purposes or with listed bonding jumpers.
- C. Bond cable trays to power source for cables contained within with bonding conductors sized according to NFPA 70, Article 250.122, "Size of Equipment Grounding Conductors."

3.3 CABLE INSTALLATION

- A. Install cables only when each cable tray run has been completed and inspected.
- B. Fasten cables on horizontal runs with cable clamps or cable ties according to NEMA VE 2. Tighten clamps only enough to secure the cable, without indenting the cable jacket. Install cable ties with a tool that includes an automatic pressure-limiting device.
- C. Fasten cables on vertical runs to cable trays every 18 inches (450 mm).
- D. Fasten and support cables that pass from one cable tray to another or drop from cable trays to equipment enclosures. Fasten cables to the cable tray at the point of exit and support cables independent of the enclosure. The cable length between cable trays or between cable tray and enclosure shall be no more than 48 inches.

3.4 CONNECTIONS

- A. Connect pathways to cable trays according to requirements in NEMA VE 2 and NEMA FG 1.

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. After installing cable trays and after electrical circuitry has been energized, survey for compliance with requirements.
 - 2. Visually inspect cable insulation for damage. Correct sharp corners, protuberances in cable trays, vibrations, and thermal expansion and contraction conditions, which may cause or have caused damage.
 - 3. Verify that the number, size, and voltage of cables in cable trays do not exceed that permitted by NFPA 70. Verify that communications or data-processing circuits are separated from power circuits by barriers or are installed in separate cable trays.
 - 4. Verify that there are no intruding items such as pipes, hangers, or other equipment in the cable tray.
 - 5. Remove dust deposits, industrial process materials, trash of any description, and any blockage of tray ventilation.
 - 6. Visually inspect each cable tray joint and each ground connection for mechanical continuity. Check bolted connections between sections for corrosion. Clean and retorque in suspect areas.
 - 7. Check for improperly sized or installed bonding jumpers.
 - 8. Check for missing, incorrect, or damaged bolts, bolt heads, or nuts. When found, replace with specified hardware.
 - 9. Perform visual and mechanical checks for adequacy of cable tray grounding; verify that all takeoff raceways are bonded to cable trays. Test entire cable tray system for continuity. Maximum allowable resistance is 1 ohm.

- B. Prepare test and inspection reports.

3.6 PROTECTION

- A. Protect installed cable trays and cables.

1. Install temporary protection for cables in open trays to safeguard exposed cables against falling objects or debris during construction. Temporary protection for cables and cable tray can be constructed of wood or metal materials and shall remain in place until the risk of damage is over.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by cable tray manufacturer.

END OF SECTION 270536

SECTION 271500 - COMMUNICATIONS 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.

1.2 SUMMARY

- A. Section Includes:

1. UTP cabling.
2. 50/125-micrometer, optical fiber cabling.
3. Coaxial cable.
4. Multiuser telecommunications outlet assemblies.
5. Cable connecting hardware, patch panels, and cross-connects.
6. Telecommunications outlet/connectors.
7. Cabling system identification products.
8. Cable management system.

- B. Related Requirements:

1. Section 280513 "Conductors and Cables for Electronic Safety and Security" for voice and data cabling associated with system panels and devices.

1.3 DEFINITIONS

- A. BICSI: Building Industry Consulting Service International.
- B. Consolidation Point: A location for interconnection between horizontal cables extending from building pathways and horizontal cables extending into furniture pathways.
- C. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
- D. EMI: Electromagnetic interference.
- E. IDC: Insulation displacement connector.
- F. LAN: Local area network.

- G. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors.
- H. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
- I. RCDD: Registered Communications Distribution Designer.
- J. UTP: Unshielded twisted pair.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of telecommunications cabling with Owner's telecommunications and LAN equipment and service suppliers.
- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software. Labeling shall be in accordance with McLeod information systems direction.
 - 2. Cabling administration drawings and printouts.
 - 3. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 - 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
- C. Samples: For workstation outlets, jacks, jack assemblies, in specified finish, one for each size and outlet configuration and faceplates for color selection and evaluation of technical features.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer, qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For splices and connectors to include in maintenance manuals.
- B. Software and Firmware Operational Documentation:
 - 1. Software operating and upgrade manuals.
 - 2. Program Software Backup: On magnetic media or compact disk, complete with data files.
 - 3. Device address list.
 - 4. Printout of software application and graphic screens.

1.8 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. Patch-Panel Units: One of each type.
 - 2. Connecting Blocks: One of each type.
 - 3. Device Plates: One of each type.
 - 4. Multiuser Telecommunications Outlet Assemblies: One of each type.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
 - 1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 - 2. Installation Supervision: Installation shall be under the direct supervision of Registered Technician, who shall be present at all times when Work of this Section is performed at Project site.
 - 3. Testing Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.
- B. Testing Agency Qualifications: An NRTL.

1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.
 1. Test optical fiber cables to determine the continuity of the strand end to end. Use optical fiber flashlight or optical loss test set.
 2. Test optical fiber cables while on reels. Use an optical time domain reflectometer to verify the cable length and locate cable defects, splices, and connector; including the loss value of each. Retain test data and include the record in maintenance data.
 3. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLING DESCRIPTION

- A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called a "permanent link," a term that is used in the testing protocols.
 1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
 2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
 3. Bridged taps and splices shall not be installed in the horizontal cabling.
 4. Splitters shall not be installed as part of the optical fiber cabling.
- B. A work area is approximately 100 sq. ft., and includes the components that extend from the telecommunications outlet/connectors to the station equipment.
- C. The maximum allowable horizontal cable length is 295 feet. This maximum allowable length does not include an allowance for the length of 16 feet to the workstation equipment or in the horizontal cross-connect.

2.2 PERFORMANCE REQUIREMENTS

- A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1 when tested according to test procedures of this standard.

- B. 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-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- 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. Grounding: Comply with J-STD-607-A.

2.3 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements in Section 061000 "Rough Carpentry" for plywood backing panels.

2.4 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements and the latest McLeod information systems cabling requirements, provide products by one of the following unless updated McLeod information systems has issued a more recent cabling specification:
 - 1. Berk-Tek (Landmark 1000); a Nexans company.
 - 2. Mohawk (Advancenet); a division of Belden Networking, Inc.
- B. Description: 100-ohm, four-pair UTP, formed into 25-pair, binder groups covered with a blue thermoplastic jacket in the following colors:
 - 1. Normal Data: Lime Green.
 - 2. Bio Med Data: Yellow.
 - 3. Voice: White
 - 4. Speakers: Orange
 - 5. Access Control: Yellow.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-B.1 for performance specifications.
 - c. Comply with TIA/EIA-568-B.2, Category 6.
 - d. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Type requirements in subparagraphs below are minimum requirements and may be revised to suit Project. Retain options if "permitted substitutions," as defined in NFPA 70, are appropriate for this Project.
 - 2) Communications, General Purpose: Type CMP or CMG in metal raceway.

- 3) Communications, Plenum Rated: Type CMP, complying with NFPA 262.
- 4) Communications, Riser Rated: Type CMR, or CMP, complying with UL 1666.
- 5) Communications, Limited Purpose: Type CMX in metal raceways.

2.5 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements and the latest McLeod information systems cabling requirements, provide products by the following unless updated McLeod information systems has issued a more recent cabling specification:
 1. Ortronics Series II.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6 for voice and data, 66-style IDC for Category 5e for speakers. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.
 1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
 1. Number of Jacks per Field: One for each four-pair UTP cable indicated.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in 48-inch 1200-mm lengths; terminated with eight-position modular plug at each end.
 1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.
 2. Patch cords shall have color-coded boots for circuit identification.

2.6 OPTICAL FIBER CABLE

- A. Manufacturers: Subject to compliance with requirements and the latest McLeod information systems cabling requirements, provide products by the following: unless updated McLeod information systems has issued a more recent cabling specification
 - 1. Ortronics Series II.
- B. Description: Armored, single mode loose tube indoor/outdoor 50/125-micrometer, 24-fiber, tight buffer, optical fiber cable.
 - 1. Comply with ICEA S-83-596 for mechanical properties.
 - 2. Comply with TIA/EIA-568-B.3 for performance specifications.
 - 3. Comply with TIA-492AAAB for detailed specifications.
 - 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651, and NFPA 70 for the following types:
 - a. General Purpose, Nonconductive: Type OFN or OFNG, or OFNR, OFNP.
 - b. Plenum Rated, Nonconductive: Type OFNP, complying with NFPA 262.
 - c. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - d. General Purpose, Conductive: Type OFC or OFCG; or OFNG, OFN, OFCR, OFNR, OFCP, or OFNP.
 - e. Plenum Rated, Conductive: Type OFCP or OFNP, complying with NFPA 262.
 - f. Riser Rated, Conductive: Type OFCR; or OFNR, OFCP, or OFNP, complying with UL 1666.
 - 5. Conductive cable shall be steel armored type.
 - 6. Maximum Attenuation: 3.50 dB/km at 850 nm; 1.5 dB/km at 1300 nm.
 - 7. Minimum Modal Bandwidth: 160 MHz-km at 850 nm; 500 MHz-km at 1300 nm.
- C. Jacket:
 - 1. Jacket Color: Aqua for 50/125-micrometer cable.
 - 2. Cable cordage jacket, fiber, unit, and group color shall be according to TIA-598-C.
 - 3. Imprinted with fiber count, fiber type, and aggregate length at regular intervals not to exceed 40 inches.

2.7 OPTICAL FIBER CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements and the latest McLeod information systems cabling requirements, provide products by the following and the latest McLeod information systems cabling requirements:
 - 1. Ortronics Series II.

- B. Cross-Connects and Patch Panels: Modular panels housing multiple-numbered, duplex cable connectors.
 - 1. Number of Connectors per Field: One for each fiber of cable or cables assigned to field, plus spares and blank positions adequate to suit specified expansion criteria.
- C. Patch Cords: Factory-made, dual-fiber cables in 36-inch lengths.
- D. Cable Connecting Hardware:
 - 1. Comply with Optical Fiber Connector Intermateability Standards (FOCIS) specifications of TIA-604-2-B, TIA-604-3-B, and TIA/EIA-604-12. Comply with TIA/EIA-568-B.3.
 - 2. Quick-connect, simplex and duplex, Type LC connectors. Insertion loss not more than 0.75 dB.
 - 3. Type SFF connectors may be used in termination racks, panels, and equipment packages.

2.8 COAXIAL CABLE

- A. RG-6 – Commscope 2279V; RG-11 – Commscope F11TSV; Flex-500 CommScope 2312V Plen Trunk 2400.
- B. Cable Characteristics: Broadband type, recommended by cable manufacturer specifically for broadband data transmission applications. Coaxial cable and accessories shall have 75-ohm nominal impedance with a return loss of 20 dB maximum from 7 to 806 MHz.
- C. RG-11/U: NFPA 70, Type CATV.
 - 1. No. 14 AWG, solid, copper-covered steel conductor.
 - 2. Gas-injected, foam-PE insulation.
 - 3. Double shielded with 100 percent aluminum polyester tape and 60 percent aluminum braid.
 - 4. Jacketed with sunlight-resistant, black PVC or PE.
 - 5. Suitable for outdoor installations in ambient temperatures ranging from minus 40 to plus 85 deg C.
- D. RG-6/U: NFPA 70, Type CATV or CM.
 - 1. No. 16 AWG, solid, copper-covered steel conductor; gas-injected, foam-PE insulation.
 - 2. Double shielded with 100 percent aluminum-foil shield and 60 percent aluminum braid.
 - 3. Jacketed with black PVC or PE.
 - 4. Suitable for indoor installations.

- E. NFPA and UL compliance, listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 1655 and with NFPA 70 "Radio and Television Equipment" and "Community Antenna Television and Radio Distribution" Articles. Types are as follows:

1. CATV Cable: Type CATV, or CATVP or CATVR.
2. CATV Plenum Rated: Type CATVP, complying with NFPA 262.
3. CATV Riser Rated: Type CATVR, complying with UL 1666.
4. CATV Limited Rating: Type CATVX.

2.9 COAXIAL CABLE HARDWARE

- A. CommScope SV2 2-Way Splitter; CommScope SVF59TG F-Type Connector; CommScope SVF59TG Wall Plate
- B. Coaxial-Cable Connectors: Type BNC, 75 ohms.

2.10 CONSOLIDATION POINTS

- A. CommScope
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.
1. Number of Terminals per Field: One for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. One for each four-pair UTP cable indicated.
 - b. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
 3. Mounting: Recessed in ceiling.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.11 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: Two-port-connector assemblies mounted in single faceplate.
1. Plastic Faceplate: High-impact plastic. Coordinate color with Section 262726 "Wiring Devices."
 2. For use with snap-in jacks accommodating any combination of UTP, optical fiber, and coaxial work area cords.

- a. Flush mounting jacks, positioning the cord at a 45-degree angle.
- 3. Legend: As required by McLeod information systems.
- 4. Legend: Machine printed, in the field, using adhesive-tape label.
- 5. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.12 GROUNDING

- A. Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems" for grounding conductors and connectors.
- B. Comply with J-STD-607-A.

2.13 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.14 CABLE MANAGEMENT SYSTEM

- A. As required by McLeod information systems.
- B. Description: Computer-based cable management system, with integrated database and graphic capabilities.
- C. Document physical characteristics by recording the network, TIA/EIA details, and connections between equipment and cable.
- D. Information shall be presented in database view, schematic plans, or technical drawings.
 - 1. Microsoft Visio Professional and AutoCAD drawing software shall be used as drawing and schematic plans software.
- E. System shall interface with the following testing and recording devices:
 - 1. Direct upload tests from circuit testing instrument into the personal computer.
 - 2. Direct download circuit labeling into labeling printer.

2.15 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Factory test UTP and optical fiber cables on reels according to TIA/EIA-568-B.1.

- C. Factory test UTP cables according to TIA/EIA-568-B.2.
- D. Factory test multimode optical fiber cables according to TIA-526-14-A and TIA/EIA-568-B.3.
- E. Factory-sweep test coaxial cables at frequencies from 5 MHz to 1 GHz. Sweep test shall test the frequency response, or attenuation over frequency, of a cable by generating a voltage whose frequency is varied through the specified frequency range and graphing the results.
- F. Cable will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Install cables in pathways and cable trays except within consoles, cabinets, desks, and counters. Conceal pathways and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements in Section 270528 "Pathways for Communications Systems."
 - 3. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
- B. Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii.
 - 2. Install lacing bars and distribution spools.
 - 3. Install conductors parallel with or at right angles to sides and back of enclosure.

3.3 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:

1. Comply with TIA/EIA-568-B.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Install 110-style IDC termination hardware unless otherwise indicated.
4. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet from communications equipment room.
5. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.
6. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
8. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
9. Do not install bruised, kinked, scored, deformed, or abraded 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.
10. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
11. In the communications equipment room, install a 10-foot-long service loop on each end of cable.
12. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch from the point of termination to maintain cable geometry.

D. Optical Fiber Cable Installation:

1. Comply with TIA/EIA-568-B.3.
2. Cable may be terminated on connecting hardware that is rack or cabinet mounted.

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.

2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 48 inches apart.
 3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.
- F. Group connecting hardware for cables into separate logical fields.
- G. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA-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 electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
 5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches.
 6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.5 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 4 AWG grounding electrode conductor from grounding bus bar to suitable electrical building ground.
- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.6 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
 - 1. Administration Class: 3.
 - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. 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.
- C. Comply with requirements in Section 099123 "Interior Painting" for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- D. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A for Class 3 level of administration, including optional identification requirements of this standard.
- 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 closets, 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-A. Furnish electronic record of all drawings, in software and format selected by Owner.

G. Cable and Wire Identification:

1. Label each cable within 4 inches of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
2. 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.
3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet.
4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. 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 device as shown.
 - b. Label each unit and field within distribution racks and frames.
5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.

H. Labels shall be as required by McLeod information systems requirements but still comply with requirements in TIA/EIA-606-A.

1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency:** Engage a qualified testing agency to 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. Visually inspect 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-B.1.
 2. Visually confirm Category 6, marking of outlets, cover plates, outlet/connectors, and patch panels.
 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.

4. Test UTP backbone 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.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. Optical Fiber Cable Tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.1. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - b. Link End-to-End Attenuation Tests:
 - 1) Horizontal and multimode backbone link measurements: Test at 850 or 1300 nm in 1 direction according to TIA-526-14-A, Method B, One Reference Jumper.
 - 2) Attenuation test results for backbone links shall be less than 2.0 dB. Attenuation test results shall be less than that calculated according to equation in TIA/EIA-568-B.1.
6. UTP Performance Tests:
 - a. Test for each outlet. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.
 - 10) Delay skew.
7. Optical Fiber Cable Performance Tests: Perform optical fiber end-to-end link tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.3.
8. Coaxial Cable Tests: Conduct tests according to Section 274133 "Master Antenna Television System."
9. Final Verification Tests: Perform verification tests for UTP and optical fiber systems after the complete communications cabling and workstation outlet/connectors are installed.

- a. Voice Tests: These tests assume that dial tone service has been installed. Connect to the network interface device at the demarcation point. Go off-hook and listen and receive a dial tone. If a test number is available, make and receive a local, long distance, and digital subscription line telephone call.
 - b. Data Tests: These tests assume the Information Technology Staff has a network installed and is available to assist with testing. Connect to the network interface device at the demarcation point. Log onto the network to ensure proper connection to the network.
- D. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- E. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.

3.8 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel in cable-plant management operations, including changing signal pathways for different workstations, rerouting signals in failed cables, and keeping records of cabling assignments and revisions when extending wiring to establish new workstation outlets. Include training in cabling administration software.

END OF SECTION 271500

SECTION 275223 - NURSE CALL/CODE BLUE SYSTEMS

PART 1 - GENERAL

- 1.1 The work of this project is the build out of the fourth floor of the McLeod Health Seacoast bed tower. The existing nurse call system presently installed in the bed tower is a Rauland Responder V. The nurse call system to be installed on the build out project is to also Rauland responder V.
- 1.2 RELATED DOCUMENTS
- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.3 SUMMARY
- A. Section includes audiovisual/voice nurse-call system.
- 1.4 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 equipment cabinets and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 2. Cabling Diagrams: Single-line block diagrams showing cabling interconnection of all components for this specific equipment. Include cable type for each interconnection.
 3. Station Installation Details: For built-in equipment, dimensioned and to scale.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.
- C. Warranty: Sample of special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For nurse-call equipment 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. Lamps: All colors for corridor dome lights and zone lights equal to 20 percent of amount installed.
 - 2. Fuses: One for every 10 of each type and rating, but no fewer than 5 of each.
 - 3. Printed Circuit Boards: Each kind, equal to 10 percent of amount installed, but no fewer than one unit.
 - 4. Master-Station Privacy Handset: One.
 - 5. System program backup software.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project.
- B. Compatibility: System shall be capable of integration with any brand of phone system (wired or wireless), staff locating system, CCTV, and fire-alarm system.
- C. Electrical Components, Devices, and Accessories: Listed and labeled according to UL 1069 as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.9 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace batteries that fail in materials or workmanship within specified warranty period. Special warranty for batteries applies to materials only, on a prorated basis for specified period.
 - 1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:
 - a. Nickel-Cadmium Batteries, Lithium Batteries, and Wet-Cell Batteries:
 - 1) Full Warranty: Five years.
 - 2) Pro Rata: 15 years.

1.10 SOFTWARE SERVICE AGREEMENT

- A. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- B. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 NURSE-CALL SYSTEM GENERAL REQUIREMENTS

- A. Station Zones: Able to program 256 station zones for each master station in the network with eight priority levels and addressable visual and audible annunciation of audible devices such as smoke detectors and door contacts.
- B. System shall provide integrated and centralized "Code Blue" and "Staff Emergency" calls.
- C. Expansion Capability: Equipment ratings, housing volume, spare keys, switches, relays, annunciator modules, terminals, and cable conductor quantities adequate to increase the number of stations in the future by 25 percent above those indicated without adding internal or external components or main trunk cable conductors.
- D. Existing System Compatibility: Functionally and electrically compatible with existing system on the existing floors of the bed tower components and wiring operate as an extension or upgrade of the existing system and existing or upgraded functional performance of the existing system applies to the entire final system. Colors, tones, types, and durations of signal manifestation shall be common among new and existing systems.
- E. Resistance to Electrostatic Discharge: System, components, and cabling, and the selection, arrangement, and connection of materials and circuits, shall be protected against damage or diminished performance when subjected to electrostatic discharges of up to 25,000 V in an environment with a relative humidity of 20 percent or less.
- F. Equipment: Microprocessor, electronic, modular.
- G. Master Nurse-Call Station: Programmed via a PC.
- H. Wall-Mounted Component Connection Method: Components connect to system wiring in back boxes with factory-wired plug connectors.

- I. Telephone Interface: Permit use of wired and wireless telephones to execute nurse-call master station functions.
- J. Third-Party Pager Interface: Programmable to send tone, numeric, and alphanumeric message to pocket pagers or personal digital assistants and to use industry standard-protocol, RS-485 interface.

2.2 AUDIOVISUAL/VOICE NURSE-CALL SYSTEM

A. The nurse call system shall be:

- 1. Rauland Responder V.

B. Operational Requirements:

- 1. Station Selection from Master Station: Capable of selectively communicating with other stations or groups of stations on its system by touch screen, mouse click, or manual switch; and capable of programming up to 256 stations for each master station in the network.
- 2. Master Station Privacy: Capable of conversing with individual stations in complete privacy.
- 3. Called Station:
 - a. Capable of hands-free and two-way conversation.
 - b. Pressing "talk/listen" key shall cause the annunciation tone to cease.
 - c. Pressing "cancel" key terminates normal calls and conversations.
 - d. Terminating of high-priority level 1, 2, 3, or 4 shall not be allowed except at calling station location and shall send "remind" message if the call is not acknowledged at point of origin in programmed time frame.
- 4. Annunciation:
 - a. At the master station, a programmable tone announces an incoming call; an annunciator light or digital display identifies the calling station and indicates the priority of the call.
 - b. Call type indications include alarm assist, bath, bed, code, communication fault, cord out, door, emergency, and fire.
 - c. Memory lamps or lighted displays identify stations selected for outgoing calls.
- 5. System Reset at Master Station: A normal, incoming call can be canceled, associated lights and audible tones extinguished, and the system reset when the station switch is returned to the normal position.
- 6. Patient Station Calls:
 - a. Lights the call-placed lamp at patient station, zone, and corridor dome lights.
 - b. Sounds a tone and lights the call lights at staff/duty stations and actuates annunciation at the master station.

- c. When the calling station is selected at the master station, the patient can converse with the master station without moving and without raising or directing the voice.
 - d. During voice communications, entertainment audio at the calling station is automatically muted.
7. Pull-Cord-Call Station Calls and Emergency-Call Station Calls:
- a. Lights call-placed lamp and corridor dome light and flashes zone light.
 - b. Master station tone pulses and annunciator light for that room flashes.
 - c. When master station acknowledges the call by touch screen or switch, the tone stops but lights continue to flash until the call is canceled at the initiating point.
8. Code Blue and Staff/Duty Station Calls:
- a. Lights the call-placed lamp at the station and actuates annunciation at the master station.
 - b. When the called station is selected at the master station, the caller and the master station operator can converse.
 - c. Code Blue: Unique sound and light pattern indicating the highest priority emergency.
 - d. Staff Station: Unique sound and light pattern indicating an emergency.
 - e. Duty Station: Sound and light pattern indicating a call to the nurse station.
9. Handset Operation: Lifting the handset on master station disconnects speaker/microphone and transfers conversation to the handset.
10. Station Privacy: No patient or staff/duty station can be remotely monitored without lighting a warning lamp at the monitored station.
11. Patient Station Cord-Set Removal:
- a. A patient station call is initiated as described above when a patient station cord-set plug is removed from the jack in the station faceplate.
 - b. Tone stops but lights continue to flash until the call is canceled at the initiating point or the plug is reinserted or replaced with a dummy plug when the master station call button for the station is pressed.
12. Patient Control Unit:
- a. Controls entertainment volume and channel selection.
 - b. Speaker is used for both nurse communication and entertainment sound.
 - c. Entertainment sound is automatically muted when station is communicating with master station.
 - d. Nurse button on the unit initiates a patient station call.
13. Selective Paging: Master station is capable of initiating a message to selected groups of stations or speakers simultaneously by using station group switches.
14. Staff Reminder:

- a. Master station can initiate a staff reminder that a patient requires direct staff response by operating a reminder control while in contact with the patient station.
- b. This reminder will light a distinctive-color lamp in the corridor dome light at the patient's room and in the appropriate zone lights.
- c. Reminder calls are canceled by operating a staff reminder cancel switch in the patient's room.

15. Call Priority Indication:

- a. Capable of eight call priority levels in addition to normal.
- b. Call priority switch near each patient station, or integral with the master station, shall control priority status of the call transmitted by individual stations.
- c. Switch selects one of the following status levels:
 - 1) Normal: No change to the normal call initiation and canceling sequence.
 - 2) Emergency: Call initiation produces signals and indications identical to those of emergency-call stations. Indicator lamps are extinguished and the system is reset only at the originating station.
 - 3) Priority: System response is the same for emergency status except voice communication between the master station and the calling station is locked in from the time of call initiation until the system is reset at the originating station.

16. Additional Call:

- a. Waiting display window on the master station similar to current call window displays incoming calls.
- b. Master station shall have a call-overflow indicator when incoming calls exceed eight calls.
- c. System shall store unlimited number of incoming calls.
- d. System shall be capable of automatically answering incoming calls in order of priority.

17. Calling Intercom Stations:

- a. Master station shall be capable of calling any intercom station using the handset or the hands-free speaker/microphone.
- b. Receipt of a call at the intercom station shall be preceded by an optional pre-announce tone.
- c. If there is a call in process, system shall place the active call on automatic hold while the new call is placed, then reestablish the previous call when the new call has ended.

18. Privacy Override:

- a. Temporarily deactivates the "Privacy" mode of a called station by calling the station and instructing the called party to press the call-cord button.

- b. On completion of the conversation, the called station shall automatically return to the "Privacy" mode.
- c. When in "Privacy" mode, a called station shall be capable of hearing the master station; however, the master station shall not be capable of hearing the called station; a privacy message shall be indicated on the master station display.

19. Master-Station-to-Master-Station Calls:

- a. Master stations shall be capable of calling other master stations using the handset.
- b. Calls from master stations shall be answered using the handset only.
- c. Busy master stations shall be indicated by a master station intercom busy tone.

20. Voice Paging:

- a. Capable of voice paging to all stations using a single "All Call" key.
- b. Capable of voice paging to eight user-defined groups of stations by selecting the group and then the "All Call" key.
- c. Capable of voice paging to all staff/duty stations and all patient stations where staff has registered presence using a single "Public Address (PA)/Staff" key.
- d. Capable of voice paging through a third-party PA system.
- e. Capable of including or excluding any station from the voice paging function(s).
- f. Automatically places an active station call on hold during any page and reestablishes the connection at the end of the page.
- g. Automatically cancels a page if the talk mode is inactive for more than 15 seconds.

21. Station Monitor:

- a. An audio monitor feature shall allow a user to sequentially or simultaneously listen to one or all stations that are included in the user-created list.
- b. Master station display shall indicate which station is being monitored when in sequential mode.
- c. The dwell time each station is monitored shall be user programmable.
- d. The user shall be able to stop the monitoring sequence by activating a "pause" key.
- e. The user shall be able to manually sequence through stations using a "next" key.

22. Night Service:

- a. Functions shall be adaptable for nighttime staffing levels, patient traffic, and day/night operations.
- b. Staff Follow:

- 1) Capable of locating roving staff; forwarding visual and audible annunciation of incoming calls to station(s) where personnel have registered presence.
- 2) Master station shall display locations where staff have registered presence.
- 3) Incorporates a programmable timer that automatically cancels a forgotten staff presence registration.

c. Tones:

- 1) Deactivates audio signals from a duty station and mini-master display telephones.
- 2) Capable of changing the tone volume at the master and duty stations.
- 3) Satellite function shall permit the user to deactivate audio signals from duty stations and other remote annunciator devices.

d. Transfer:

- 1) Permits one nurse station to take control of all or individually selected bed call cords from another nurse station. It shall be possible to view transfer status of a nurse station.
- 2) Includes a minimum of three transfer modes to allow one nurse station to take control or share calls and operations from another nurse station.
 - a) Parallel Transfer Mode: Permits both nurse stations to share all calls and operations.
 - b) Supervised Transfer Mode: Permits the transferred nurse station to share all calls and operations with the controlling nurse station; however, the controlling nurse station calls are not shared with the transferring station.
 - c) Capture Transfer Mode: Transfers all calls and operations from the transferred nurse station to the controlling nurse station.
 - d) Transferred station shall have no control over calls, and its display shall indicate calls have been transferred to another station.
- 3) Includes two "patient swing" modes to allow one nurse station to take control or share calls from one or many calls from another nurse station.
 - a) Supervised Transfer Mode: Permits the transferred calls to be shared with the controlling nurse station.
 - b) Capture Transfer Mode: Transfers all calls from the call cord from the transferred nurse station to the controlling nurse station.
 - c) Transferred station has no control over those transferred calls.

23. Service Request:

- a. Permits users to assign a service request to a substation, at programmable priority level.
 - b. Displays service request on the nurse station display and light the green flashing corridor lamp at the respective substation and automatically generate a service reminder request.
 - c. Cancels service requests only at the initiating point.
 - d. Recall calls shall sound and be displayed at the master station if the service request has not been cancelled at the initiating point within the programmed period of time.
24. Call Reminder Function:
- a. Automatically generates a reminder call for a patient- or staff-initiated, high-priority 2, .3, or 4 request that has had the call tones silenced, allowing time to physically attend to the request and cancel the call at the initiating point.
 - b. Regenerated calls shall display the same tones and visual indications and priority as the original call and shall also display a "regenerated call" message.
 - c. Capable of manually adding low-priority calls to the reminder list.
 - d. "Call Reminder" function and reminder timer shall be programmable by call priority.
25. Hide Function: Prevents a selected station from displaying calls or generating tones on the nurse station.
26. Door Control Function: Capable of being programmed to enable the user to remotely activate electric door locks.
27. Test and Diagnostics Feature:
- a. Able to automatically diagnose system faults and categorize them as warnings, communication errors, or fatal errors.
 - b. Warnings shall indicate possible system problems.
 - c. Communication errors shall indicate the inability of the master station to communicate with a substation or another nurse-call station.
 - d. Fatal errors shall indicate a major hardware or software failure.
28. User-Configured System Programming - Access Code Not Required:
- a. Patient call-cord priority levels.
 - b. Monitor list.
 - c. "All Call" list.
 - d. Master station communication parameters (volume, filtering, talk/listen, sensitivity).
 - e. Master and duty station call annunciation tone volume.
 - f. Date/time.
 - g. Staff-follow operating mode.
 - h. Transfer type.
 - i. Presence mode.
29. User-Configured System Programming - Access Code Required:

- a. Master station number.
- b. Room device type.
- c. Room number.
- d. Reminder duration.
- e. Staff presence registration cancel duration.
- f. Display language.
- g. Paging group assignment(s).
- h. Zone group assignments.
- i. Monitoring duration.
- j. Call tone assignment by priority.
- k. Pretone activation.
- l. Call tones minimum volume.
- m. Clock mode (12 h/24 h).

C. Master Station:

- 1. Speaker/microphone unit with operating controls.
- 2. Indicator lamps with legends or by digital display designate identification and priority of calling stations and called stations.
- 3. Pulse rate of incoming-call lights denotes priority of calls awaiting response.
- 4. Station Selection Controls: Touchpad select stations for two-way voice communications.
- 5. Signal Tones: Programmable to announce incoming calls.
- 6. Pulse rate and frequency of tone identify the highest priority call awaiting response at one time.
- 7. Volume Control: Regulates incoming-call volume.
- 8. Privacy Handset with Hook Switch: Of the type that does not require push-to-talk switch attached to each station unless otherwise indicated.
- 9. Staff Reminder Control: Initiates flashing of corresponding corridor dome lights for patients requiring service. Permits scanning equipment to indicate which patients are currently in reminder status.
- 10. Call Priority Selection: Controls associated with patient-station selection switches determine the priority displayed when a call is initiated at a patient station.

D. Central Equipment Cabinet:

- 1. Lockable metal.
- 2. Houses amplifiers, tone generators, power supplies, controls, terminal strips, and other components.
- 3. Amplifier: With fidelity and overall gain necessary to achieve the sound-transmission and reproduction characteristics specified, considering interoperability with the installed speakers/microphones and wiring.
 - a. Power Output: Not less than 3 W at a total harmonic distortion not exceeding 5 percent.
 - b. Hum and Noise: 60 dB below full output with normal input open.
 - c. Volume Control: Concealed within the amplifier unit to control the volume of sound reproduced at all stations.
 - d. Protection: Circuit to prevent damage to the amplifier in case of shorted or open circuit.

4. Selective Paging Amplifiers: Plug-in card mounted in central equipment cabinet, rated 15 W.
5. System Power Supply:
 - a. 24-V dc for operation of the call system.
 - b. Equipment Rating: Suitable for continuous operation between 32 and 120 deg F (0 and 49 deg C), from a primary line voltage between 105- to 125-V ac, 60 Hz.
 - c. Output: Regulated 24-V dc with protection against overloads. Line-to-load regulation shall not exceed 2-1/2 percent with ripple and noise remaining below the 10-mV, rms level.
 - d. Overload Protection: Electronic fold-back circuit set to limit the volt-ampere output to less than 100 VA during overloaded or shorted output. Restore power output automatically on removal of overload without resetting circuit breakers or replacing fuses.
6. Power-on indicator lamp.
7. Surge Protector Device: Comply with Section 264313 "Surge Protection for Low-Voltage Electrical Power Circuits" for auxiliary panel suppressors, with digital indicator lights for power and protection status.
8. Battery Backup Unit: Sealed nickel-cadmium, wet-cell battery supplies power through an automatic switch when normal power fails, for a period of not less than six minutes at rated output.
 - a. Automatic retransfer to normal power, after a 15-minute time delay.
 - b. Two-rate battery charger with an automatic trickle rate and a recharge rate.

E. Speaker/Microphones:

1. Type: Permanent-magnet, dynamic or ceramic, protected against dust and humidity.
2. Sound Reproduction: Sound level of 90 dB plus or minus 3 dB at a distance of 48 inches (1220 mm) on the axis without overdriving or distorting any frequencies between 300 and 3000 Hz when installed in an enclosure or in the pillow speaker.
3. Power Handling Capacity: Not susceptible to damage from overdriving within the range of power available from the amplifier.
4. Impedance Matching: Coordinated and matched to the input and output circuits of the amplifier, both for single connection and for group monitoring, to provide the sound reproduction specified. Subsystems or components shall not be combined, which could cause unacceptable distortion such as feedback between pillow speakers and unmuted room speaker/microphone combinations. This protection shall extend throughout the entire range of operation (volume control) of all components.

- F. Single-Patient Station:** Speaker/microphone with 2-inch (50-mm) dynamic cone, a polarized receptacle to match the cord-set plug, monitor lamp, reset switch, and call-placed lamp; assembled under a single faceplate.

- G. Staff/Duty Stations: Audible call-tone signal device, speaker/microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, routine-call lamp, emergency-call lamp, and call push button; assembled under a single faceplate.
- H. Code Blue Station: Audible call-tone signal device, speaker/microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, Code Blue emergency-call lamp, and call push button; assembled under a single faceplate.
- I. Ambulatory-Patient Station: Speaker/microphone with 2-inch (50-mm) dynamic cone, monitor lamp, reset switch, call-placed lamp, and call push button; assembled under a single faceplate.
- J. Selective Paging Speakers: 8-inch (200-mm) cone type with 1-inch (25-mm) voice coil and minimum 5-oz. (140-g) ceramic magnet, multitap matching transformer, flush-mounted steel back-box, and white enamel-finished metal ceiling grille.
- K. Call Priority Switch Station: Three-position, tamper-resistant priority selection switch. Positions designated by labeling "Normal," "Emergency," and "Priority."
- L. Staff Reminder Cancel Switch Station: Momentary contact.

2.3 SYSTEM COMPONENTS

- A. Emergency-Call Station: Locking-type push button, labeled "Push to Call Help"; reset trigger to release push button and cancel call; and call-placed lamp, mounted in a single faceplate.
- B. Emergency-Bath Station:
 - 1. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "URGENT" in bold letters.
 - 2. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
 - 3. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
 - 4. Water resistant and able to withstand routine cleaning and chemical disinfectants.
 - 5. Uses magnetic reed switch technology for reliability and corrosion resistance.
 - 6. Mounts on a single-gang electrical box wire to the respective patient station or input controller.
- C. Code Blue Station:
 - 1. Consists of a sliding, chemical-resistant, ABS blue fascia marked with the word "CODE" in bold letters.
 - 2. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
 - 3. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.

4. Water resistant and able to withstand routine cleaning and chemical disinfectants.
5. Uses magnetic reed switch technology for reliability and corrosion resistance.
6. Mounts on a single-gang electrical box wire to the respective patient station or input controller.

D. Staff, Emergency Station:

1. Consists of a sliding, chemical-resistant, ABS red fascia marked with the word "EMERGENCY" in bold letters.
2. Capable of being activated with nylon pull cord or by sliding the face of the unit downwards.
3. Activation of the station shall illuminate a reassurance digital display on the face of the unit in addition to notifying the master station.
4. Mounts on a single-gang electrical box wire to the input controller.

E. Pull-Cord-Call Station:

1. Pull-Down Switch: Lever-locking type, labeled "Pull Down to Call Help."
2. Reset trigger.
3. Call-placed lamp.
4. Water-resistant construction.

F. Patient Control Unit:

1. Equipped with plug and 96-inch- (2400-mm-) long white cord.
2. Ethylene oxide, sterilizable.
3. Light-Control Switch: Arranged for independent on-off control of patient's up and down light.
4. Integral Speaker: 2 inches (50 mm), with 0.35-oz. (9.9-g) magnet, rated 0.2 W.
5. Controls: Speaker volume, TV control, and nurse call.
6. Housing: High-impact white plastic.
7. Attachment: Stainless-steel bed clamp with permanently attached polyester film strap.
8. Quantity: 12 units for every 10 patient beds.

G. Indicator Lamps: Digital type with rated life of 20 years unless otherwise indicated.

H. Station Faceplates:

1. High-impact plastic.
2. Color: Beige.
3. Molded or machine-engraved labeling identifies indicator lamps and controls.

I. Corridor Dome Lights and Zone Lights:

1. Three-lamp signal lights.
2. Lamps: LED. Front replaceable without tools, low voltage with rated life of 7500 hours. Barriers are such that only one color is displayed at a time.

3. Lenses: Heat-resistant, shatterproof, translucent polymer that will not deform, discolor, or craze when exposed to hospital cleaning agents.
4. Filters: Two per unit, amber and red.

J. Cable:

1. Conductors: Jacketed single and multiple, twisted-pair copper cables.
2. Sizes and Types: As recommended by equipment manufacturer.
3. Cable for Use in Plenums: Listed and labeled for plenum installation.

K. Grounding Components: Comply with requirements in Section 270526 "Grounding and Bonding for Communications Systems."

2.4 SOFTWARE REQUIREMENTS

A. Telephone System Interface:

1. Permits use of wired and/or wireless telephones to execute nurse-call master station.
2. Two-way communication with patient and staff stations.
3. Two-way communication with the master nurse station.
4. "All Call," group call, and staff call paging.
5. Capable of being programmed to forward calls destined for a master nurse station to any connected telephone.
6. Telephones connected to the telephone interface shall have the same call tone ring patterns as those generated at the master nurse station.
7. Telephones having a display shall indicate the call type, priority code, and the calling station number of incoming calls.
8. Telephones shall be capable of initiating a service request for a particular patient station, logging calls on the master station's reminder list, and activating door lock mechanisms associated with a call station.
9. Capable of routine setup and configuration changes using the keypads on display telephone and/or the master station.

B. Display Telephones:

1. Digital telephones for use as mini-master nurse-call stations.
2. Digital display shall indicate the call type, priority code, and calling station number of incoming calls.
3. Ring patterns shall be identical to those generated at the master station.
4. Capable of two-way communication with patient and staff stations and the master station, and other telephones interfaced with the system.
5. Capable of placing or answering outside calls when interfaced with the facility telephone system.
6. Capable of "All Call," group call, and staff call paging and of initiating service requests, logging calls to the reminder list, and activating optional door controls.

C. Statistical Software:

1. Includes a data statistical software package that stores, sorts, and analyzes activities occurring on the nurse-call system network.
2. Windows based and operated on a PC that is connected to the nurse-call system network.
3. Stores events on the PC's hard disk. Accumulation of these stored events shall make up the database that is used to generate reports and statistics.
4. Events stored by the software shall include date, day of week, time, ward, priority, and room number.
5. Capable of assigning a patient name to bed number.
6. Stored events shall include, but not be limited to, calls placed, call priority, calls cancelled at the nurse station, calls cancelled at the point of origin, regenerated calls, calls answered, calls sent to pager interface, staff presence registration, staff presence cancellation, service request, service cancellation, and system and network error messages.

D. Data Analysis Software:

1. Capable of analyzing the stored information and generating computed analysis.
2. Analysis of the database can be conducted by specifying one, many, or all of the following parameters of the database: date, day of week, time, wards, priority, and room number.
3. Analysis shall include, but not be limited to, total number of calls placed, average call response time (from call placed to call cancellation), total number of presence registrations, average presence time in a room, total number of service requests, average response time (from audio answer to call cancellation), and average ring time (from call placed to audio answer).

E. Statistical Software Package:

1. Capable of displaying multiple calls/events on a PC monitor or on a RS-485 data-bus-driven digital display panel.
2. Calls from patient or staff stations and associated devices shall be displayed by priority. Display shall be customizable as follows:
 - a. Choice of color by type of call.
 - b. Choice of display size (character size).
 - c. Choice of priority levels, type of events, points of origin.
 - d. Identification of facility.
 - e. Identification of ward.
 - f. Identification of patient with specific patient information.

2.5 CONDUCTORS AND CABLES

A. Audio Cables:

1. Conductors: Jacketed, twisted-pair and twisted-multipair, untinned solid copper. Sizes as recommended by system manufacturer, but no smaller than No. 22 AWG.
2. Insulation: Thermoplastic, not less than 1/32 inch (0.8 mm) thick.

3. Shielding: For speaker/microphone leads and elsewhere where recommended by manufacturer; No. 34 AWG, tinned, soft-copper strands formed into a braid or equivalent foil.
 4. Minimum Shielding Coverage on Conductors: 60 percent.
 5. Plenum Cable: Listed and labeled for plenum installation.
- B. Data Cable and Hardware: Category 6 balanced twisted-pair cabling and hardware. Comply with requirements in Section 271513 "Communications Copper Horizontal Cabling."
- C. Power Conductors and Cables: Copper, solid, No. 20 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- D. Grounding Conductors and Cables: Copper, stranded, No. 16 AWG. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wiring Method:
1. Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters.
 - a. Conceal raceway and cables except in unfinished spaces.
 2. Cable Trays: Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
 3. Conduit and Boxes: Comply with requirements in Section 270528 "Pathways for Communications 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. 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 parallel and perpendicular to surfaces or exposed structural members, and follow surface contours.
- 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 270553 "Identification for Communications Systems" for cable administration, cable schedule, and cable and wire identification.
- K. Equipment Identification:
 - 1. Comply with requirements in Section 270553 "Identification for Communications 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 260526 "Grounding and Bonding for Electrical 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.
- C. Tests and Inspections:
 - 1. Schedule tests a minimum of seven days in advance.
 - 2. Report: Submit a written record of test results.
 - 3. Operational Test: Perform an operational system test and demonstrate proper operations, adjustment, and sensitivity of each station. Perform tests that include originating station-to-station and "All Call" messages and pages at each nurse-call station. Verify proper routing, volume levels, and freedom from noise and distortion. Test each available message path from each station on the system. Meet the following criteria:
 - a. Speaker Output: 90 dB plus or minus 3 dB, 300 to 3000 Hz, reference level threshold of audibility 0 dB at 0.02 mPa of sound pressure.
 - b. Gain from patient's bedside station to nurse station, with distortion less than 65 dB (plus or minus 3 dB, 300 to 3000 Hz).
 - c. Signal-to-Noise Ratio: Hum and noise level at least 45 dB below full output.
 - 4. Test Procedure:
 - a. Frequency Response: Determine frequency response of two transmission paths by transmitting and recording audio tones.
 - b. Signal-to-Noise Ratio: Measure the ratio of signal to noise of the complete system at normal gain settings using the following procedure: Disconnect a speaker/microphone and replace it in the circuit with a signal generator using a 1000-Hz signal. Measure the ratio of signal to noise and repeat the test for four speaker microphones.
 - c. Distortion Test: Measure distortion at normal gain settings and rated power. Feed signals at frequencies of 300, 400, 1000, and 3000 Hz into each nurse-call equipment amplifier, and measure the distortion in the amplifier output.
- D. Retesting: Rectify deficiencies indicated by tests and completely retest work affected by such deficiencies at Contractor's expense. Verify, by the system test, that the total

system meets these Specifications and complies with applicable standards. Report results in writing.

- E. Inspection: Verify that units and controls are properly labeled and interconnecting wires and terminals are identified.
- F. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sound levels and controls to suit actual occupied conditions. Provide up to three visits to Project during other-than-normal operating hours for this purpose.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel and caregiver staff to adjust, operate, and maintain nurse-call equipment.

END OF SECTION 275223

SECTION 280513 - CONDUCTORS AND CABLES FOR ELECTRONIC SAFETY AND SECURITY

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. UTP cabling. (See Specification Section 271500 for UTP cabling).
 - 2. 50/125-micrometer, multimode optical-fiber cabling. (See Specification Section 271500 for optical fiber cabling)
 - 3. Coaxial cabling. (See Specification Section 271500 for coaxial cabling)
 - 4. RS-232 cabling.
 - 5. RS-485 cabling.
 - 6. Control-voltage cabling.
 - 7. Control-circuit conductors.
 - 8. Fire alarm wire and cable.
 - 9. Identification products.

1.3 DEFINITIONS

- A. EMI: Electromagnetic interference.
- B. IDC: Insulation displacement connector.
- C. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control and signaling power-limited circuits.
- D. Open Cabling: Passing telecommunications cabling through open space (e.g., between the studs of a wall cavity).
- E. RCDD: Registered Communications Distribution Designer.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate layout and installation of electronic safety and security cabling with Owner's telecommunications and LAN equipment and service suppliers.

- B. Coordinate telecommunications outlet/connector locations with location of power receptacles at each work area.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Installation data for UTP and optical-fiber cables as specified in TIA 569-C-1.
 - 2. For coaxial cable, include the following installation data for each type used:
 - a. Nominal OD.
 - b. Minimum bending radius.
 - c. Maximum pulling tension.
- B. Shop Drawings:
 - 1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 - 2. System Labeling Schedules: Electronic copy of labeling schedules that are part of the cabling and asset identification system of the software.
 - 3. Cabling administration drawings and printouts.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified layout technician, installation supervisor, and field inspector.
- B. Source quality-control reports.
- C. Field quality-control reports.

1.7 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by BICSI as an RCDD to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. 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-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 50 or less.
- 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.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches. Comply with requirements for plywood backing panels in Section 061000 "Rough Carpentry."

2.3 RS-485 CABLE FOR ACCESS CONTROL

- A. Paige Number 454932 AYW.
- B. Plenum-Rated Cable: NFPA 70, Type CMP.
 - 1. Pairing shall be as manufactured as Paige 454932AYW.
 - 2. Fluorinated ethylene propylene insulation.
 - 3. Unshielded.
 - 4. Fluorinated ethylene propylene jacket.
 - 5. Flame Resistance: NFPA 262, Flame Test.

2.4 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, not less than No. 18 AWG installed in metal conduit.
 - 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. Line-Voltage Circuits: No. 12 AWG, minimum, in pathway.
2. All cable and fire alarm system conductors shall be installed in metal conduit. MC type cables are not permitted for fire alarm system.

2.5 IDENTIFICATION PRODUCTS

- A. See Specification Section 260553
- B. Comply with TIA-606-B and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- C. Comply with requirements in Section 260553 "Identification for Electrical Systems."

2.6 CABLE MANAGEMENT SYSTEM

- A. As required by McLeod information systems.
- B. Description: Computer-based cable management system, with integrated database and graphic capabilities.
- C. Document physical characteristics by recording the network, TIA details, and connections between equipment and cable.
- D. Information shall be presented in database view, schematic plans, or technical drawings.
 1. Microsoft Visio Professional and AutoCAD drawing software shall be used as drawing and schematic plans software.
- E. System shall interface with the following testing and recording devices:
 1. Direct upload tests from circuit-testing instrument into the personal computer.
 2. Direct download circuit labeling into labeling printer.

2.7 SOURCE QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to evaluate cables.
- B. Cable will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION OF HANGERS AND SUPPORTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for installation of supports for cables.

3.2 WIRING METHOD

- A. Install wiring in metal pathways and wireways.
 - 1. Minimum conduit size shall be 3/4 inch. Control and data-transmission wiring shall not share conduits with other building wiring systems.
 - 2. Comply with requirements in Section 260536 "Cable Trays for Electrical Systems."
 - 3. Comply with requirements in Section 270536 "Cable Trays for Communications Systems."
- B. Install cable in metal conduit concealed in accessible ceilings, walls, and floors when possible.
- C. Wiring on Racks and within Enclosures:
 - 1. Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM's "Cabling Termination Practices" chapter. Cable ties shall not be excessively tightened such that the transmission characteristics of the cable are altered.
 - 2. Install lacing bars and distribution spools.
 - 3. Separate power-limited and non-power-limited conductors as recommended in writing by manufacturer.
 - 4. Install conductors parallel with or at right angles to sides and back of enclosure.
 - 5. Connect conductors associated with intrusion system that are terminated, spliced, or interrupted in any enclosure onto terminal blocks.
 - 6. Mark each terminal according to system's wiring diagrams.
 - 7. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1 and NFPA 70.
- B. Conductors: Size according to system manufacturer's written instructions unless otherwise indicated.
- C. Do not install conductors and cables that are wet, moisture damaged, or mold damaged.

D. General Requirements for Cabling:

1. Comply with TIA-568-C.1.
2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels. Leave a minimum of 6 inches of slack at outlet terminations and coil loosely into box after termination on outlet fitting.
4. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
5. Maintain minimum cable bending radius during installation and termination of cables.
6. Do not install bruised, kinked, scored, deformed, or abraded 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.
7. Cold-Weather Installation: Bring cable to room temperature before dereeling. Heat lamps shall not be used for heating.
8. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions. Do not exceed manufacturer's rated cable-pulling tension.
9. Riser Cable: Riser cable support intervals shall be in accordance with manufacturer's recommendations.
10. Comply with Section 280544 "Sleeves and Sleeve Seals for Electronic Safety and Security Pathways and Cabling."

E. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunication spaces with terminating hardware and interconnection equipment.
2. Suspend copper cable not in a wireway or pathway a minimum of 8 inches above ceilings by cable supports not more than 48 inches apart. Cable supports shall be fastened to structural members or floor slabs in accordance with Section 260529 "Hangers and Supports for Electrical Systems."
3. Cable shall not be run in contact with pipes, ducts, or other potentially damaging items. Cables shall not be run through structural members or use structural members, pipes, ducts, or equipment as a support.

F. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA-569-C recommendations for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communication cables or cables in nonmetallic pathways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches.

3. Separation between communication cables in grounded metallic pathways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches.
4. Separation between cables in grounded metallic pathways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches.
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches.
5. Separation between Cables and Electrical Motors and Transformers, 5 kVA or hp and Larger: A minimum of 48 inches.
6. Separation between Cables and Fluorescent Fixtures: A minimum of 5 inches.

3.4 FIRE ALARM WIRING INSTALLATION

- A. Comply with NECA 1 and NFPA 72.
- B. Wiring Method: Install wiring in metal pathway.
 1. Fire alarm circuits and equipment control wiring associated with the fire alarm system shall be installed in a dedicated metal conduit pathway system. This system shall not be used for any other wire or cable.
- C. Wiring Method:
 1. Cables and pathways used for fire alarm circuits, and equipment control wiring associated with the fire alarm system, may not contain any other wire or cable.
 2. Fire-Rated Cables: Use of two-hour, fire-rated fire alarm cables, NFPA 70, Types MI and CI, is not permitted.
 3. Signaling Line Circuits: Power-limited fire alarm cables shall not be installed in the same cable or pathway as signaling line circuits.
- D. Wiring within Enclosures: Separate power-limited and non-power-limited conductors as recommended by manufacturer. Install conductors parallel with or at right angles to sides and back of the enclosure. Bundle, lace, and train conductors to terminal points with no excess. Connect conductors that are terminated, spliced, or interrupted in any enclosure associated with the fire alarm system to terminal blocks. Mark each terminal according to the system's wiring diagrams. Make all connections with approved crimp-on terminal spade lugs, pressure-type terminal blocks, or plug connectors.
- E. Cable Taps: Use numbered terminal strips in junction, pull, and outlet boxes, cabinets, or equipment enclosures where circuit connections are made.

- F. Color Coding: Color code fire alarm conductors differently from the normal building power wiring. Use one color code for alarm circuit wiring and another for supervisory circuits. Color code audible alarm-indicating circuits differently from alarm-initiating circuits. Use different colors for visible alarm-indicating devices. Paint fire alarm system junction boxes and covers red.
- G. Risers: Install at least two vertical cable risers to serve the fire alarm system. Separate risers in close proximity to each other with a minimum one-hour-rated wall, so the loss of one riser does not prevent the receipt or transmission of signals from other floors or zones.
- H. Wiring to Remote Alarm Transmitting Device: 1-inch conduit between the fire alarm control panel and the transmitter. Install number of conductors and electrical supervision for connecting wiring as needed to suit monitoring function.

3.5 POWER AND CONTROL-CIRCUIT CONDUCTORS

- A. 120-V Power Wiring: Install according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables" unless otherwise indicated.
- B. Minimum Conductor Sizes:
 - 1. Class 1 remote-control and signal circuits, No. 14 AWG.
 - 2. Class 2 low-energy, remote-control and signal circuits, No. 16 AWG.
 - 3. Class 3 low-energy, remote-control, alarm and signal circuits, No. 12 AWG.

3.6 CONNECTIONS

- A. Comply with requirements in Section 284621.1 "Digital, Addressable Fire-Alarm System" for connecting, terminating, and identifying wires and cables.
- B. Comply with requirements in Section 283500 "Refrigerant Detection and Alarm" for connecting, terminating, and identifying wires and cables.

3.7 FIRESTOPPING

- A. Comply with requirements in Section 078413 "Penetration Firestopping."
- B. Comply with TIA-569-C, "Firestopping" Annex A.
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.8 GROUNDING

- A. For communication wiring, comply with J-STD-607-A and with BICSI TDMM's "Grounding, Bonding, and Electrical Protection" chapter.

3.9 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA-606-B. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to 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. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
- D. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

END OF SECTION 280513

SECTION 284621.11 - ADDRESSABLE FIRE-ALARM SYSTEMS

PART 1 - GENERAL

- 1.1 The work of this project is the build out of the fourth level of the McLeod Health Seacoast Bed Tower. The bed tower presently has a Simplex fire alarm system that the fire alarm devices being added in this project shall connect to for monitoring and reporting. All components required to allow the existing fire alarm system new devices being added as a part of this project are a part of this project.

1.2 RELATED DOCUMENTS

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

1.3 SUMMARY

- A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Magnetic door holders.
7. Remote annunciator.
8. Addressable interface device.
9. Network communications.

- B. Related Requirements:

1. Section 271513 "Communications Copper Horizontal Cabling" for cables and conductors for fire-alarm systems.

1.4 DEFINITIONS

- A. EMT: Electrical Metallic Tubing.
- B. FACP: Fire Alarm Control Panel.
- C. HLI: High Level Interface.
- D. NICET: National Institute for Certification in Engineering Technologies.

- E. PC: Personal computer.
- F. VESDA: Very Early Smoke-Detection Apparatus.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product, including furnished options and accessories.
 - 1. Include construction details, material descriptions, dimensions, profiles, and finishes.
 - 2. Include rated capacities, operating characteristics, and electrical characteristics.
- B. Shop Drawings: For fire-alarm system.
 - 1. Comply with recommendations and requirements in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - 2. Include plans, elevations, sections, details, and attachments to other work.
 - 3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations. Indicate conductor sizes, indicate termination locations and requirements, and distinguish between factory and field wiring.
 - 4. Detail assembly and support requirements.
 - 5. Include voltage drop calculations for notification-appliance circuits.
 - 6. Include battery-size calculations.
 - 7. Include input/output matrix.
 - 8. Include statement from manufacturer that all equipment and components have been tested as a system and meet all requirements in this Specification and in NFPA 72.
 - 9. Include performance parameters and installation details for each detector.
 - 10. Verify that each duct detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 - 11. Provide program report showing that air-sampling detector pipe layout balances pneumatically within the airflow range of the air-sampling detector.
 - 12. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale; coordinate location of duct smoke detectors and access to them.
 - a. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators.
 - b. Show field wiring required for HVAC unit shutdown on alarm.
 - c. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' control system.
 - d. Show field wiring and equipment required for HVAC unit shutdown on alarm and override by firefighters' smoke-evacuation system.
 - e. Locate detectors according to manufacturer's written recommendations.
 - 13. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits and point-to-point wiring diagrams.

C. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified, fire-alarm technician; Level IV minimum.
 - c. Licensed or certified by authorities having jurisdiction.

D. Delegated-Design Submittal: For notification appliances and smoke and heat detectors, in addition to submittals listed above, indicate compliance with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Drawings showing the location of each notification appliance and smoke and heat detector, ratings of each, and installation details as needed to comply with listing conditions of the device.
2. Design Calculations: Calculate requirements for selecting the spacing and sensitivity of detection, complying with NFPA 72. Calculate spacing and intensities for strobe signals and sound-pressure levels for audible appliances.
3. Indicate audible appliances required to produce square wave signal per NFPA 72.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Seismic Qualification Data: Certificates, for fire-alarm control unit, 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.

1.7 Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following and deliver copies to authorities having jurisdiction:
 - a. Comply with the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - b. Provide "Fire Alarm and Emergency Communications System Record of Completion Documents" according to the "Completion Documents" Article in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - c. Complete wiring diagrams showing connections between all devices and equipment. Each conductor shall be numbered at every junction point with indication of origination and termination points.
 - d. Riser diagram.
 - e. Device addresses.
 - f. Record copy of site-specific software.
 - g. Provide "Inspection and Testing Form" according to the "Inspection, Testing and Maintenance" chapter in NFPA 72, and include the following:
 - 1) Equipment tested.
 - 2) Frequency of testing of installed components.
 - 3) Frequency of inspection of installed components.
 - 4) Requirements and recommendations related to results of maintenance.
 - 5) Manufacturer's user training manuals.
 - h. Manufacturer's required maintenance related to system warranty requirements.
 - i. Abbreviated operating instructions for mounting at fire-alarm control unit and each annunciator unit.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On magnetic media or compact disk, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.9 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. Lamps for Remote Indicating Lamp Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 2. Lamps for Strobe Units: Quantity equal to 10 percent of amount installed, but no fewer than one unit.
 3. Smoke Detectors: Quantity equal to 10 percent of amount of each type installed, but no fewer than one unit of each type.

4. Detector Bases: Quantity equal to two percent of amount of each type installed, but no fewer than one unit of each type.
5. Keys and Tools: One extra set for access to locked or tamperproofed components.
6. Audible and Visual Notification Appliances: One of each type installed.
7. Fuses: Two of each type installed in the system. Provide in a box or cabinet with compartments marked with fuse types and sizes.

1.10 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Installer Qualifications: Installation shall be by personnel certified by NICET as fire-alarm Level IV technician.
- C. NFPA Certification: Obtain certification according to NFPA 72 by a UL-listed alarm company.

1.11 PROJECT CONDITIONS

- A. Perform a full test of the existing system prior to starting work. Document any equipment or components not functioning as designed.
- B. Interruption of Existing Fire-Alarm Service: Do not interrupt fire-alarm service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary guard service according to requirements indicated:
 1. Notify Owner in writing no fewer than 30 days before proposed interruption of fire alarm service stating the proposed start date, expected duration of the interruption in advance of proposed interruption of fire-alarm service.
 2. Do not proceed with interruption of fire-alarm service without owner's written permission.
 3. Assist owner in providing fire alarm watch services and methods used to provide fire alarm coverage during the interruption of the fire alarm system.
- C. Use of Devices during Construction: Protect devices during construction unless devices are placed in service to protect the facility during construction.

1.12 SEQUENCING AND SCHEDULING

- A. Existing Fire-Alarm Equipment: Maintain existing equipment fully operational until new equipment has been tested and accepted. As new equipment is installed, label it "NOT IN SERVICE" until it is accepted. Remove labels from new equipment when put into service, and label existing fire-alarm equipment "NOT IN SERVICE" until removed from the building.

- B. Equipment Removal: After acceptance of new fire-alarm system, remove existing disconnected fire-alarm equipment and wiring and turn over to the owner all fire alarm devices not installed as part of the project.

1.13 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace fire-alarm system equipment and components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Extent: All equipment and components not covered in the Maintenance Service Agreement.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Source Limitations for Fire-Alarm System and Components: Components shall be compatible with, and operate as an extension of, existing system. Provide system manufacturer's certification that all components provided have been tested as, and will operate as, a system.
- B. Noncoded addressable system, with multiplexed signal transmission and chime/strobe evacuation.
- C. Automatic sensitivity control of certain smoke detectors.
- D. All components provided shall be listed for use with the selected system.
- E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices:
 - 1. Manual stations.
 - 2. Heat detectors.
 - 3. Smoke detectors.
 - 4. Duct smoke detectors.
 - 5. Automatic sprinkler system water flow.
 - 6. Fire-extinguishing system operation.
 - 7. Fire standpipe system.
 - 8. Fire pump running.

- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm notification appliances.
 2. Identify alarm and specific initiating device at fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Activate chime/alarm communication system.
 7. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 8. Activate smoke-control system (smoke management) at firefighters' smoke-control system panel.
 9. Close smoke dampers in air ducts of designated air-conditioning duct systems.
 10. Recall elevators to primary or alternate recall floors.
 11. Activate elevator power shunt trip.
 12. Record events in the system memory.
 13. Record events by the system printer.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Elevator shunt-trip supervision.
 3. Fire pump running.
 4. Fire-pump loss of power.
 5. Fire-pump power phase reversal.
 6. User disabling of zones or individual devices.
 7. Loss of communication with any panel on the network.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.
 4. Loss of primary power at fire-alarm control unit.
 5. Ground or a single break in internal circuits of fire-alarm control unit.
 6. Abnormal ac voltage at fire-alarm control unit.
 7. Break in standby battery circuitry.
 8. Failure of battery charging.
 9. Abnormal position of any switch at fire-alarm control unit or annunciator.
- E. System Supervisory Signal Actions:
1. Initiate notification appliances.

2. Identify specific device initiating the event at fire-alarm control unit, connected network control panels, off-premises network control panels, and remote annunciators.
3. Record the event on system printer.
4. After a time delay of 200 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
5. Transmit system status to building management system.
6. Display system status on graphic annunciator.

2.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways 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."

2.4 FIRE-ALARM CONTROL UNIT

- A. The fire alarm system shall be manufactured by Simplex
- B. General Requirements for Fire-Alarm Control Unit:
1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
 - a. System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
 - c. Provide communication between the FACP and remote circuit interface panels, annunciators, and displays.
 - d. The FACP shall be listed for connection to a central-station signaling system service.
 - e. Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FACP shall provide a minimum 500-event history log.
 2. Addressable Initiation Device Circuits: The FACP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
 3. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FACP shall be listed for releasing service.

- C. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands.
- D. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
 - 1. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
 - 2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.
- E. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
 - 1. Pathway Class Designations: NFPA 72, Class A.
 - 2. Pathway Survivability: Level 1.
 - 3. Install no more than 100 addressable devices on each signaling-line circuit.
 - 4. Serial Interfaces:
 - a. One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
 - b. One USB port for PC configuration.
- F. Smoke-Alarm Verification:
 - 1. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
 - 2. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
 - 3. Record events by the system printer.
 - 4. Sound general alarm if the alarm is verified.
 - 5. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
- G. Notification-Appliance Circuit:
 - 1. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
 - 2. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.

3. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
- H. Elevator Recall:
1. Elevator recall shall be initiated only by one of the following alarm-initiating devices:
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
 2. Elevator controller shall be programmed to move the cars to the alternate recall floor if lobby detectors located on the designated recall floors are activated.
 3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.
 - a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- I. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
- J. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
- K. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- L. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also, print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
- M. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals shall be powered by 24-V dc source.
1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- N. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

1. Batteries: Sealed, valve-regulated, recombinant lead acid.
- O. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.5 MANUAL FIRE-ALARM BOXES

- A. Manual fire alarm boxes shall be by Simplex
- B. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 1. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 2. Station Reset: Key- or wrench-operated switch.

2.6 SYSTEM SMOKE DETECTORS

- A. System smoke detectors shall be by Simplex
- B. General Requirements for System Smoke Detectors:
 1. Comply with UL 268; operating at 24-V dc, nominal.
 2. Detectors shall be four-wire type.
 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
 4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 6. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 7. Remote Control: Unless otherwise indicated, detectors shall be digital-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
 - a. Rate-of-rise temperature characteristic of combination smoke- and heat-detection units shall be selectable at fire-alarm control unit for 15 or 20 deg F (8 or 11 deg C) per minute.
 - b. Fixed-temperature sensing characteristic of combination smoke- and heat-detection units shall be independent of rate-of-rise sensing and shall be

settable at fire-alarm control unit to operate at 135 or 155 deg F (57 or 68 deg C).

- c. Multiple levels of detection sensitivity for each sensor.
- d. Sensitivity levels based on time of day.

C. Photoelectric Smoke Detectors:

- 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

D. Duct Smoke Detectors: Photoelectric type complying with UL 268A.

- 1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
- 2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).
- 3. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC system ducts.
- 4. Each sensor shall have multiple levels of detection sensitivity.
- 5. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- 6. Relay Fan Shutdown: Fully programmable relay rated to interrupt fan motor-control circuit.

E. Single-Station Duct Smoke Detectors:

- 1. Comply with UL 268A; operating at 120-V ac.
- 2. Sensor: LED or infrared light source with matching silicon-cell receiver.
 - a. Detector Sensitivity: Smoke obscuration between 2.5 and 3.5 percent/foot (0.008 and 0.011 percent/mm) when tested according to UL 268A.
- 3. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base

shall be designed for mounting directly to air duct. Provide terminals in the fixed base for connection to building wiring.

- a. Weatherproof Duct Housing Enclosure: NEMA 250, Type 4X; listed for use with the supplied detector.
- 4. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific duct size, air velocity, and installation conditions where applied.
- 5. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.

2.7 HEAT DETECTORS

- A. Heat detectors shall be by Simplex
- B. General Requirements for Heat Detectors: Comply with UL 521.
 - 1. Temperature sensors shall test for and communicate the sensitivity range of the device.
- C. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
 - 1. Mounting: Twist-lock base interchangeable with smoke-detector bases.
 - 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.8 NOTIFICATION APPLIANCES

- A. Notification appliances shall be by Simplex.
- B. General Requirements for Notification Appliances: Connected to notification-appliance signal circuits, zoned as indicated, equipped for mounting as indicated, and with screw terminals for system connections.
 - 1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated, and with screw terminals for system connections.
- C. Chimes, Low-Level Output: Vibrating type, 75-dBA minimum rated output.
- D. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- E. Visible Notification Appliances: Xenon strobe lights complying with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
 - 1. Rated Light Output:

- a. 15/30/75/110 cd, selectable in the field.
2. Mounting: Wall mounted unless otherwise indicated.
3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
4. Flashing shall be in a temporal pattern, synchronized with other units.
5. Strobe Leads: Factory connected to screw terminals.
6. Mounting Faceplate: Factory finished, white.

2.9 FIREFIGHTERS' SMOKE-CONTROL SYSTEM

A. Initiate Smoke-Management Sequence of Operation:

1. Comply with sequence of operation as described in Section 230993.11 "Sequence of Operations for HVAC DDC."
2. Fire-alarm system shall provide all interfaces and control points required to properly activate smoke-management systems.
3. First fire-alarm system initiating device to go into alarm condition shall activate the smoke-control functions.
4. Subsequent devices going into alarm condition shall have no effect on the smoke-control mode.

B. Addressable Relay Modules:

1. Provide address-setting means on the module. Store an internal identifying code for control panel use to identify the module type.
2. Allow the control panel to switch the relay contacts on command.
3. Have a minimum of two normally open and two normally closed contacts available for field wiring.
4. Listed for controlling HVAC fan motor controllers.

2.10 MAGNETIC DOOR HOLDERS

A. Description: Units are equipped for wall or floor mounting as indicated and are complete with matching doorplate.

1. Electromagnets: Require no more than 3 W to develop 25-lbf (111-N) holding force.
2. Wall-Mounted Units: Flush mounted unless otherwise indicated.
3. Rating: 24-V ac or dc.

B. Material and Finish: Match door hardware.

2.11 REMOTE ANNUNCIATOR

A. Description: The existing annunciator shall be upgraded or modified if/as required to accommodate the devices being added for this project.

2.12 ADDRESSABLE INTERFACE DEVICE

- A. General:
 - 1. Include address-setting means on the module.
 - 2. Store an internal identifying code for control panel use to identify the module type.
 - 3. Listed for controlling HVAC fan motor controllers.
- B. Monitor Module: Microelectronic module providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- C. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.
 - 1. Allow the control panel to switch the relay contacts on command.
 - 2. Have a minimum of two normally open and two normally closed contacts available for field wiring.
- D. Control Module:
 - 1. Operate notification devices.
 - 2. Operate solenoids for use in sprinkler service.

2.13 NETWORK COMMUNICATIONS

- A. Provide network communications for fire-alarm system according to fire-alarm manufacturer's written requirements.
- B. Provide network communications pathway per manufacturer's written requirements and requirements in NFPA 72 and NFPA 70.
- C. Provide integration gateway using integration protocol presently in used with the existing fire alarm for connection to building automation system.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions for compliance with requirements for ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment and wiring are installed, before installation begins.

- B. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION

- A. Comply with NFPA 72, NFPA 101, and requirements of authorities having jurisdiction for installation and testing of fire-alarm equipment. Install all electrical wiring to comply with requirements in NFPA 70 including, but not limited to, Article 760, "Fire Alarm Systems."
 - 1. Devices placed in service before all other trades have completed cleanup shall be replaced.
 - 2. Devices installed but not yet placed in service shall be protected from construction dust, debris, dirt, moisture, and damage according to manufacturer's written storage instructions.
- B. Connecting to Existing Equipment: Verify that existing fire-alarm system is operational before making changes or connections.
 - 1. Connect new equipment to existing control panel in existing part of the building.
 - 2. Connect new equipment to existing monitoring equipment at the supervising station.
 - 3. Expand, modify, and supplement existing control and monitoring equipment as necessary to extend existing control and monitoring functions to the new points. New components shall be capable of merging with existing configuration without degrading the performance of either system.
- C. Install wall-mounted equipment, with tops of cabinets not more than 78 inches (1980 mm) above the finished floor.
 - 1. Comply with requirements for seismic-restraint devices specified in Section 270548.16 "Seismic Controls for Communications Systems."
- D. Manual Fire-Alarm Boxes:
 - 1. Install manual fire-alarm box in the normal path of egress within 60 inches (1520 mm) of the exit doorway.
 - 2. Mount manual fire-alarm box on a background of a contrasting color.
 - 3. The operable part of manual fire-alarm box shall be between 42 inches (1060 mm) and 48 inches (1220 mm) above floor level. All devices shall be mounted at the same height unless otherwise indicated.
- E. Smoke- or Heat-Detector Spacing:
 - 1. Comply with the "Smoke-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for smoke-detector spacing.

2. Comply with the "Heat-Sensing Fire Detectors" section in the "Initiating Devices" chapter in NFPA 72, for heat-detector spacing.
 3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
 4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Annex A or Annex B in NFPA 72.
 5. HVAC: Locate detectors not closer than 36 inches (910 mm) from air-supply diffuser or return-air opening.
 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture and not directly above pendant mounted or indirect lighting.
- F. Install a cover on each smoke detector that is not placed in service during construction. Cover shall remain in place except during system testing. Remove cover prior to system turnover.
- G. Duct Smoke Detectors: Comply with NFPA 72 and NFPA 90A. Install sampling tubes so they extend the full width of duct. Tubes more than 36 inches (9100 mm) long shall be supported at both ends.
1. Do not install smoke detector in duct smoke-detector housing during construction. Install detector only during system testing and prior to system turnover.
- H. Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location. Do not install smoke detectors in sprinklered elevator shafts.
- I. Remote Status and Alarm Indicators: Install in a visible location near each smoke detector, sprinkler water-flow switch, and valve-tamper switch that is not readily visible from normal viewing position.
- J. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install chimes on flush-mounted back boxes. Install all devices at the same height unless otherwise indicated.
- K. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling. Install all devices at the same height unless otherwise indicated.
- L. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- 3.3 PATHWAYS
- A. Pathways above recessed ceilings and in non-accessible locations shall be routed in EMT conduit.
 - B. Pathways shall be installed in EMT.
 - C. Exposed EMT shall be painted red enamel.

3.4 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Section 087100 "Door Hardware." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are listed for use with installed fire-alarm system before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 36 inches (910 mm) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighters' smoke-control system panel.
 - 2. Alarm-initiating connection to stairwell and elevator-shaft pressurization systems.
 - 3. Smoke dampers in air ducts of designated HVAC duct systems.
 - 4. Magnetically held-open doors.
 - 5. Electronically locked doors and access gates.
 - 6. Alarm-initiating connection to elevator recall system and components.
 - 7. Supervisory connections at valve supervisory switches.
 - 8. Supervisory connections at elevator shunt-trip breaker.
 - 9. Data communication circuits for connection to building management system.
 - 10. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.

3.5 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.6 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.
- B. Ground shielded cables at the control panel location only. Insulate shield at device location.

3.7 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by Architect and Authorities having jurisdiction.

- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed record Drawings and system documentation that is required by the "Completion Documents, Preparation" table in the "Documentation" section of the "Fundamentals" chapter in NFPA 72.
 - b. Comply with the "Visual Inspection Frequencies" table in the "Inspection" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 - 2. System Testing: Comply with the "Test Methods" table in the "Testing" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 - 4. Test audible appliances for the private operating mode according to manufacturer's written instructions.
 - 5. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 - 6. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" section of the "Fundamentals" chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" section of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
- E. Reacceptance Testing: Perform reacceptance testing to verify the proper operation of added or replaced devices and appliances.
- F. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports.
- H. Maintenance Test and Inspection: Perform tests and inspections listed for weekly, monthly, quarterly, and semiannual periods. Use forms developed for initial tests and inspections.
- I. Annual Test and Inspection: One year after date of Substantial Completion, test fire-alarm system complying with visual and testing inspection requirements in NFPA 72. Use forms developed for initial tests and inspections.

3.8 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of manufacturer's designated service organization. Include preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include visual inspections according to the "Visual Inspection Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 2. Perform tests in the "Test Methods" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.
 - 3. Perform tests per the "Testing Frequencies" table in the "Testing" paragraph of the "Inspection, Testing and Maintenance" chapter in NFPA 72.

3.9 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.
- C. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.
 - 1. Upgrade Notice: At least 30 days to allow Owner to schedule access to system and to upgrade computer equipment if necessary.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain fire-alarm system.

END OF SECTION 284621.11