July 19, 2019 IDEA PUBLIC SCHOOLS – IDEA Owassa Phase II

GOMEZ MENDEZ SAENZ, INC. 1150 PAREDES LINE RD. BROWNSVILLE, TEXAS 78526 (956) 546-0110

ADDENDUM NO. 3



A. PURPOSE AND INTENT

This addendum is issued for the purpose of modifying the plans and specifications for the IDEA PUBLIC SCHOOLS – IDEA Owassa Phase II

This addendum shall become part of the contract and all CONTRACTORS shall be bound by its content. All aspects of the specifications and drawings not covered herein shall remain the same.

The General Conditions and the Special Conditions of the specifications shall govern all parts of the work and apply in full force to this Addendum.

B. SCOPE

I. CLARIFICATIONS:

- Clarification from Addenda#2 under III.Plans Revise notation as shown below. Sheet A2.01 – Floor plan
 - a. REPLACE Sheet A2.01 Floor plan previously issued with Sheet A2.01 floor plan included in <u>addendum #2.</u>

II. SPECIFICATIONS:

- 1. Front End Specification,
 - a. Bid Proposal Form
 - i. ADDED Alternate #6: Bid Package No. 2 IDEA Headquarters Kitchen in Weslaco, Texas. <u>Bid Proposal Form included in this addendum will become part of the Contract Documents.</u>
- 2. SECTION 01010 SUMMARY OF WORK:
 - a. REPLACE Section 01010 SUMMARY OF WORK previously issued, with Section 01010 SUMMARY OF WORK included within this addendum.
- 3. ADD to contract: Bid package #2 specifications (Architectural & MEP 188 sheets) included within this addenda.

III. PLANS:

1. ADD to contract: Bid package #2 Drawings (Architectural & MEP 8 sheets) included within this addenda.

MEP Addendum Items: See Attached Information (16 Pages)

End of Addendum 3

BID PROPOSAL FORM (GENERAL CONTRACT)

| Project: | Idea Public Schools Owassa Academy and College Prep Phase II |
|----------|---|
| Place: | Idea Public Schools, 2115 W. Pike Blvd., Weslaco, Texas 78596 |
| Date: | Tuesday, July 23, 2019 |
| Time: | 4:00 p.m. |

1. Pursuant to and in compliance with the Invitation to Bid and the proposed Contract Documents, prepared by Gomez Mendez Saenz, Inc. relating to the above referenced project, the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the work at the place where the work is to be completed, and having fully inspected the site in all particulars, hereby proposes and agrees to fully perform the work within the time stated and in strict accordance with the proposed Contract Documents, and addenda, thereto, including furnishing of any and all labor and materials for all General Construction and Site Work, for the following sum of money:

A: BID:

All labor, materials, services and equipment, necessary for completion of the work shown on the drawings and described in the specifications for the IDEA Owassa Academy and College Prep Phase II._____

B. ALTERNATES:

All labor, materials, services and equipment, necessary for completion of the work shown on the drawings and in the specifications.

_____ DOLLARS (\$

Alternate No. 1: Provide Automated Logic, in lieu of, Johnson Controls____

Alternate No. 2: Provide exterior athletic lighting (Poles, fixtures, contractor cabinet and branch circuits as noted on drawings). Reference Specification 265586_____

> _____ DOLLARS (\$)

Alternate No. 3: Provide MC cable for all branch circuit wiring as allowed per NEC (homeruns to be in raceway). Reference Specification 260519.

Alternate No. 4: Add restroom 208B at K classroom 208 with associated finishes as indicated in Architectural and MEP Drawings.

DOLLARS (\$

Alternate No. 5: Provide Voice Data Communication Cabling Equipment including cabling for the multimedia and projector(s) outlets (rapid run).

DOLLARS (\$

DOLLARS (\$

DOLLARS (\$

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Alternate No. 6: Perform scope included in Bid Package No. 2 - Idea Headquarters Kitchen in Weslaco, Texas _____ DOLLARS (\$

2. If awarded this Contract the undersigned will execute a satisfactory Construction Contract, Performance Bond, Labor and Material Payment Bond and proof of insurance coverage, with the Owner for the entire work as per the Contract Documents within 10 days after notice of award. It is agreed that this proposal is subjected to the Owner's acceptance for a period of Thirty (30) calendar days from the above date.

3. This building must be completed by <u>May 15, 2020</u>. Time extensions shall be submitted for review on a monthly basis.

4. Enclosed is a Certified Check or Bidders Bond in the amount of \$______ in compliance with the specification requirements. (5% of the highest amount bid).

The above check or Bidders Bond is to become the property of the Owner in the event the Construction Contract (when offered by the Owner) and the bonds and proof of insurance coverage are not executed within the time set forth above.

5. The undersigned agrees to the following:

- To furnish all materials as shown and specified in the plans and specifications.
- To start work 5 days after notice of award of contract.
- To work ______ working days per week.

6. The full amount of all allowances as specified in the General Requirements, Division 1, of the specifications, in the Base Proposal price shown.

| 7. Receipt is ac | knowledged of the follov | ving addendas: | | | |
|------------------|--------------------------|----------------|-------|-----|-------|
| No. | Dated | No. | Dated | No. | Dated |
| No. | Dated | No. | Dated | No. | Dated |

8. Bidder agrees that the Owner has the right to accept or reject any or all bids and to waive all informalities.

9. A list of Sub-Contractors and Material Suppliers which are proposed to be used on this project is included with this proposal in a separate envelope. Upon acceptance of proposal, substitution of Sub-Contractors or Suppliers listed may be made only with approval by the Owner.

10. By signing, bidder acknowledges that **ALL ALLOWANCES** as listed in Section 01010 – Summary of Work, have been included in the Base Bid.

Respectfully submitted,

| / /· · · · · · | | | CONTRACTOR |
|--------------------------------------|----------|-----------------------|------------------------------|
| (SEAL: - if Bid is by a Corporation) | | Ву: | |
| | | Title: | |
| Address: Street or Box | City | State | Zip |
| Telephone () Fax: () | | | |
| FILL IN APPLICABLE INFORMATION: | | | |
| A CORPORATION, Chartered in the S | TATE of | , authorized to do bu | siness in the State of TEXAS |
| A PARTNERSHIP composed of: | | | |
| AN INDIVIDUAL, operating under the | name of: | | |

DIVISION 1 - GENERAL REQUIREMENTS

SECTION 01010 - SUMMARY OF WORK:

1.1 Location: The project site for IDEA Owassa Campus - Phase II is located at 1000 East Owassa Road Pharr, Texas

1.2 Approval of Working Surfaces: Any contractor performing work over the work of other contractors shall notify the Architect of any unsatisfactory condition. Beginning of work by any contractor shall constitute the acceptance of the previous work.

1.3 Checking Dimensions at Site: Before ordering any materials or doing any work, verify all measurements of the building and be responsible for the correctness of them. No extras will be allowed for variations from drawings in existing conditions or for work performed under this contract. Any discrepancies found shall be submitted to the Architect for instruction before proceeding. The Section shall be enforced diligently.

1.4 Cutting & Patching: No excessive cutting will be permitted, nor shall any structural members be cut without the approval of the Architect. Each contractor shall leave all chases and openings straight, true and of the proper size in his work as may be necessary for the proper installation of his and/or other contractor's work. After such work has been installed, he shall carefully fit around, close up, repair, patch and point up same as directed, to the entire satisfaction of the Architect.

1.5 Cooperation: The General Contractor, all other contractors and all sub-contractors shall coordinate their work with all adjacent work and shall cooperate with all other trades so as to facilitate the general progress of the work. Each trade shall afford all other trades every reasonable opportunity for installation of their work and storage of their materials.

1.6 Project Logbook: The project superintendent shall maintain a daily project logbook, indicating which sub-contractors were on the job, time of arrival, and the number of workers. Statements as to the daily progress shall be logged. This log book shall be made available to the Architect and shall be kept at the job site office.

1.7 Inspection and Tests: Architect and his representative shall at all times have access to the work whether it is in preparation or progress. Provide proper and safe facilities for such access and inspection. Make all inspections and test in connection with this entire contract as required by the Architect. All material testing shall be paid for by the Owner.

1.8 Security: Provide security fencing in all work areas. See Temporary Facilities.

1.9 Mock up Panel: Provide a mock-up for evaluation of product and application workmanship.

- 1. Install in area and of size designated by Architect.
 - a. Construct mockup to illustrate backup wall, exterior sheathing, air barrier, cavity wall, connectors, weep holes, cavity vents, and through wall flashing.
 - b. Construct mockup panel 72 inches by 72 inches to illustrate coursing, anchorage, mortar joints and color, window opening and flashing system.
- 2. Do not proceed with work until finish color, texture, pattern, joint sizes, and installation workmanship are approved by Architect.
- 3. Correct mock-up area as required to produce acceptable work.

2. ALLOWANCES:

See Paragraph 4.8 of the General Conditions.

2.1 Betterment Allowance: Include the sum set forth below as a Betterment Allowance which will, if needed, be expended on Betterment to the Project, as directed in writing by approved change orders;

BETTERMENT ALLOWANCE: \$ 150,000.00

2.2 Structural Allowance:

Reinforcing Bars = 1.0 tons @ \$2,000 per ton M&L (Refer to Spec Section 03200 and Sheet S1.1 General Structural Notes, Concrete Note 12)

Fabricated / Primed Steel = 1.0 tons @ \$4,000 per ton M&L (Refer to Spec Section 05120 and Sheet S1.1 General Structural Notes, Structural Steel Note 17)

SECTION 0110 - BID SCHEDULE

1. BID SCHEDULE: All proposals and alternate bid items shall be subject to the General and Special Conditions and all other related sections of the specifications and requirements of the drawings. The Owner shall have the right to accept or reject any or all alternates.

- 1.1 BASE BID: The Contractor shall state on the General Contract Bid Proposal under the Base Bid, the amount for all work, complete in all respects in accordance with plans and specifications, to construct Owassa Phase II. The scope of work is defined in the plans and specifications.
- 1.2 ALTERNATES: The Contractor shall state on his Bid Form, under each Alternate the amount to add to his bid to perform all work, complete in all respects, in accordance with the plans and specifications to construct work required by the Alternates.

<u>Alternate #1 – HVAC Controls:</u> Provide Automated Logic, in lieu of, Johnson Controls

<u>Alternate #2 – Athletic Lighting:</u> Provide exterior athletic lighting (Poles, fixtures, contractor cabinet and branch circuits as noted on drawings). Reference Specification 265586

<u>Alternate #3 – MC Cable:</u> Provide MC cable for all branch circuit wiring as allowed per NEC (homeruns to be in raceway). Reference specification 260519.

<u>Alternate #4:</u> Add Restroom 208B at K Classroom 208 with associated finishes as indicated in Architectural and MEP Drawings.

<u>Alternate #5:</u> Provide Voice Data Communication Cabling Equipment including cabling for the multimedia and projector(s) outlets (rapid run).

<u>Alternate #6:</u> Perform scope included in Bid Package No. 2 - Idea Headquarters Kitchen in Weslaco, Texas Texas .

SECTION 0120 - AS BUILT DRAWINGS:

As the work proceeds, keep careful records of piping, electrical circuits, duct work and other concealed work whose installed location varies from that shown on plans. Furnish the Architect with one marked up set before final.

SECTION 0130 - REPORTS:

The Contractor will provide a written report to the Architect after each inspection conducted by the City Inspectors concerning their findings.

SECTION 0140 - QUANTITIES & WARRANTIES:

All guarantees and warranties expressed or implied shall be provided to the Architect in written form prior to final payment.

SECTION 0150 - PICTURES:

The Contractor will provide the Architect with sequence photographs showing the flashing in place prior to installation of exterior windows, doors and application of roofing material. This is MANDATORY. Close-ups of <u>ALL</u> flashing are required.

The Contractor is required to submit progress photos with each month's application for payment.

The Contractor is required to provide Aerial Photos (North, South, West, and East) monthly and submit with each month's application for payment until the project is substantially complete.

SECTION 0160 - CERTIFICATION OF CONSTRUCTION:

The building contractor or construction manager shall certify in writing that the facility has been constructed in accordance to the construction documents and its specifications.

SECTION 0170 - CERTIFICATION OF NON-USE OF ASBESTOS PRODUCTS

The General Contractor shall provide the Architect with written certification letters from all subcontractors and suppliers that no asbestos products shall be used on this project.

SECTION 0180 - SCOPE AND SEQUENCE OF CONSTRUCTION

1.1 General:

This building must be completed by <u>May 15, 2020</u>. Time extensions shall be submitted for review on a monthly basis.

The successful bidder shall under no circumstances leave this project unsecured or unprotected at any time during construction. The General Contractor is to refer to Section 01505 Temporary Facilities for any and all requirements required by this project.

The General Contractor to provide all necessary precautions and safeguards during construction for protection of any visitor whom might visit the project site. The General Contractor shall provide in a neat format project monthly reports with photos showing progress of construction for their review.



119 W. Van Buren Ave. Ste. 101 Harlingen, TX 78550 Off: (956) 230-3435 Fax: (956) 720-0830 www.ethoseng.net

July 18, 2019 IDEA Owassa College Prep Phase II



MECHANICAL/PLUMBING

ELECTRICAL

ADDENDUM NO. 3

A. PURPOSE AND INTENT

This addendum is issued for the purpose of modifying the plans and specifications for the project referenced above.

This addendum shall become part of the contract and all contractors shall be bound by its content. All aspects of the specifications and drawings not covered herein shall remain the same.

The General Conditions and the Special Conditions of the specifications shall govern all parts of the work and apply in full force to this addendum.

I. Specifications:

1) Section 269750 Voice and Data Communications: Modify per attached document "Internal Connections – Structured Cabling".

II. Drawings:

- 1) Sheet M3.01:
 - a) Revised Mechanical Plan for rooms 146B. See attached sheet M301b.
- 2) Sheet E3.01:
 - a) Revised Lighting Plan for rooms 146B. See attached sheet E3.01b.
- 3) Sheet E4.01:
 - a) Revised Electrical Plan for rooms 146B. See attached sheet E4.01b.
- 4) Sheet E6.01:
 - a) Light Fixture Type J2E: Mark Lighting Slot 4 LED is an acceptable substitution.
- 5) Sheet P2.01:
 - a) Revised Plumbing Plan for rooms 146B. See attached sheet P2.01b.

F. Internal Connections - Structured Cabling

F.1 General Requirements

F.1.1 The primary scope of work is to provide a complete, "turn-key" structured cable infrastructure, if applicable, that will serve the district reliably for many years. All cabling, copper, and fiber optic must be plenum rated. Vendor is responsible for old cable removal when needed. This also includes rack and old network equipment.

F.2 Standards

All Vendors must meet all applicable codes / standards defined below, and any others that may be F.2.1 defined.

- F.2.2 The Vendor will follow the National Electric Code (NEC), the National Electric Safety Code (NESC), any applicable State of Texas code, and local codes.
- F.2.3 The Vendor will provide materials and equipment that is new and will conform to the NEMA, UL, ANSI, IEEE, and IPCEA standards. All cabling will follow the BISCI standards of installation, testing and maintenance.
- F.2.3 ANSI/TIA/EIA Standards 568D Commercial Building Telecommunications Cabling Standard ANSI/TIA/EIA Standard 569 - Commercial Building Standards for Telecommunications Pathways and Spaces ANSI/TIA/EIA -606 - Administration Standard of the Infrastructure of Commercial Buildings ANSI/TIA/EIA -607 - Commercial Building Grounding and Bonding Requirements for Telecommunications ANSI/TIA/EIA-758 - Customer Owned Plant Telecommunications Cabling Standard TSB-67, 95, and 72 - Testing standards and reporting

F.3 Scope of Project /Scope of work

F.3.1 The Horizontal Structured Cabling System shall consist of Category 6 cables placed from the Telecommunications Room on each floor to the outlets as shown on drawings. All Category 6 outlets will terminate in the Telecommunications Room on 24-port or 48-port Category 6 patch panels. Wire management shall be used to provide cable management above, below and to each side of the patch panel.

Cabling for horizontal cabling shall be routed through J-hooks placed above ceiling and below floor as needed to accomplish proper cable routing to work areas. J-hooks and all cable pathways they create shall follow building lines and allow access to cabling from hallway and open area locations and not be placed over other end user offices. J-hooks should follow all building lines.

All structured cabling shall be from a single manufacturer to insure optimum performance.

Faceplate types are as follows: Flush Wall mount 1, 2, 3, or 4-port faceplate mounted on wall in device box at the work-area.

Contractor will provide all materials to place and terminate all outlet types.

Category 6 outlets will be colored Blue.

Category 6 horizontal cables shall be Blue.

Patch cords to complete work area patching shall be provided by the contractor.

Twenty-Five (25) CAT 6 work area patch cord, 6 inches in length and Blue in color shall be provided. Fifty (50) CAT 6 work area patch cord, 10 feet in length and Blue in color shall be provided. Ten (10) CAT 6 work area patch cord, 15 feet in length and Blue in color shall be provided. Five (5) CAT 6 work area patch cord, 25 feet in length and Blue in color shall be provided. Two (2) CAT 6 work area patch cord, 50 feet in length and Blue in color shall be provided.

Customer staff will be responsible for patch cord installation.

Patch cords to complete closet patching shall be provided by the contractor. One (1) CAT 6 work area patch cord, 6 inches in length and Blue in color shall be provided for 100 percent of the patch panel ports terminated in this project. Customer staff will be responsible for patch cord installation.

F.3.2 Backbone-Fiber

The Backbone Fiber Riser System shall consist of fiber cables with either 12 (twelve) 50-um multimode interlocking armor cable placed from the each IDF and terminating in the MDF, as shown on the drawings. All fiber terminations shall be fusion spliced pigtails with LC connectors. Fiber will be terminated and routed through rack mount fiber panels. 2 duplex 7' LC patch cords will be provided for each closet.

F.3.3 J-Hooks

The cabling from the Telecommunications Rooms will be routed to their respective outlets utilizing J-Hooks above ceiling and below floor. Cables will be bundled in groups of less than 50 and placed no more than 5' apart following the pathway from Telecommunications Room to work area outlet. Jhooks and all mounting hardware as well as any placement of these devices are the responsibility ofthe contractor.

F.3.4 Rack Hardware

Rack Hardware will be utilized in the IDF's and MDF to house terminated Category 6 patch panels, fiber termination hardware, and network switch equipment. All rack hardware will be secured to the floor with appropriate hardware and overhead by cable tray. All racks will be 7 feet in height and 19 inches wide with 3-inch channels.

Vertical cable management will be utilized between each rack and at the end of each rack row to manage vertical patch cables (in front) and horizontal cable runs (in back). 6" vertical cable managers will be used between racks to provide cable management vertically.

Horizontal wire management shall be provided so there will be wire management above and below each copper patch panel.

Alternately, as noted on the drawings, wall-mounted racks shall be utilized in the IDF to house terminated Category 6 patch panels, fiber termination hardware, and network switch equipment. All rack hardware will be secured to the wall with appropriate hardware.

All rack hardware shall be grounded to an approved building ground.

F.3.5 Cable Tray

Cable tray shall be placed inside the IDF's and MDF to provide a pathway into the room and routing the cables to the rack mounted termination hardware. Cable tray will be 18" wide and mounted to walls and racks as shown on drawings. Tray shall be mounted above racks and doors to allow a natural cable drop from the tray to the rack.

All cable trays shall be grounded to an approved building ground.

F.3.6 Fire-stopping systems

Suitable fire-stopping shall be used to prevent the spread of smoke and fire through out the building. Contractor will be responsible for installing fire-stopping system for every wall or floor penetration as required by code.

F.3.7 UPS

An Uninterruptible Power System shall be placed into each Telecommunications Room to provide conditioned power and back-up in case of power failure. UPS shall be mounted in the bottom of the rack housing the network equipment.

F.3.8 Grounding

Contractor shall provide a ground bar at each termination location (Telecommunications Rooms and Equipment Room). Contractor shall provide a #6 AWG stranded copper wire cable between ground bars located at each TR and ER to the building main service ground point. This ground conductor shall be utilized for grounding termination equipment, equipment rack and cable tray.

Telecommunication Network System

F.4 Requirements

- F.4.1 The Structured Cabling System shall consist of any one or all of the following structured cabling elements or subsystems:
 - Work area
 - Horizontal cabling
 - Telecommunications room (or horizontal cross connect)
 - Backbone cabling
 - Equipment room
 - Entrace facility
 - All cable support structure

F.4.2 Supported Applications

The Structured Cabling System shall be capable of supporting and/or integrating the following:

Analogue and digital voice applications

- · Data applications
- · Local area network services
- Wide area network services
- Video /Imaging services
- Low voltage devices for building controls

F.4.3 Additional requirements

• Categorized copper product shall be used in conjunction with an equivalent or higher Category cable as verified by ETL or TSV.

• All structured cabling products shall be installed according to any applicable instructions.

• All networks and other applications shall be installed per applicable standards and manufacturers' guidelines and transmitted over the appropriate minimum Category copper cable or fiber cable for which it was intended to operate on.

• All applicable local, state, national, and federal electrical and fire safety standards shall be adhered to during and after installation.

F.5 Work Area Outlet

The Work Area shall consist of the connectivity equipment used to connect the horizontal cabling subsystem and the equipment in the work area. The connectivity equipment shall include the following options:

- * Category 6 Copper outlets
- * Patch (equipment) cords
- * Faceplates

F.5.1 Category 6 Copper Outlets

All category 6 information outlets designed for termination of 4-pair balanced twisted-pair category 6 copper cables must possess the following characteristics at the minimum:

• Be able to be a gravity feed (45 degree angled) as well as flush mount utilizing the same jack.

• Have 110 style insulation displacement connectors with quadrant pair isolation and a pyramid wire entry system. Termination is accomplished with a single conductor impact tool.

• Be backwards compatible to allow lower performing categories of cables or connecting hardware to operate to their full capacity.

• Have rear protective strain relief caps rear entry, which will be installed onto cable after termination.

• Support industry standards for T568A or T568B wiring options (568B wiring scheme applicable to this project) on each individual outlet.

• Be side-stackable for high-density solutions.

- Provide color-coded and labeled for VOICE, DATA or Blank , Snap-In icons for circuit identification.
- Be constructed of high impact, flame-retardant thermoplastic.
- Must be Third Party Verified to all claims.

• Verified to ETL TSV performance in a channel

CommScope Uniprise- UNJ600-BL or equivalent

F.5.2 Patch Cords

All category 6 Patch (Work-area) Cords shall use 4-pair balanced twisted-pair category 6 23 AWG stranded twisted pair copper cable and be available in both Booted and Non Booted options. The cords must be available in Blue in a length of 10 feet. Patch cords shall be from the same manucturer as the horizontal cabling to insure optimum performance.

CommScope UNC6-BL-10F Work Area CAT 6 Patch Cord 10' Blue or equivalent

F.5.3 Face/Wall plates

The faceplates shall support the network system by providing high-density in-wall, surface mount or modular office furniture cabling applications. The outlets consist of faceplates for flush and recessed in-wall mounting as well as mounting to the modular office furniture systems. The surface mount boxes can be mounted where in-wall applications are not possible or to support applications where surface mount is the best option.

Designer series faceplates shall be available in single gang design in White and available in (1 or 4) port openings. They shall poses contoured edges for a contemporary appearance. They shall feature openings on both sides to allow easy identifications of the ports and accept Uniprise information outlets. They shall come equipped with mounting screws, label covers, and label cards. CommScope – M14LE-262 (4-port outlet) or equivalent

CommScope – M13LE-262 (3-port outlet) or equivalent CommScope – M12LE-262 (2-port outlet) or equivalent CommScope – M10LE-262 (1-port outlet) or equivalent

F.6 Horizontal cabling Subsystem

The horizontal cabling system is the portion of the telecommunications cabling system that extends from the work area telecommunications outlet/connector to the horizontal cross-connect in the TC.

- Horizontal cabling in an office should terminate in a TC located on the same
- floor as the work area being served
- Horizontal cabling is installed in a star topology (home run)
- · Bridged taps and splices are not permitted as part of the copper horizontal cabling

F.6.1 Copper UTP Cable

Category 6 UTP Cable * Maximum cable lenght is 90 meters

These requirements are for cables of four unshielded twisted pairs of 23 AWG bare copper, thermoplastic insulated solid conductors enclosed by a thermoplastic jacket. The finished cable shall exceed the requirements of ANSI/TIA/EIA-568-B.2-1 Category 6.

All cable shall conform to the requirements for communications circuits defined by the National Electrical Code (Article 800) and the Canadian Building Code. All cable shall be listed with an OSHA approved laboratory and carry labeling of either CMP or CMR which ever is appropriate for the installation environment.

The cable manufacturer shall be ISO 9001 registered.

F.6.2 Cabling Testing Criteria

- Tested to 650 MHz
- Maximum Delay Skew < or = 25 ns
- Typical Positive PowerSum ACR ≥ 400 Mhz
- Capacitance Unbalance of 58.2 pF Max @ 23 degrees Celsius.
- Typical PSUM NEXT & NEXT ≥ 10dB better than category 6 standard

F.6.3 Color codes

The color code shall be as follows:

Pair 1 Blue-White/with extruded Blue stripe on White single Pair 2 Orange-White/with extruded Orange stripe on White single Pair 3 Green-White/with extruded Green stripe on White single Pair 4 Brown-White/with extruded Brown stripe on White single

F.6.4 Cable-Jacket Print

The cable jacket shall be printed with a minimum of the following information: Manufacturer, Manufacturer's part number, cable type, listing file number, number of pairs, listing type (i.e. CMR), and sequential footage markings starting at 1000 ending at 0. Web-Trak cable test report identification number

CommScope CS37P BLU C6 4/23 U/UTP CPK 1KFT Category 6e U/UTP Cable, Blue

F.7 Telecommunications Rooms

The telecommunications room (TR) includes those products that connect the networking equipment to the horizontal and backbone cabling subsystems. These products include termination hardware (connectors and patch cords), racks, cable management products and cable routing products.

F.7.1 Cable Termination Hardware

Each horizontal or backbone cabling run will be terminated using appropriate connectors or connecting blocks depending upon the cable type. Matching patch cords will be used to perform cross-connect activities or to connect into the networking/voice hardware.

F.7.1.1 Modular Path Cables

Uniprise UNP600 Category 6 Angled Patch Panels are 19-inch rack-mounted modular jack panels designed for quick and repeatable configuration of Category 6 circuits. The panel back consists of craft friendly color-coded gas-tight insulation displacement connections.

Design features include termination options for either T568A or T568B wiring schemes (568B wiring scheme applicable to this project). Each 6-port module includes cable tie slots (and ties) to quickly secure cables. Also included are icon labels with plastic holders for easy port identification. Advanced design features also include offset terminations that reduce crosstalk. Insertion life exceeds 750 cycles.

Patch panels will be installed above and below switches. 24-port patch panels shall be installed above the top switch and below the bottom switch in each rack. 48-port patch panels shall be installed between switches in each rack.

CommScope UNP-6-DM-2U-48 Category 6 Patch Panel, 48 port or equivalent CommScope UNP-6-DM-1U-24 Category 6 Patch Panel, 24 port or equivalent

F.7.1.2 Copper Patch (Equipment) Cords

6" patch cords are prefered in the closet to avoid the need for horozontal and vertical management of patch cords. Patch cords shall be from the same manucturer as the horizontal cabling to insure optimum performance.

Uniprise Category 6 patchcords are high-performance UTP components available in a broad range of lengths and easy-to trace colors. They are designed to meet or exceed all Category 6 specifications, yet are fully backward compatible with Category 5e and lower systems.

23 AWG conductors are securely mated with a patented RJ45 plug design to deliver superior electrical performance with excellent repeatability. The unique anti-snagging feature simplifies removal and replacement of patch cords.

CommScope UNC6-BL-6N Closet CAT 6 Patch Cord 6" Blue or equivalent

F.7.1.3 Fiber Termination Enclosure

All fiber optic rack mount enclosures shall be CommScope. All adapter panels shall be CommScope for Multi-mode applications. All rack mount enclosures shall be CommScope Uniprise Ready enclosures.

CommScope SD-1U Enclosure or equivalent CommScope SD-2U Enclosure or equivalent CommScope SD-4U Enclosure or equivalent

F.7.1.4 Fiber Patch (Equipment) Cords

All fiber optic patch cords shall be duplex CommScope fiber patch cords. Connector type shall be CommScope LC connectors for Multi-mode applications. All fiber patch cords shall be CommScope factory assembled and tested, and supplied for each terminated fiber connection, plus 15%. Lengths shall be 3 - 10 meters.

F.7.1.5 Fiber Pigtail Kits

All fiber optic pigtails and connectors shall be CommScope. Connector type shall be CommScope LC connectors for both Single-mode and Multi-mode applications. Multi-mode pigtails shall be constructed with LazrSPEED 550 OM4 fiber. Singlemode pigtails shall be constructed with TeraSPEED OS2 fiber.

CommScope FAXLCUC0C-F003 Pigtail Kit (50-um) or equivalent CommScope FAWLCUC0C-F003 Pigtail Kit (SMF) or equivalent

F.7.2 Cable Management

The Cable Management System shall be used to provide a neat and efficient means for routing and protecting fiber and copper cables and patch cords on telecommunication racks and enclosures. The system shall be a complete cable management system comprised of vertical and horizontal cable managers to manage cables on both the front and rear of the rack. The system shall protect network investment by maintaining system performance, controlling cable bend radius and providing cable strain relief.

F.7.2.1 Rack Systems

Standard Rack

The 7'H x 19"W UL listed standard equipment rack is an Underwriters Laboratory listed 22Y9 communications circuit accessory designed specifically for use in telecommunications equipment installations where codes require UL Listed equipment racks.

Vertical Cable Management

Double-Sided Vertical Management

The 7'H x 6"W vertical managers are double-sided to allow for front and back side cable management. The doors are lightweight, but sturdy. Doors are equipped with dual hinge latching to enable opening from the right or left.

Recessed handles eliminate snag potential for clothes and arms. C Channel bracket allows for easy access to the cable trough. Tool-less installation of Cable Spool.

IDF's Racks:

CommScope RK3-45A 7' x 19" 2-post rack or equivalent CommScope VCM-DS-84-6B or equivalent

MDF Racks: APC AR3150 - Netshelter

IDF-Portables Chatsworth Tinted CUBE-iT PLUS Cabinet System or equivalent with 30" Depth, 48" Height

F.7.2.2 Cable Tray

The Cable Tray in a Telecommunications Room / Equipment Room shall be placed to allow easy access into the room and formed as shown on drawings. Tray shall route cables from room entrance to their termination location. Tray shall use a stand off bracket to allow cables to be routed above racks and flow easily into vertical managers.

All cable trays shall be grounded to ground bar located in the termination location.

F.8 Backbone Cabling System

The Backbone Cable Subsystem in a building is the part of the premises distribution system that provides connection between equipment rooms, telecommunication rooms, and telecommunications service entrance facilities. A backbone subsystem provides either intra-building connections between floors in multi-story buildings or inter-building connections in campus-like environments.

All cables shall be run using a star topology (home run) from the Main Cross-Connect (MC) in the Equipment Room to each Horizontal Cross-Connect (HC) within the Telecommunications Room. The length of each individual run of backbone fiber cable shall not exceed 2000 meters for multimode and the length of each UTP cable run for voice applications is not to exceed 800 meters (90 meters for data) as specified under TIA/EIA-568-A.

The type of backbone fiber cable shall be 50/125 m multimode fiber optic cable. The bending radius and maximum pulling tension of the cable shall be adhered to during handling and installation.

F.8.1 Fiber Backbone

The type of fiber cable used shall contain Laser Optimized 50 micron OM-3 Multimode fiber.

Termination enclosure will be located at the top of the rack housing the network equipment in the Telecommunications Room.

Termination enclosure shall be located at the top of the rack housing the network equipment in the Equipment Room.

F.8.2 Fiber Cable

• Fiber Optic Backbone Cable shall be rated OFNP or OFNR per the installation environment as defined by the NEC and local authority having jurisdiction.

Multimode:

a) Fiber construction shall be multi-mode with a core/cladding size of 50/125 microns. Contractor shall purchase and install the appropriate CommScope fan out and breakout materials where dictated by the application and choice of fiber optic cable type. The maximum attenuation of the cable shall be 3.0 dB/km at 850nm and 1.0 dB/km at 1300nm. The cable shall be capable of supporting 10 Gigabit Ethernet to 300 meters.

b) See Multimode Fiber Specifications section for detailed specifications.

Singlemode:

a) Fiber construction shall be matched clad singlemode. The maximum attenuation of the cable shall be 0.50 dB/km at 1310nm and 0.50 dB/km at 1550nm.

b) See Singlemode Fiber Specifications section for detailed specifications.

• Fiber Optic Cable size shall contain 12 fibers, and termination shall be as per the backbone diagram, or Customer requirements. All Fiber Optical Cable shall be constructed to the requirements listed in Fiber Cable Specifications.

• All fiber links shall be tested for attenuation using a power meter and light source. The allowable attenuation for any link shall be calculated using the CommScope link loss calculator.

All testing shall be accomplished according to Section 11 of ANSI/TIA/EIA-568.1-D

CommScope 50 micron LazrSPEED 300 Multimode fiber cable P-012-DZ-5LFSUAQ or equivalent CommScope 50 micron LazrSPEED 550 Multimode fiber cable P-012-DZ-5K-FSUAQ or equivalent CommScope TeraSPEED Singlemode fiber cable P-012-DZ-8W-FSUYL or equivalent

F.8.2.1

1. Fiber Optic Backbone Cable shall be rated OFNP or OFNR per the installation environment as defined by the NEC and local authority having jurisdiction.

a) Multi Mode

Fiber construction shall be multi-mode with a core/cladding size of 50/125 microns. Contractor shall purchase and install the appropriate CommScope fan out and breakout materials where dictated by the application and choice of fiber optic cable type. The maximum attenuation of the cable shall be 3.0 dB/km at 850nm and 1.0 dB/km at 1300nm. The cable shall be capable of supporting 10 Gigabit Ethernet to 300 meters.

When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550 nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550 nm

F.8.3 Fiber Cable Specifications

This optical fiber backbone cable shall be suitable for installation in building riser systems, in conduit, in cable tray and/or in innerduct.

1. Optical fiber cable shall be encased in an interlocking armor with an overall jacket.

a. Optical fiber cable shall carry an OFCP (Optical Fiber Conductive Plenum) or OFCR (Optical Fiber Conductive Riser) rating, depending on installation environment.

b. Outer Sheath: The outer sheath shall be marked with the manufacturer's name, date of manufacture, fiber type, listing (OFCP or OFCR), manufacturer's identification number, and sequential length markings every two feet.

2. Temperature Range:

Storage: -40°C to +70°C (no irreversible change in attenuation).

Operating: -20°C to +70°C.

3. Humidity Range: 0% to 100%.

4. Single Unit Cables:

a. Maximum Tensile Strength (2 fibers).

During Installation: 1001 Newton (225 lb. force) (no irreversible change in attenuation). Long Term: 300 N (67 lb. force).

b. Maximum Tensile Strength (≥4 fibers):

During Installation: 1335 Newton (300 lb. force) (no irreversible change in attenuation).

Long Term: 400 N (90-lb. force).

5. Multiple Unit Cables:

a. Maximum Tensile Strength (£24 fibers).

During Installation: 2670 Newton (600 lb. force) (no irreversible change in attenuation). Long Term: 180 N (801 lb. force).

b. Maximum Tensile Strength (36 ³ fibers ³ 48):

During Installation: 3560 Newton (800 lb. force) (no irreversible change in attenuation). Long Term: 1068 N (240-lb. force).

c. Maximum Tensile Strength (≥60 fibers):

During Installation: 4450 Newton (1000 lb. force) (no irreversible change in attenuation). Long Term: 1335 N (300-lb. force).

6. Bending Radius: During Installation: 20 times cable diameter. No Load: 10 times cable diameter.

F.8.4 Fiber Hardware Hardware

All Fiber Optic termination Hardware shall be CommScope. Termination hardware in the Equipment Room shall be shall be CommScope for Multi-mode applications. All rack mount enclosures shall be CommScope Uniprise Ready enclosures.

CommScope SD-1U Enclosure or equivalent CommScope SD-2U Enclosure or equivalent CommScope SD-4U Enclosure or equivalent

F.8.5 LC Connectors

When fusion splicing is not practical, epoxy-polish fiberoptic connectors shall be used to terminate mulcimode and singlemode fiber. All Fiber Optic Connectors shall be CommScope. They shall be available in LC style connectors. They shall be terminated with anaerobic style kits.

CommScope MFC-LCR-09-BG LC Connector for 0.9 mm Fiber (MM) or equivalent CommScope SFC-LCR-09-BL LC Connector for 0.9 mm Fiber (SM) or equivalent

F.8.6 Fiber Optic Adapter Splice Cassettes

The splicing cassette is designed for use in the SD fiber shelf, which has a LGX/1000 style footprint. Fusion splices are utilized and managed inside the cassette after splicing. The cassettes are available

with 12 fiber LC duplex connections in 50-micron Multi-mode fiber and Singlemode Fiber versions. The splice cassette is provided with pigtails in the appropriate fiber type and fusion splice protection sleeves. Break out kits are not required when utilizing the splice cassette.

This product is intended for indoor use or can be used outdoors in a suitable protective enclosure.

CommScope PNL-CS-12LCX-PT Splice Cassette (MM) or equivalent CommScope PNL-CS-12LCW-PT Splice Cassette (SM) or equivalent

F.8.7 Fiber Optic Patch Cords

All fiber optic patch cords shall be available in LC connector type. Cords shall be available in multiple jumper lengths. CommScope's fiber optic jumpers connect the patch panel/shelf to the equipment bay.

CommScope Multimode Duplex LC jumper FEXLCLC42-MXF or equivalent

F.9 Grounding

Contractor shall provide a ground bar at each termination location (Telecommunications Rooms and Equipment Room). Contractor shall provide a #6 AWG stranded copper wire cable between ground bars located at each TR and ER to the building main service ground point. This ground conductor shall be utilized for equipment, termination, equipment rack, cable tray and computer equipment grounding.

All grounding and bonding shall meet the National Electrical Code (NECÒ) as well as local codes, which specify additional grounding and/or bonding requirements.

Bonding and Grounding

Communication bonding and grounding shall be in accordance with the NECÒ and NFPA. Horizontal cables shall be grounded in compliance with ANSI/NFPA 70 and local requirements and practices. Horizontal equipment includes cross connect frames, patch panels and racks, active telecommunication equipment and test apparatus and equipment. When required by local code, provide a Telecommunications Bonding Backbone utilizing a #6-AWG or larger bonding conductor that provides direct bonding between equipment rooms and telecommunications closets. This is part of the grounding and bonding infrastructure (part of the telecommunications pathways and spaces in the building structure), and is independent of equipment or cable.

IDEA OWASSA CAMPUS PHASE II

PHARR







NORTH

TEXAS

IDEA OWASSA CAMPUS PHASE II

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REVISION: BY: NO: ADD 2019-07-18 ETHOS engineering TEXAS REGISTERED ENGINEERING FIRM F-15998 RAY PEYNADO DATE: 06/13/19 CHECKED BY: R.P. DRAWN BY: J.M. PROJECT NO .: 18V36 CAD FILE: SHEET: E3.01b

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IDEA OWASSA CAMPUS PHASE II

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GMS ARCHITECT 1150 Paredes Line Ro Brownsville TX 78526 (956) 546-0110 fax (956) 546-0196 SZ Ŷ Ш $\mathbb{R}^{>}$ \supset Ζ Q ш ◀ S S Ш ШХ Т Т A C O Ш⊢ Σ MEX BID PACKAGE #2 **IDEA** Public Schools C Copyright 2019 Gomez Mendez Saenz Ir Architects-Planners Interior Designers Project Architect: Roan G Gomez, AIA Drawn By: IDEA HQ KITCHEN





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No. REVISIONS BY

CODES & ORDINANCES:

1. GENERAL:

- a. UNLESS DRAWINGS OR SPECIFICATIONS HAVE MORE STRINGENT REQUIREMENTS, PERFORM ALL WORK PER APPLICABLE VERSION OF INTERNATIONAL BUILDING CODES, AND LOCAL CODES AND ORDINANCES.
- b. PRIOR TO SUBMITTING PROPOSAL, NOTIFY ENGINEER OF ANY ASPECTS OF DESIGN WHICH ARE THOUGHT TO BE IN NONCOMPLIANCE WITH APPLICABLE CODES.
- 2. PERMITS: a. CONTRACTOR IS RESPONSIBLE FOR ALL PERMITS AND FEES ASSOCIATED WITH PROJECT, INCLUDING FEES FOR INSPECTIONS, APPLICATIONS, AND PROVISION OF NEW SERVICES.
- b. CONTRACTOR WHO WILL ACTUALLY PERFORM WORK MUST APPLY FOR ALL REQUIRED PERMITS.
- 4. APPROVALS AND INSPECTIONS: a. OBTAIN APPROVAL FROM CITY FIRE DEPARTMENT AND BUILDING AND SAFETY DEPARTMENT PRIOR TO INSTALLATION OF ANY FIRE RELATED ITEMS.
- b. COORDINATE PRESSURE TESTS, INSPECTIONS AND APPROVAL FOR ALL SYSTEMS WITH PERMITTING OFFICER, OWNER AND ENGINEER.

GENERAL NOTES:

- 1. CONTRACT RELATED: a. COORDINATE WORK AMONG ALL DISCIPLINES. IT IS NOT THE INTENT OF THESE DOCUMENTS TO DICTATE WHO MUST DO THE WORK. ALL WORK SHOWN IS THE RESPONSIBILITY OF THE (PRIME) CONTRACTOR.
- b. WORK TO BE DONE UNDER ALLOWANCES BECOMES AN INTEGRAL PART OF THE PROJECT AND RESPONSIBILITY OF CONTRACTOR ONCE ALLOWANCE IS APPROVED.
- c. CONTRACTOR SHALL NOT PROCEED WITH ANY WORK INVOLVING A CHANGE IN PROJECT SCOPE OR COST WITHOUT FIRST HAVING OBTAINED ENGINEER'S APPROVAL IN WRITING. UNLESS ENGINEER HAS AGREED TO SUCH CHANGE PRIOR TO IT BEING DONE, AND HAS AGREED THAT AN INCREASE IN COST ASSOCIATED WITH SUCH CHANGE IS WARRANTED; CONTRACTOR WILL NOT BE REIMBURSED FOR SUCH CHANGE.
- 2. TEST & BALANCE: a. TEST & BALANCE SHALL BE PERFORMED UNDER GENERAL CONTRACTOR, SEPARATE FROM MECHANICAL CONTRACT. DURING BIDDING, CONTRACTOR SHALL SUBMIT A COPY OF EVIDENCE THAT TAB AGENT MEETS THE QUALIFICATIONS SPECIFIED UNDER DIV. 23 SECTION 230593 TO PRIME CONTRACTOR.
- b. TEST & BALANCE TO COORDINATE MINIMUM AND MAXIMUM OUTSIDE AIR DAMPER SETTINGS WITH DDC CONTROLS AND ENGINEER. PROVIDE TIME ALLOTMENT FOR MULTIPLE DAMPER SETTINGS IN SOME CASES.
- c. CONTRACTOR SHALL COORDINATE TAB ACTIVITIES WITH TAB CONTRACTOR.

COORDINATION:

- 1. GENERAL a. CONTRACTOR SHALL REVIEW COMPLETE DOCUMENTS PRIOR TO SUBMITTAL OF PROPOSAL TO GAIN COMPLETE UNDERSTANDING OF PROJECT SCOPE, WORK BY OTHERS, AND MECHANICAL WORK ASSOCIATED WITH OTHER DISCIPLINES.
- b. IT IS NOT THE INTENT OF THESE DOCUMENTS TO DICTATE WHO MUST DO THE WORK. ALL WORK SHOWN IS THE RESPONSIBILITY OF THE (PRIME) CONTRACTOR. COORDINATE MECHANICAL WITH OTHER TRADES SUCH AS PLUMBING, ELECTRICAL AND STRUCTURAL WORK. COORDINATE SCHEDULE OF WORK WITH ALL SUB-CONTRACTORS TO ACHIEVE SMOOTH FLOW OF CONSTRUCTION.
- c. TIME OR MONEY ALLOWANCES WILL NOT BE MADE TO ACCOMMODATE UTILITY CONFLICTS THAT CAN BE REASONABLY RESOLVED BY COORDINATION DURING SHOP DRAWING STAGE.
- d. PROVIDE COORDINATION DRAWINGS OF REFLECTED CEILING PLAN AND SECTION ABOVE CEILING SHOWING WORK OF ALL AFFECTED TRADES. DO NOT PROCEED WITH FABRICATION WORK UNTIL COORDINATION DRAWINGS HAVE BEEN APPROVED BY A/E.
- 2. SITE: a. TIME OR MONEY ALLOWANCES WILL NOT BE MADE TO ACCOMMODATE UTILITY CONFLICTS THAT CAN BE REASONABLY RESOLVED BY COORDINATION DURING SHOP DRAWING STAGE.
- 3. ARCHITECTURAL AND STRUCTURAL: a. REFER TO ARCHITECTURAL AND STRUCTURAL PLANS FOR DETAILS OF CONSTRUCTION, INCLUDING BEAMS, FLOOR AND WALL PENETRATIONS, CHASES, AND REFLECTED CEILING PLANS. VERIFY OPENING SIZES WITH EQUIPMENT FURNISHED.
- b. SLEEVE ALL EXTERIOR WALL AND GRADE BEAM PENETRATIONS. GRADE BEAM PENETRATIONS SHALL BE MADE WITHIN MIDDLE 1/3 OF VERTICAL SPAN OF BEAM.
- c. SEAL AROUND DUCTS AND PIPING AT ALL WALLS, A/C ROOMS AND WALL LOUVER PENETRATIONS WITH FIREPROOF CAULKING. RE: SPECS. PROVIDE ESCUTCHEON PLATES AND FLASHING AROUND PENETRATION, BOTH INSIDE AND OUTSIDE, TO PROVIDE FINISHED LOOK.
- 4. SPATIAL COORDINATION: a. COORDINATE ALL WORK WITH OTHER TRADES; COORDINATE SCHEDULE OF WORK WITH ALL SUB-CONTRACTORS TO ACHIEVE SMOOTH FLOW OF CONSTRUCTION.
- b. SPACES ABOVE CEILING ARE CONGESTED. DESIGN INTENT IS THAT UTILITIES BE INSTALLED TIGHT AGAINST CEILING STRUCTURE TO EXTENT POSSIBLE, WHILE RETAINING ADEQUATE MAINTENANCE ACCESS PER CODES.
- c. IN CASE OF CONFLICTS, ITEMS SHALL BE ARRANGED ACCORDING TO THE FOLLOWING PRIORITIES: LIGHTING, FIRE PROTECTION, HVAC. PROVIDE OFFSETS/RISES/DROPS REQUIRED TO RESOLVE CONFLICTS WITH OTHER UTILITIES, AND TO ACCOMMODATE ALL UTILITIES ABOVE CEILINGS.
- d. IN GENERAL, REROUTE SMALLER DUCTS/PIPES THROUGH JOISTS TO RESOLVE CONFLICTS WITH LARGER. PERFORM REROUTING IN MOST EFFICIENT MANNER POSSIBLE, AND IN ACCORDANCE WITH INDUSTRY STANDARDS.
- e. PROVIDE COORDINATION DRAWINGS OF REFLECTED CEILING PLAN AND SECTION ABOVE CEILING SHOWING WORK OF ALL AFFECTED TRADES. DO NOT PROCEED WITH FABRICATION WORK UNTIL COORDINATION DRAWINGS HAVE BEEN APPROVED BY A/E.
- f. IN GENERAL ROUTE DUCTS/PIPES IN MOST EFFICIENT MANNER POSSIBLE, AND IN ACCORDANCE WITH INDUSTRY STANDARDS.
- g. SEE ELECTRICAL PLANS FOR EXACT LOCATION OF ELECTRICAL PANELS TO AVOID DUCTWORK AND PIPING RUNNING OVER THESE AREAS. COORDINATE WITH ELECTRICAL CONTRACTOR.
- h. LOCATE AIR DEVICES AS SHOWN. COORDINATE WITH OTHER TRADES TO AVOID CONFLICT AND ADJUST LOCATION IF NEEDED WITHOUT COMPROMISING AIR DEVICES PERFORMANCE.
- 5. CONTROLS: a. REFER TO SPECIFICATIONS FOR CONTROL COMPONENTS AND DEVICES TO BE COORDINATED WITH MECHANICAL WORK.

EQUIPMENT:

- 1. EQUIPMENT INSPECTION: a. FIELD VERIFY ALL CONDITIONS AND MEASURE DIMENSIONS WITHIN THE BUILDING PRIOR TO ORDERING EQUIPMENT AND/OR PROCEEDING WITH INSTALLATION.
- b. ALL EQUIPMENT SHALL BE FACTORY TESTED, AND CONTRACTOR SHALL VERIFY EQUIMENT CONDITION PRIOR TO INSTALLATION. CONTRACTOR IS RESPONSIBLE FOR EQUIPMENT DAMAGED DURING MOVING AND INSTALLATION.
- c. EQUIPMENT FOUND DEFECTIVE PRIOR TO FINAL ACCEPTANCE SHALL BE REPLACED AT NO COST TO OWNER. EQUIPMENT ACCESS:
- a. PROVIDE MANUFACTURER RECOMMENDED AND CODE ENFORCED CLEARANCES AROUND EQUIPMENT. MAINTAIN 36" CLEAR IN FRONT OF VAV BOX CONTROLLER, ELECTRIC HEATERS, ETC. b. INSTALL ALL VALVES, CONTROLS, DAMPERS, FANS, ETC. IN ACCESSIBLE
- LOCATIONS. PROVIDE ADEQUATELY SIZED ACCESS DOORS WHERE REQUIRED.
- 3. EQUIPMENT INSTALLATION: a. PROVIDE SPRING HANGER TYPE VIBRATION ISOLATORS TO SUPPORT SUSPENDED AHUS, FANS AND OTHER POWERED VIBRATING EQUIPMENT. PROVIDE FLEXIBLE DUCT CONNECTORS.
- b. COMPLETELY WEATHERPROOF ALL EQUIPMENT, DUCTS, PIPES AND OTHER DEVICES AND MATERIALS INSTALLED OUTSIDE THE BUILDING, IN PARKING AREA, OR OTHERWISE EXPOSED TO WEATHER. AS A MINIMUM, WEATHERPROOFING SHALL INCLUDE, BUT IS NOT LIMITED TO THE FOLLOWING: JACKETING FOR ALL PIPING INSULATION, VALVES AND ACCESSORIES RATED FOR OUTDOOR SERVICE, ELECTRICAL ENCLOSURES NEMA 4X-SS. PROVIDE ELECTRICAL HEAT TRACING FOR UTILITIES SUSCEPTIBLE TO FREEZING.
- c. AFFIX ID TAGS TO ALL MECHANICAL EQUIPMENT PER SPECIFICATIONS. 4. EQUIPMENT INSULATION:
- a. INSULATE ALL SURFACES THAT ARE CAPABLE OF BECOMING COLD AND COLLECTING CONDENSATE. THIS INCLUDES SUPPLY DIFFUSERS AND CONNECTING DUCTWORK / TRANSITION PIECES.
- 5. ELECTRICAL: a. CONTRACTOR IS RESPONSIBLE FOR COORDINATION WITH ELECTRICAL CONTRACTOR REGARDING EQUIPMENT SIZES AND TYPES OF ELECTRICAL INTERFACE EQUIPMENT REQUIRED.
- b. DUE TO VARIATIONS IN EQUIPMENT CHARACTERISTICS BY DIFFERENT EQUIPMENT SUPPLIERS, MECHANICAL EQUIPMENT ULTIMATELY PROVIDED MAY DIFFER IN HORSEPOWER OR AMPERAGE REQUIREMENTS FROM THAT SPECIFIED IN THESE DRAWINGS. COORDINATE WITH GENERAL CONTRACTOR PRIOR TO BIDDING. AND PRIOR TO SUBMITTALS AND ORDERING EQUIPMENT, TO ENSURE THAT EQUIPMENT ELECTRICAL REQUIREMENTS ARE CONVEYED TO ELECTRICAL CONTRACTOR. IT IS SOLELY CONTRACTOR'S

RESPONSIBILITY TO ENSURE COMPATIBILITY ISSUES ARE COORDINATED.

| ABBK | EVIATIONS | | | | |
|--------|----------------------------|-------------|-------------------------|--------|--------------------------|
| А | AMPS | ENT. | ENTERING | NO | NORMALLY OPEN |
| ACCU | AIR COOLED CONDENSING UNIT | EXT. | EXTERNAL OR EXTERIOR | NTS | NOT TO SCALE |
| ACT | ACTUATOR | FCU | FAN COIL UNIT | OA | OUTSIDE AIR |
| AFF | ABOVE FINISHED FLOOR | FD | FIRE DAMPER | PH | PHASE |
| AHU | AIR HANDLING UNIT | FM | FLOW METER | RA | RETURN AIR |
| В. | BOTTOM | FS | FLOW SWITCH | RAG/RG | RETURN AIR GRILLE |
| BAS | BUILDING AUTOMATION SYSTEM | FPI | FINS PER INCH | RD | ROOF DRAIN |
| BOP | BOTTOM OF PIPE | G. | GROUND | RM. | ROOM |
| BOTT. | BOTTOM | GA. | GAGE | RPZ | REDUCED PRESSURE ZONE |
| C. | CONDUIT OR COMMON | GALV. | GALVANIZED | SA | SUPPLY AIR |
| CHR | CHILLED WATER RETURN | GPM | GALLONS PER MINUTE | SD | SUPPLY AIR DIFFUSER |
| CHS | CHILLED WATER SUPPLY | GRND. | GROUND | SS | STAINLESS STEEL |
| CHW | CHILLED WATER | HB | HOSE BIBB | SZ | SINGLE ZONE |
| CHWP | CHILLED WATER PUMP | HP | HORSEPOWER | TAB | TESTING & BALANCING |
| CR | CONDENSER WATER RETURN | HS | HUMIDITY SENSOR | T.O.L. | TOP OF LOUVER |
| CS | CONDENSER WATER SUPPLY | HVAC | HEATING, VENTILATION, & | TS | TEMPERATURE SENSOR |
| CLG. | CEILING OR COOLING | | AIR CONDITIONING | TSTAT | THERMOSTAT |
| COMB. | COMBINATION | LVG. | LEAVING | UG | UNDERGROUND |
| CONC. | CONCRETE | MECH | MECHANICAL | UNO | UNLESS OTHERWISE NOTED |
| COND. | CONDUIT | MOT. STRTR. | MOTOR STARTER | V | VOLTS |
| СТ | COOLING TOWER | MS | MOTOR STARTER | VAV | VARIABLE AIR VOLUME |
| CU. | COPPER | MZ | MULTI-ZONE | VFD | VARIABLE FREQUENCY DRIVE |
| CW | CITY WATER | NC | NORMALLY CLOSED | W | WIRE |
| DDC | DIRECT DIGITAL CONTROLS | | | | |
| DMPR. | DAMPER | | | | |
| DISC. | DISCONNECT | | | | |
| EAG/EG | EXHAUST AIR GRILLE | | | | |
| EMS | ENERGY MANAGEMENT SYSTEM | | | | |
| | | | | | |

DUCTWORK:

- 1. DUCTWORK GENERAL a. DRAWINGS ARE DIAGRAMMATIC IN NATURE. FOR CLARITY SAKE, MOST DUCT OFFSETS/RISES/DROPS ARE NOT SHOWN. WHERE DUCTS PENETRATE WALLS, INSTALL THEM PERPENDICULAR TO WALL.
- b. RECTANGULAR AND ROUND DUCTWORK SHALL BE GALVANIZED STEEL. SIZES SHOWN ARE INSIDE CLEAR DIMENSION, UNLESS NOTED OTHERWISE.
- c. VERIFY BOTTOM OF DUCT ELEVATION AND COORDINATE WITH OTHER TRADES.
- d. CONSTRUCT AND LEAKAGE TEST ALL DUCTWORK BASED ON SPECIFICATIONS AND SMACNA REQUIREMENTS. WHICHEVER IS MORE STRINGENT. COORDINATE PRESSURE CLASSES WITH EQUIPMENT SCHEDULES.
- e. FLEXIBLE DUCTS MAXIMUM LENGTH SHALL NOT EXCEED 6 FEET. USE OF FLEXIBLE DUCTWORK IS LIMITED TO AREAS WITH AN ACCESSIBLE SUSPENDED CEILING. PINCHED DUCT WILL HAVE TO BE REPLACED.
- f. IN AREAS WHERE DUCT CONFLICTS CANNOT BE AVOIDED, ROUTE SMALLER DUCTS THROUGH ROO JOISTS.
- g. LOCATE AIR DEVICES AS SHOWN. COORDINATE WITH ELECTRICAL, IF NEEDED. RELOCATE DIFFUSER TO ADJACENT TILE. 2. DUCTWORK INSULATION:
- a. WRAP ALL OUTSIDE AIR, SUPPLY AND RETURN DUCTWORK UNLESS NOTED OTHERWISE.
- b. IN ADDITION, FOR ACOUSTICAL PERFORMANCE INTERNALLY LINE FIRST 10' OF SUPPLY AND LAST 10' OF RETURN DUCTWORK.
- c. PROVIDE ACOUSTICAL LINING FOR ALL TRANSFER DUCTS AND RETURN AIR FI BOWS.
- d. INSULATION ON DUCT SHOULD TO BE PROPERLY TAPED AND MASTICS MUST BE APPLIED ON SEAMS AND JOINTS AND AT ENDS ADJACENT TO DUCT FLANGES AND FITTINGS. FOR DUCT SIDES WITH DIMENSIONS LARGER THAN 18 INCHES, APPLY ADDITIONAL PINS AND CLIPS TO HOLD INSULATION TIGHTLY AGAINST SURFACE AT CROSS BRACING.
- e. INSULATE ALL EXHAUST DUCTWORK 10 FEET FROM EXTERIOR OPENING. 3. DUCT FITTINGS:
- a. WHERE RECTANGULAR TEE FITTINGS ARE SHOWN, PROVIDE FITTING WITH ADJUSTABLE DIVIDER SHEET AND TURNING VANES. b. WHERE RECTANGULAR MAIN AND BRANCH CONNECTIONS ARE SHOWN,
- PROVIDE EXTRACTOR VANES. NOT APPLICABLE TO DUCTWORK DOWNSTREAM OF VAV BOXES.
- c. PROVIDE TURNING VANES IN ALL ELBOWS PER SPECS.
- 4. DAMPERS: a. IN AN ACCESSIBLE LOCATION, PROVIDE MANUAL-TYPE VOLUME BALANCING DUCT DAMPERS IN ALL SUPPLY, RETURN AND EXHAUST DUCT BRANCHES TO INDIVIDUAL GRILLES, REGISTERS AND DIFFUSERS (GRD). TO MINIMIZE NOISE INSTALL DAMPERS CLOSER TO THE BRANCH CONNECTION THAN TO THE GRD. IN DUCTWORK, PROVIDE ACCESS DOORS TO ALL DAMPERS.
- ABOVE INACCESSIBLE CEILINGS AND IN CASE DUCT CONFIGURATION DOES NOT ALLOW FOR INSTALLATION OF DAMPER IN DUCTWORK. PROVIDE REMOTE MANUAL DAMPER BY YOUNG REGULATOR OR EQUAL, (CABLE OPERATED SYSTEM) WITH ENGINEER'S PERMISSION CONTRACTOR MAY PROVIDE VOLUME DAMPER THAT IS INTEGRAL TO GRD.
- c. PROVIDE BALANCING DAMPERS ON ALL EXHAUST GRILLES TO ACHIEVE DESIRED AIRFLOW.
- d. PROVIDE DYNAMIC FIRE DAMPERS (RUSKIN DIDB20, TYPE B OR EQUAL) IN ACCORDANCE WITH CODE REQUIREMENT, IN ALL PENETRATIONS OF FIRE RATED WALLS, OCCUPANCY SEPARATION WALLS, BARRIERS AND PARTITIONS, AND EXIT CORRIDORS. REFER TO ARCHITECTURAL PLANS FOR RATED WALLS. PROVIDE ACCESS DOORS AS PER CODE REQUIREMENTS. EQUAL TO RUSKIN ADH-22 FOR RECTANGULAR DUCT, ACUDOR RD FOR ROUND DUCT. WHERE GRILLE ACCESS IS INDICATED, ADDITIONAL DUCT ACCESS DOOR IS NOT REQUIRED. WHERE THE CEILING IS FIRE RATED PROVIDE FIRE RATED AIR DEVICES FOR TRANSFER & RETURN AIR GRILLES AND SUPPLY AIR DIFFUSERS AS PER CODE REQUIRMENTS. REFER TO ARCHITECTURAL PLANS FOR RATED CEILINGS.
- e. PROVIDE ACCESS DOORS (NOT SHOWN IN DRAWINGS) FOR INSPECTION OF DUCT MOUNTED EQUIPMENT SUCH AS FIRE/SMOKE DAMPERS, MANUAL BALANCING DAMPERS AND TURNING VANES. IN AREAS WITH HARD CEILING COORDINATE ACCESS DOOR LOCATIONS AND CEILING ACCESS PANELS WITH OTHER TRADES.

INSULATION:

- 1. FIBERGLASS INSULATION MAY NOT BE USED ON ANY COLD PIPING SURF ONLY CLOSED CELL INSULATION IS ACCEPTABLE.
- 2. PROVIDE INSULATION ON ALL SURFACES CAPABLE OF CREATING CONDENSATION.

MECHANICAL SYMBOLS LEGEND

| 12x12 | DUCT SIZE: FIRST FIGURE IS SIDE SHOWN | 0 | THERMOSTAT |
|----------------|---|------------------|---------------------|
| (12x12) | BELOW DUCT SIZE: FIRST FIGURE IS SIDE SHOWN | RH | SPACE HUMIDITY SENS |
| / | DIRECTION OF FLOW-RETURN | RH | DUCT HUMIDITY SENSO |
| | DIRECTION OF FLOW-SUPPLY | Õ | SPACE CARBON DIOXID |
| | | SP | STATIC PRESSURE SEN |
| | FIRE DAMPER | С | DUCT CARBON DIOXIDE |
| | FLEXIBLE DUCT | CHR | CHILLED WATER RETUR |
| EG-X | | —— снs—— | CHILLED WATER SUPPL |
| | EXHAUST AIR GRILLE | ср | CONDENSATE PIPING |
| RG/TG-X cfm | RETURN AIR/TRANSFER AIR GRILLE | ſ | BUTTERFLY VALVE |
| SD-X cfm | SUPPLY AIR DIFFUSER | | MANUAL VALVE |
| Ē | SIDE TAP WITH DAMPER | | AUTOMATIC VALVE |
| | BACKDRAFT DAMPER | | CHECK VALVE |
| AFR | AUTO-FLOW REGULATOR | f | PRESSURE GAUGE & CO |
| ф Н | DRAIN VALVE | TS L | TEMPERATURE SENSOF |
| IФI | BALL VALVE | т ^w т | THERMOMETER WELL |



| FACES; | |
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EXISTING CHW AIR HANDLING UNIT SCHEDULE - VERTICAL CONFIGURATION

| | | 7 11 1 1 1 1 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|-------|------|--------------|----------|------------|------------|---------|-------|-------|----------|------------|--------------|-----------|---------|---------|-------|-------|-------|------|------|-----------|--------------|------------|-------|---------|-------|-------|-------|-------------|--------|--------|--------|--------|
| | | EXISTING | EXISTING | NEW | NEW | | | MIN | | EXISTING (| HILLED WATER | COIL COND | DITIONS | | | | | | | NEW CHILL | ED WATER COI | l conditio | NS | | | | | | HEATIN | G COIL | | |
| | UNIT | TOTAL | OA | TOTAL | <u>OA</u> | SERVES | ESP | MOTOR | ELECT. | TOTAL | SENS. | EAT (F) | | LAT (F) | | EWT | LWT | CHW | WPD | TOTAL | SENS. | EAT (F) | | LAT (F) | | EWT | LWT | <u>CHW</u> | WPD | | | WEIGHT |
| MARK | TYPE | CFM | CFM | <u>CFM</u> | <u>CFM</u> | | IN WG | HP | V/P/H | BTUH | BTUH | DB | WB | DB | WB | (F) | (F) | GPM | (FT) | BTUH | BTUH | DB | WB | DB | WB | (F) | (F) | <u>GPM</u> | (FT) K | W | STAGES | (LBS.) |
| AHU-9 | СН₩ | 3600 | 300 | 3600 | 700 | KITCHEN | 1.50 | 5 | 460/3/60 | 143 | 99 | 78.40 | 66.40 | 53.00 | 53.00 | 44.00 | 56.00 | 23.8 | 10.0 | 171 | 101 | 78.80 | 68.00 | 52.80 | 52.60 | 44.00 | 56.00 | <u>28.3</u> | 5.8 10 | .0 | SCR | 2,075 |

NOTES:

1. RE-BALANCE EXISTING AIR HANDLERS TO TO THE AIR AND WATER FLOWS SHOWN.

EXISTING DUAL PATH AIR HANDLER UNIT SCHEDULE

| Project: | IDEA HEADQUARTERS | | | | | | | | | | | | | | | | | | | | | | |
|----------|-------------------|----------|----------|--------------|--------------|----------|----------|---------|----------|------------|---------------|-----------------|-------|---------|------|-----------|-------------|----------------|-----------|---------|-------------|----------------|-------|
| | | EXISTING | EXISTING | NEW | NEW | | | | | EXISTING C | CHILLED WATER | R COIL CONDITIO | NS | | | NEW CHILL | ED WATER CO | OIL CONDITIONS | | | | | |
| | | TOTAL | OA | <u>TOTAL</u> | <u>OA</u> | SERVES | ESP | | | TOTAL | SENSIBLE | EAT | | | | TOTAL | SENSIBLE | EAT | | | | MANUFACTURER | NOTES |
| MARK | TYPE | CFM | CFM | <u>CFM</u> | <u>CFM</u> | | (INCHES) | MIN. HP | ELECT. | MBH | MBH | DB/WB | LAT | EWT/LWT | GPM | MBH | MBH | DB/WB | LAT | EWT/LWT | <u>GPM</u> | MODEL NUMBER | |
| AHU-7 | COMMON FAN | 9,000 | - | <u>9,000</u> | - | TRAINING | 3.00 | 10 | 480/3/60 | - | - | - | - | - | - | - | - | - | - | - | - | YORK XTI 48X78 | |
| | RETURN AIR UNIT | 7,250 | - | <u>7,100</u> | - | CENTRAL | - | - | - | 191.9 | 164.4 | 76/64 | 55/55 | 44/56 | 31.9 | 227.9 | 171.7 | 76/64 | 54/53.1 | 44/56 | <u>37.9</u> | YORK XTI 48X78 | ALL |
| | OUTSIDE AIR UNIT | 1,750 | 1,750 | <u>1,900</u> | <u>1,900</u> | | - | - | - | 159.5 | 56.6 | 82.1/78.65 | 53/53 | 44/56 | 26.5 | 176.0 | 64.9 | 82.1/78.65 | 53/53 | 44/55.1 | <u>31.5</u> | YORK XTI 33X36 | |
| AHU-8 | COMMON FAN | 4,000 | - | 4,000 | - | DINING | 1.50 | 5 | 480/3/60 | - | - | - | - | - | - | - | - | - | - | - | - | YORK XTI 39X45 | |
| | RETURN AIR UNIT | 2,800 | - | <u>2,600</u> | - | HALL | - | - | - | 74.1 | 63.5 | 76/64 | 55/55 | 44/56 | 12.3 | 82.7 | 63.9 | 76/64 | 53.5/53.1 | 44/56 | <u>13.1</u> | YORK XTI 39X45 | ALL |
| | OUTSIDE AIR UNIT | 1,200 | 1,200 | <u>1,400</u> | <u>1,400</u> | | _ | _ | _ | 109.4 | 38.8 | 82.1/78.65 | 53/53 | 44/56 | 18.2 | 130.0 | 47.9 | 82.1/78.65 | 53.1/53 | 44/55.3 | 23.0 | YORK XTI 33X30 | |

EXISTING NOTES: 1. RE-BALANCE EXISTING AIR HANDLERS TO TO THE AIR AND WATER FLOWS SHOWN

EXISTING EXHAUST FAN SCHEDULE

| | | | ELECTR. | EXISTING CFM | NEW CFM | INPUT | MOTOR | E.S.P. | SOUND | MANUFACTURER | WEIGHT | CONTROL | |
|-------|----------------------------|---------|----------|--------------|---------|-------|-------|---------|----------|----------------|--------|---------|-------|
| MARK | SERVING | TYPE | V/H/P | CFM | CFM | WATTS | HP | IN. H20 | IN SONES | & MODEL NUMBER | (LBS) | NOTES | NOTES |
| | TRAINING | ROOF | | | | | | | | GREENHECK | | | |
| EF-31 | RESTROOMS, JANITOR/STORAGE | MOUNTED | 120/60/1 | 1605 | 1000 | - | 0.75 | 0.4 | 7.5 | G-123-A | 75 | A | ALL |
| | | | | | | | | | | | | | |
| NOTEO | | | | | | | | | | | | | |

<u>NOTES:</u> 1. PROVIDE FIELD-INSTALLED FAN SPEED CONTROLLER. COORDINATE INSTALLATION WITH ELECTRICAL CONTRACTOR.

CONTROL NOTES:A.PROVIDE DDC START/STOP POINTS. REFER TO SEQUENCES OF OPERATIONS.

KITCHEN HOOD INFORMATION

| 00D | ACCUREX | HOOD DIME | NSIONS | | | COOKING | EXHAUST PLENUM | | | | SUPPLY PLENUM | HOOD | |
|-----------------------------|--------------------------------|------------------------|---|---------------------------|---------------|-----------------|----------------|--------------------------------|----------------------|-------------------|----------------------|----------------------------|---------|
| NO. | MODEL | LENGTH | WIDTH | HEIGHT | HOOD | load / Duty | TOTAL | RISER(S) | | | TOTAL | TOTAL | SECTIO |
| | | | | | CONSTRUCTION | RATING | CFM | DIAMETER | CFM | S.P. | CFM | WEIGHT | LOCATIO |
| (H-3 | 6630 | 14'-0" | 4'-6" | 2'-0" | 430 SS | HEAVY | 3,500 | 14 | 1,750 | 0.647 | 3,150 | 600 LBS | SINGLE |
| | XXEW-168-S | | | | WHERE EXPOSED | | | 14 | 1,750 | 0.647 | | | |
| | HEN HOOD PERF | ORATE |) SUPPLY PL | ENUM(S) | | | | | | | | | 1 |
| KITC | HEN HOOD PERF | | D SUPPLY PL size | ENUM(S) | | | | | | | | | |
| KITC | HEN HOOD PERF Pos. | FORATEI TYPE | D SUPPLY PL size length | ENUM(S) | HEGHT | INSULATED | DAMPERS | COLLARS | | | | | |
| KITC HOOD NO. | HEN HOOD PERF pos. | FORATEI TYPE | D SUPPLY PL Size Length | ENUM(S) | HEGHT | INSULATED | DAMPERS | COLLARS WIDTH | LENGTH | CFM | S.P. | VEL. | |
| KITC hood no. kh-3 | HEN HOOD PERF pos. front | FORATEI TYPE ASP | D SUPPLY PL size length 15'-0" | ENUM(S) | HEGHT 10" | INSULATED | DAMPERS | COLLARS WIDTH 12" | LENGTH 32" | CFM 350 | S.P. 0.23 | VEL. 394 FPM | |
| KITC 1000 NO. (H-3 | HEN HOOD PERF Pos. FRONT | TYPE ASP | D SUPPLY PL size length 15'-0" | ENUM(S) width 1'-4" | HEGHT 10" | INSULATED NO | DAMPERS YES | COLLARS WIDTH 12" 12" | LENGTH 32" 32" | CFM 350 350 | S.P. 0.23 0.23 | VEL. 394 FPM 394 FPM | |

| 00D | ACCUREX | HOOD DIME | INSIONS | | | COOKING | EXHAUST PLENUM | | | | SUPPLY PLENUM | HOOD | |
|-----------------------------|--------------------------------|------------------------|---|---------------------------|---------------|-----------------|----------------|--------------------------------|----------------------|-------------------|----------------------|----------------------------|---------|
| NO. | MODEL | LENGTH | WIDTH | HEIGHT | HOOD | load / Duty | TOTAL | RISER(S) | | | TOTAL | TOTAL | SECTIO |
| | | | | | CONSTRUCTION | RATING | CFM | DIAMETER | CFM | S.P. | CFM | WEIGHT | LOCATIO |
| (H–3 | 6630 | 14'-0" | 4'-6" | 2'-0" | 430 SS | HEAVY | 3,500 | 14 | 1,750 | 0.647 | 3,150 | 600 LBS | SINGLE |
| | XXEW-168-S | | | | WHERE EXPOSED | | | 14 | 1,750 | 0.647 | | | |
| | HEN HOOD PERF | ORATE | D SUPPLY PL | ENUM(S) | | | | | | | | | 1 |
| | HEN HOOD PERF | | D SUPPLY PL SIZE | ENUM(S) | | | | | | | | | |
| KITC 100D NO. | HEN HOOD PERF Pos. | TYPE | D SUPPLY PL size length | ENUM(S) | HEGHT | INSULATED | DAMPERS | COLLARS | | | | | |
| KITC 1000 NO. | HEN HOOD PERF pos. | TYPE | D SUPPLY PL size length | ENUM(S) | HEGHT | INSULATED | DAMPERS | COLLARS WIDTH | LENGTH | CFM | S.P. | VEL. | |
| KITC 1000 NO. (H-3 | HEN HOOD PERF pos. front | FORATEI TYPE ASP | D SUPPLY PL size length 15'-0" | ENUM(S) | HEGHT | INSULATED NO | DAMPERS | COLLARS WIDTH 12" | LENGTH 32" | CFM 350 | S.P. 0.23 | VEL. 394 FPM | |
| KITC NOD NO. | HEN HOOD PERF Pos. FRONT | TYPE ASP | D SUPPLY PL SIZE LENGTH 15'-0" | ENUM(S) width 1'-4" | HEGHT 10" | INSULATED NO | DAMPERS YES | COLLARS WIDTH 12" 12" | LENGTH 32" 32" | CFM 350 350 | S.P. 0.23 0.23 | VEL. 394 FPM 394 FPM | |

KITCHEN HOOD INFORMATION

| HOOD | GREASE FILTRATION DETAILS | | | | LIGHTING DETAILS | |
|------|---------------------------|-----|--------|--------|------------------|-------|
| NO. | TYPE | QTY | HEIGHT | LENGTH | QTY | TYPE |
| | | | | | | |
| KH-3 | X-TRACTOR | 8 | 20" | 16" | 4 | ROUND |
| | STAINLESS STEEL | 2 | 20" | 20" | | LED |

NOTES: 1. ALL STAINLESS STEEL CONSTRUCTION, BAFFLE TYPE GREASE EXTRACTORS.

2. UL LISTED LED LIGHTS PRE-WIRED TO SWITCH; FAN AND LIGHT SWITCHES PRE-WIRED TO J-BOX. PROVIDE WET CHEMICAL FIRE PROTECTION SYSTEM PER NFPA REQUIREMENTS. SYSTEM TO BE FIELD INSTALLED OR BY MANUFACTURER.

4. MOUNT BOTTOM OF KITCHEN HOOD AT 6'-6" A.F.F. 5. HOOD MANUFACTURER TO PROVIDE STAINLESS STEEL 24" FILLER PANEL BETWEEN THE TOP OF THE HOOD AND THE CEILING.

- FIELD VERIFY EXACT HEIGHT AFTER SETTING HOOD.
- 6. PROVIDE A FIRE DAMPER IN THE SUPPLY DUCT COLLAR.
- 7. KITCHEN HOOD MUST EXTEND MINIMUM 6 INCHES BEYOND EDGE OF APPLIANCES ON ALL OPEN SIDES OF HOOD. VERIFY FINAL LOCATIONS AND DIMENSIONS OF KITCHEN EQUIPMENT PRIOR TO ORDERING KITCHEN HOOD.
- 8. SUPPLY FAN SHALL BE INTERLOCKED WITH FIRE PROTECTION SYSTEM. UPON ACTIVATION OF SYSTEM, SUPPLY FAN SHALL TURN-OFF, EXHAUST FAN REMAINS OPERATIONAL.
- 10. MASTER CONTROL SHALL INCLUDE KITCHEN HOOD MAKE-UP AIR AND EXHAUST FANS MOTOR STARTERS AND CONTROLLERS. COORDINATE INSTALLATION WITH ELECTRICAL CONTRACTOR. CONTROL PLANE SHALL BE INTEGRAL WITH HOOD CONFIGURATION.

EXISTING KITCHEN HOOD FAN SCHEDULE

| | | EXISTIN | NG PERFOR | RMANCE | | | | | | | NEW P | ERFORMAN | CE | | | | | | | |
|--------------|--------|---------|-----------|----------|---------------|-------|---------|----------|------------|-----------|-------|----------|----------|-----------|-------|---------|----------|-----------|----------|-------|
| | | EXHAU | ST | | | SUPPL | Y | | | | EXHAU | ST | | | SUPPL | Y | | |] | |
| MARK | SERVES | CFM | SP | FAN MTR. | MANUF. | CFM | SP | FAN MTR. | MANUF. | WT. (LBS) | CFM | SP | FAN MTR. | WT. (LBS) | CFM | SP | FAN MTR. | WT. (LBS) | POWER | |
| | HOOD | | IN (WC) | HP | MODEL # | | IN (WC) | HP(W) | MODEL # | | CFM | IN (WC) | HP | | | IN (WC) | HP(W) | | V/P/H | NOTES |
| | | | | | ACCUREX | | | | ACCUREX | | | | | | | | | | | |
| KEF-2, KSF-2 | KH-3 | 2598 | 1.5 | 2 | XRUB-180HP-15 | 2000 | 1 | 1 1/2 | XRS-120-7 | 575 | 2492 | 1.5 | 3 | 350 | 2200 | 1 | 3 | 575 | 460/3/60 | ALL |
| | | | | | ACCUREX | | | | ACCUREX | | | | | | | | | | | |
| KEF-3, KSF-3 | KH-3 | 4161 | 1.5 | 2 | XRUB-240HP-20 | 3258 | 1 | 1 1/2 | XRS-150-15 | 575 | 5600 | 1.5 | 3 | 350 | 5040 | 1 | 3 | 575 | 460/3/60 | ALL |
| | | | | | | | | | | | | | | | | | | | | |

NOTES: SUPPLY FAN SHALL BE INTERLOCKED WITH FIRE PROTECTION SYSTEM. UPON ACTIVATION, SUPPLY FAN SHALL TURN-OFF, EXHAUST FAN REMAINS ON. BALANCE FANS FOR NEW REQUIREMENTS SHOWN. PROVIDE MOTOR STARTERS INTEGRAL TO KITCH HOOD. COORIDINATE WITH KITCHEN HOOD SUPPLIER AND ELECTRICAL CONTRACTOR. SYSTEM SHALL MEET ALL REQUIREMENTS OF NFPA AND IMC CODES FOR TESTING AND OPERATION.

AIR DEVICE & DIFFUSER SCHEDULE

| TRANSFER AIR GR | ILLE (TG-1) | | | |
|-----------------|---------------------|-------------------------------------|-------------------------------------|--------------------|
| | TITUS 50F | DESCRIPTION: ALUMINUM GRID EGGCRATE | RETURN GRILLE WITH | |
| | NC < 20 | | BORDER TYPE 3 (LAY-IN). | |
| CFM | CLG. MODULE | NOMINAL DUCT SIZE | DIFFUSER | |
| RANGE | SIZE | INCHES | DIFFUSION | |
| | INCHES | (INLET) | PATTERN & CFM | |
| 0 - 1600 | 24 X 24 | 18 X 18 | TG1-CFM (RETURN AIR GRILLES ONLY) | |
| TRANSFER AIR GR | ILLE (TG-2) SIDE V | VALL | | |
| | TITUS 50F | | DESCRIPTION: ALUMINUM GRID EGGCRATE | RETURN GRILLE WITH |
| | NC < 20 | | BORDER TYPE 1 (SURFACE). | |
| CFM | NOMINAL DUCT SIZE | FACE SIZE | | DIFFUSER |
| RANGE | INCHES | (INCHES | | DIFFUSION |
| | (INLET | LENGTH X WIDTH | | PATTERN & CFM |
| 0-1900 | 48 X 12 | INLET SIZE PLUS 1-3/4" | | TG2-CFM |

NOTES:

PROVIDE MANUFACTURER'S STANDARD BAKED WHITE ENAMEL FINISH.

PROVIDE MOUNTING FRAME TYPE COMPATIBLE WITH SCHEDULED CEILING OR WALL (SURFACE OR LAY-IN). AIR DEVICES SHALL MATCH ARCHITECTURAL FINISH. COORDINATE COLOR WITH ARCHITECT.

| NOTES |
|-------|
| ALL |
| |
| |
| NOTES |
| ΔΗ |







03 KITCHEN HOOD ELEVATION SCALE: N.T.S.







SCOPE OF WORK

- 1. GENERAL: THE "IDEA HQ KITCHEN" CONSISTS OF AN EXISTING SINGLE-STORY BUILDING, APPROXIMATE AREA IN SCOPE OF WORK IS 1,049 SQFT.
- 2. ELECTRICAL: PROVIDE ALL MATERIALS AND LABOR ASSOCIATED WITH COMPLETE OPERATIONAL ELECTRICAL DISTRIBUTION SYSTEM. MAJOR ITEMS OF WORK INCLUDE, BUT ARE NOT LIMITED TO:
- (a) ELECTRICAL SERVICE: PROVIDE A NEW DISTRIBUTION PANELBOARD.
- (b) LIGHTING SYSTEMS: INTERIOR AND EXTERIOR LIGHTING SYSTEM SHALL CONSIST OF LED TYPE.
- (c) COMMISSIONING: PROVIDE FOR THE LIGHTING EQUIPMENT AND LIGHTING CONTROLS AS REQUIRED PER IECC 2015.
- (d) POWER SYSTEMS: PROVIDE MISCELLANEOUS DUPLEX RECEPTACLES, CONNECTIONS FOR HVAC, PLUMBING AND KITCHEN EQUIPMENT, FIRE ALARM EQUIPMENT.
- (e) FIRE ALARM SYSTEM: PROVIDE PULL STATIONS, MISCELLANEOUS STROBES AND FIRE ALARMS, MISC DETECTORS, FIRE ALARM EQUIPMENT.

SPECIFICATIONS

1. REFER TO THE IDEA - OWASSA COLLEGE PREP PHASE II SPECIFICATIONS. THESE SPECIFICATIONS APPLY TO THIS WORK.







03 TINCE

ELECTRICAL SYMBOL LEGEND:

| SYMBOL | DESCRIPTION | MNTG. (SEE N |
|----------------|--|-----------------|
| O =GFCI | DUPLEX RECEPTACLE W/ GROUND FAULT INTERRUPTING TYPE - HUBBELL MODEL #GFRST20X | 18"AFF |
| Ø | SPECIAL RECEPTACLE – TYPE AS NOTED | 18"AFF |
| Ю | JUNCTION BOX W/ BLANK STAINLESS STEEL COVERPLATE | AS REC |
| Ø | EQUIPMENT CONNECTION | AS REC |
| | ELECTRICAL PANELBOARD – SURFACE MOUNTED | AS REC |
| | CONCEALED RACEWAY | AS REC |
| How | CONDUIT OR EMT HOMERUN TO PANELBOARD CONCEALED IN WALLS OR ABOVE CEILING. LONG CROSSMARKS DENOTE NUMBER OF "HOT" CONDUCTORS SHORT CROSSMARKS INDICATE NEUTRALS AND DOTS INDICATE NUMBER OF GROUND CONDUCTORS. ARROW INDICATES HOME RUN TO ELECTRICAL PANEL. | AS REC |
| | | |

<u>NOTES:</u> 1.) U.N.O. INDICATES UNLESS NOTED OTHERWISE.

18" AFF INDICATES TO TOP OF DEVICE;

ALL OTHER MOUNTING HEIGHTS REFER TO CENTERLINE OF DEVICE.

ABBREVIATIONS:

| A | AMPS | EXT. | EXTERNAL OR EXTERIOR | N/A | NOT APPLICABLE |
|-----------|----------------------------|-------|-----------------------------|-------|------------------|
| ABC | ABOVE CEILING LINE | FCU | FAN COIL UNIT | NIC | NOT IN CONTRACT |
| ACCU | AIR COOLED CONDENSING UNIT | FD | FIRE DAMPER | NTS | NOT TO SCALE |
| AFF | ABOVE FINISHED FLOOR | G. | GROUND | Р | POLE(S) |
| В. | BOTTOM | GA. | GAGE | PH | PHASE |
| BLC. | BELOW CEILING LINE | GALV. | GALVANIZED | RM. | ROOM |
| C. | CONDUIT OR COMMON | GRND. | GROUND | SS | STAINLESS STEEL |
| CLG. | CEILING | HP | HORSEPOWER | SPD | SURGE PROTECTION |
| COMB. | COMBINATION | HVAC | HEATING, VENTILATION, | TSTAT | THERMOSTAT |
| COND. | CONDUIT | | & AIR CONDITIONING | TYP. | TYPICAL |
| CU. | COPPER | INT. | INTRUSION DETECTION | UG | UNDERGROUND |
| DISC. | DISCONNECT | МСА | MINIMUM CIRCUIT AMPACITY | UNO | UNLESS OTHERWIS |
| EXIST./EX | EXISTING | MECH | MECHANICAL | V | VOLTS |
| EF | EXHAUST FAN | MOCP | MAX. OVERCURRENT PROTECTION | W | WIRE |

1 PROVIDE UNISTRUT STRUCTURAL CHANNEL SECURED TO TO JOIST AT BOTH ENDS. 2 PROVIDE 1/2″ GALVANIZED ROD MINIMUM. 3 PROVIDE LOCKNUT.

4 PROVIDE GALVANIZED UNISTRUT 8'-0" D/C 5 MAXIMUM. PROVIDE 0'-1" MAXIMUM 6 SIZE DN BOTTOM OF UNISTRUT.

ENGRAVED BLACK LETTERING — -PANEL "XXX" MECHANICAL FASTENERS — FED FROM PANEL X
© -CKT : XX LAMINATED ACRYLIC OR MELAMINE PLASTIC

01 <u>ILL.</u> SCALE : NOT TO SCALE

NOTE: ATTACH NAMEPLATES TO ALL ELECTRICAL GEAR AS NOTED ON SECTION 260553

EQUIPMENT

IDENTIFICATION LABEL DETAIL

SUPPORT DETAIL

KEYED NOTES:

1 PROVIDE PULL STATION (FLUSH MOUNTED). 2 PROVIDE J-BOX FOR ANSUL SYSTEM POWER. CONTRACTOR SHALL COORDINATE SIGNAL SYSTEM REQUIREMENTS WITH KITCHEN EQUIPMENT SUPPLIER.

4 PROVIDE CONTROL SIGNAL TO SHUNT-TRIP BREAKERS.

5 PROVIDE SHUNT-TRIP BREAKERS AS NOTED ON PANELBOARD SCHEDULES.

6 ANSUL SYSTEM CONTROL BOX.









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05 KITCHEN ELECTRICAL PLAN

- #10 & #8 FOR 175'.
- INSULATED "NEUTRAL AND 1 SHARED "GROUND".
- GROUND OPENING IN THE "UP" POSITION.
- JOINTS.

- 277V LIGHTING CIRCUIT.



BID PACKAGE #2



BID PACKAGE #2

IDEA PUBLIC SCHOOLS IDEA HEADQUARTERS KITCHEN RENOVATION

WESLACO, TEXAS

ARCHITECTS - PLANNERS

Gomez Mendez Saenz, Inc. Ethos Engineering

Set No.

BID PACKAGE #2 IDEA HEADQUARTERS KITCHEN RENOVATION TABLE OF CONTENTS

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PART 1 - GENERAL

- 1.1 RELATED DOCUMENTS
 - A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- 1.2 SUMMARY
 - A. Section Includes:
 - 1. Non-load-bearing steel framing systems for interior partitions.
 - 2. Suspension systems for interior ceilings and soffits.
 - 3. Grid suspension systems for gypsum board ceilings.
 - B. Related Requirements:
 - 1. Section 05400 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; roof rafters and ceiling joists; and roof trusses.
- 1.3 INFORMATIONAL SUBMITTALS
 - A. Product Certificates: For each type of code-compliance certification for studs and tracks.
 - B. Evaluation Reports: Submit evaluation reports certified under an independent third party inspection program administered by an agency accredited by IAS to ICC-ES AC98, IAS Accreditation Criteria for Inspection Agencies.
 - C. Manufacturers Certification: Submit manufacturer's certification of product compliance with codes and standards along with product literature and data sheets for specified products.
- 1.4 QUALITY ASSURANCE
 - A. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Steel Framing Industry Association (SFIA) or be a part of a similar organization that provides verifiable code compliance program.
 - B. Contractor shall provide effective, full time quality control over all fabrication and erection complying with the pertinent codes and regulations of government agencies having jurisdiction. Conduct pre-installation meeting to verify project requirements, substrate conditions, and manufacturer's installation instructions.
- 1.5 DELIVERY, STORAGE, AND HANDLING
 - A. Notify manufacturer of damaged materials received prior to installation.
 - B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.
 - C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI's "Code of Standard Practice".
- PART 2 PRODUCTS
- 1.1 PERFORMANCE REQUIREMENTS
 - A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E 119 by,

and displaying a classification label from an independent testing agency acceptable to the authority having jurisdiction.

- 1. Construct fire-resistance rated partitions in compliance with tested assembly requirements.
- 2. Rated assemblies to be substantiated from applicable testing using proposed products, by Contractor.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.
- C. Horizontal Deflection: For wall assemblies, limited to 1/240 of the wall height based on horizontal loading of 5 lbf/sq. ft. (480 Pa).
- D. Design framing systems in accordance with American Iron and Steel Institute Publication "S220 - North American Specification for the Design of Cold-Formed Steel Framing - Nonstructural Members", except as otherwise shown or specified.
- E. Design loads: As indicated on the Structural Drawings or 5 PSF minimum as required by the International Building Code, latest edition.
- F. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 2 inches.

1.2 FRAMING SYSTEMS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus onehalf of preconsumer recycled content not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 645 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal unless otherwise indicated.
 - 2. High Performance Coating: Comply with ASTM C 645; ASTM A 653. G-90 Coating; roll-formed from steel meeting mechanical and chemical requirements of ASTM A 1003 with a zinc-based coating. *Galvannealed products are not acceptable.*
 - a. Provide at all exterior framing and channels, and where noted.
 - b. All other partitions to have EQ Coating with equivalent corrosion resistance of <u>DiamondPlus® coating;</u>
- C. Studs and Tracks: ASTM C 645.
 - 1. Non-Structural Studs: Cold-formed galvanized steel C-studs as per ASTM C 645 for conditions indicated below:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; ProSTUD products named below, or a comparable product from one of the members of the SFIA:
 - b. Flange Size: 1-1/4 inches (32 mm).

Web Depth: 8", 6", 3-5/8"

- c. Member Description: ProSTUD 25 (25 EQ) 50 ksi.
 - 1) Minimum Base-Steel Thickness: 0.0150 inch (0.3810 mm).

- 2) Minimum Design Thickness: 0.0158 inch (0.4013 mm).
- 2. Non-Structural Track: Cold-formed galvanized steel runner tracks, drywall track, in conformance with ASTM C 645 for conditions indicated below:
 - a. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; ProTRAK, or a comparable product from one of the members of the SFIA:
 - b. Flange Size: 1-1/4 inches (32 mm).
 - c. Web Depth: Track web to match stud web size.
 - d. Minimum Base-Steel Thickness: Track thickness to match wall stud thickness or as per design.
- 3. "EQ" (Equivalent Gauge Thickness) Steel Studs and Runners: Members that can show certified third party testing with gypsum board in accordance with ICC ES AC86 (Approved May 2012) need not meet the minimum thickness limitation or minimum section properties set forth in ASTM C 645. The submission of an evaluation report is acceptable to show conformance to this requirement.
- 4. Interior Steel Framing Stud and Deflection Track Wall System: Selflocking metal studs with telescoping stud extension with knockout in each flange to allow for 1 inch (25 mm) of deflection for fire-rated head-of-wall deflection system.
 - Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; TRAKLOC Deflection Stud (TLD) and TRAKLOC Track (TTS) or a comparable product from one of the members of the SFIA:
 - b. Minimum Base-Steel Thickness: 0.0179 inch (0.45 mm)
 - c. Depth: 3-5/8 inches, 6 inches, 8 inches.
- D. Backing Plate: Proprietary fire-retardant-treated wood blocking and bracing in width indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Danback Fire-Retardant Treated Wood Backing Plate D24F, or a comparable product from one of the members of the SFIA:
- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Backing Plate or a comparable product from one of the members of the SFIA:
 - 2. Minimum Base-Steel Thickness: 0.0296 inch (0.75 mm).
- F. Channel Bridging and Bracing: Pre-notched steel, 7/8 inch by 7/8 inch by 50 inches (22.2 mm by 22.2 mm by 1270 mm), 0.0329-inch (0.84-mm) minimum base-steel thickness.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Spazzer 9200 Bridging and Spacing Bar or a comparable product from one of the members of the SFIA:
- B. U-Channel Bridging: Steel, 0.0538-inch (1.37-mm) minimum base-steel thickness, with minimum 1/2-inch- (13-mm-) wide flanges.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Cold-Formed U-Channel and EasyClip U-Series Angle], or a comparable product from one of the members of the SFIA:
 - 2. Depth: Clip Angle: Not less than 1-1/2 by 1-1/2 inches (38 by 38 mm), 0.0538-inch (1.37-mm) thick, galvanized steel.
- C. Hat-Shaped, Rigid Furring Channels: ASTM C 645.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Furring Channel or a comparable product from one of the members of the SFIA:
 - 2. Minimum Base-Steel Thickness: [As indicated on Drawings.
 - 3. Depth: As indicated on Drawings. 7/8 inch, 1-1/2 inches.
- B. Resilient Furring Channels: 1/2-inch- (13-mm-) deep, steel sheet members designed to reduce sound transmission.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; RC Deluxe (RCSD) Resilient Channel or a comparable product from one of the members of the SFIA:
 - 2. Configuration: Asymmetrical.
- B. Carrying Channels: 0.053-inch (1.37-mm) uncoated-steel thickness, with minimum 1/2-inch (13-mm) wide flanges.
 - 1. Depth: [As indicated on Drawings].
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0296 inch (0.75 mm).
 - 3. Tie Wire: ASTM A 641/A 641M, Class 1 zinc coating, soft temper, 0.062inch (1.57-mm) diameter wire, or double strand of 0.048-inch (1.21-mm) diameter wire.
- C. Z-Shaped Furring: Nonslotted web, face flange of 1-1/4 inches (32 mm), wall attachment flange of 3/4 inch (19 mm), minimum uncoated-steel thickness of 0.0179 inch (0.45 mm), and depth required to fit insulation thickness indicated.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Z-Furring Channel or a comparable product from one of the members of the SFIA: 20 ga.
- B. Headers and Jambs: Manufacturer's proprietary shape used to form header beams and jambs, columns or posts, of web depths indicated, unpunched, with stiffened flanges and as follows:
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide ClarkDietrich Building Systems; Heavy Duty Studs HDS, or a comparable product from one of the members of the SFIA:
 - 2. Minimum Base-Steel Thickness: [As indicated on Drawings.
 - 3. Web and Flange Widths, Type HDS: 3-5/8 by 3 by 1-1/16 by 3/4 inch, 6 by 3 by 2-1/4 by 3/4 inch.
- 0.2 AUXILIARY MATERIALS
 - A. General: Provide auxiliary materials that comply with referenced installation standards.

- 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Isolation Strip at Exterior Walls: Provide the following at all exterior wall locations:
 - 1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch (3.2 mm) thick, in width to suit steel stud size.

PART 2 - EXECUTION

0.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

0.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches (610 mm) o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.
- 0.3 INSTALLATION, GENERAL
 - A. Installation Standard: ASTM C 754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C 841 that apply to framing installation.
 - 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C 1063 that apply to framing installation.
 - 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C 844 that apply to framing installation.
 - 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.
 - B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.
- 0.4 INSTALLING FRAMED ASSEMBLIES
 - A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
 - 1. Single-Layer Application: [16 inches (406 mm) o.c unless otherwise indicated.
 - 2. Tile Backing Panels: [16 inches (406 mm) o.c.] unless otherwise indicated.
 - B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
 - C. Install studs so flanges within framing system point in same direction.
 - D. Install tracks 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 that penetrate 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 track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch (13-mm) clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.
 - 3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 - 4. Fire-Resistance-Rated Partitions: Install framing to comply with fireresistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Install fire-resistant partitions using manufacturer's proprietary equivalent gauge studs in compliance with requirements of [UL V450] [UL V438] [UL U419].
 - b. Firestop Track: Where indicated, install to maintain continuity of fireresistance-rated assembly indicated.

- 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
- 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches (152.4 mm) o.c.
- E. Direct Furring:
 - 1. Screw to wood framing.
 - 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
- F. Z-Shaped Furring Members:
 - 1. Erect insulation, specified in Section 072100 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced [24 inches (610 mm)] <Insert dimension> o.c.
 - 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches (610 mm) o.c.
 - 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screwattach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches (305 mm) from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch (3 mm) from the plane formed by faces of adjacent framing.

SECTION 09250 - GYPSUM DRYWALL

<u> PART 1 - GENERAL</u>

RELATED DOCUMENTS

Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 General Requirements sections, apply to work of this section.

DESCRIPTION OF WORK:

Types of work include:

Gypsum drywall including screw type metal support system

Drywall finishing (joint tape and compound treatment)

Gypsum Sheathing

QUALITY ASSURANCE:

<u>Fire Resistance Rating</u>: Where gypsum drywall systems with fire resistance ratings are indicated or are required to comply with governing regulations, provide materials and installations identical with applicable assemblies which have been tested and listed by recognized authorities, including UL and AIA.

Gypsum Board Terminology Standard: GA 505 by Gypsum Association.

<u>Single Source Responsibility</u>: Obtain gypsum board products from a single manufacturer, or from manufacturers recommended by the prime manufacturer of gypsum boards.

SUBMITTALS:

<u>Product Data</u>: Submit manufacturer's product specifications and installation instructions for each gypsum drywall component, including other data as may be required to show compliance with these specifications.

DELIVERY, STORAGE AND HANDLING:

<u>Deliver materials</u> in original packages, containers or bundles bearing brand name and identification of manufacturer or supplier.

<u>Store materials</u> inside under cover and in manner to keep them dry, protected from weather, direct sunlight, surface contamination, corrosion and damage from construction traffic and other causes. Neatly stack gypsum boards flat to prevent sagging. <u>Handle gypsum boards</u> to prevent damage to edges, ends or surfaces. Protect metal corner beads and trim from being bent or damaged.

PROJECT CONDITIONS:

<u>Environmental Requirements, General</u>: Comply with requirements of referenced gypsum board application standards and recommendations of gypsum board manufacturer, for environmental conditions before, during and after application of gypsum board.

<u>Cold Weather Protection</u>: When ambient outdoor temperatures are below 55 degrees F (13 degree C) maintain continuous, uniform, comfortable building working temperatures of not less than 55 degree F (13 degree C) for a minimum period of 48 hours prior to, during and following application of gypsum bard and joint treatment materials or bonding of adhesives.

<u>Ventilation</u>: Ventilate building spaces as required to remove water in excess of that required for drying of joint treatment material immediately after its application. Avoid drafts during dry, hot weather to prevent too rapid drying.

PART 2 PRODUCTS

ACCEPTABLE MANUFACTURERS:

Metal Support Materials:

Gold Bond Building Products Div., National Gypsum Co. Milcor Division; Inryco Inc. United States Gypsum Co.

Direct Suspension Systems:

Chicago Metallic Corp. Donn Corporation. National Rolling Mills Co. Roblin Building Products, Inc. United States Gypsum Co.

Gypsum Board and Related Products:

Gold Bond Building Products Div., National Gypsum Co. United States Gypsum Co.

METAL SUPPORT MATERIALS:

Ceiling Support Materials and Systems:

<u>General</u>: Size ceiling support components to comply with ASTM C 754 unless indicated otherwise, hot dipped galvanized at exterior walls.

Main Runners: Steel channels with rust inhibitive paint finish, hot or cold rolled.

Hanger Wire: ASTM A 641, soft, Class 1 galvanized.

<u>Hanger Anchorage Devices</u>: Screws, clips, bolts, cast in place concrete inserts or other devices applicable to the indicated method of structural anchorage for ceiling hangers and whose suitability for use intended has been proven through standard construction practices or by certified test data. Size devices for 3x calculated load supported except size direct pull out concrete inserts for 5x calculated loads.

Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, hat shaped.

Where shown as "Resilient", provide manufacturer's special type designed to reduce GYPSUM DRYWALL 09250 - 2 sound transmission.

Furring Members: ASTM C 645; 0.0179" min. thickness of base metal, C shaped studs.

<u>Furring Anchorages</u>: 16 gage galvanized wire ties, manufacturer's standard wire type clips, bolts, nails or screws as recommended by furring manufacturer and complying with C 754.

<u>Direct Suspension Systems</u>: Manufacturer's standard zinc coated or painted steel system of furring runners, furring tees, and accessories designed for concealed support of gypsum drywall ceilings; of proper type for use intended.

Wall/Partition Support Materials:

Exterior Studs: Refer to Structural_

<u>Interior Studs</u>: ASTM C 645; 0.0179" min. thickness of base metal unless otherwise indicated, 25 gage. Provide 16 gage hot dipped galvanized at exterior walls, unless noted otherwise.

Depth of Section: 4", except as otherwise indicated.

Deflection System: Provide Slotted Deflection Track at all interior partitions.

Suspended Drywall System: Equal to Armstrong Drywall Grid System

<u>Shaft Wall System:</u> Equal to USG Shaftwall System at elevator/mechanical shafts. Provide and install system with C-H profile studs.

<u>Runners</u>: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

<u>Furring Members</u>: ASTM C 645; 0.0179" min. thickness of base metal, hat shaped. Where shown as "Resilient," provide manufacturer's special type designed to reduce sound transmission.

<u>Z Furring Members</u>: Manufacturer's standard screw type galvanized steel, zee shaped furring members; ASTM A 525, G60, 0.0179" min. thickness of base metal; of depth indicated; designed for mechanical attachment of insulation boards or blankets to monolithic concrete and masonry walls. Hot dipped galvanized at exterior walls.

<u>Fasteners for Furring Members</u>: Type and size recommended by furring manufacturer for substrate and application indicated.

GYPSUM BOARD PRODUCTS:

Gypsum Wallboard: (GypWbd) ASTM C 36, of types, edge configuration and thickness indicated, in maximum lengths available to minimize end-to-end butt joint

Type: USG Gypsum Mold Tough Wallboard, Type MR Edges: Manufacturer's standard. Thickness: 1/2" at ceilings, 5/8" at wall partitions, unless otherwise indicated Uses: at toilet ceilings and wall partitions, where noted. Type: USG Gypsum Firecode Core Wallboard, Type X Edges: Manufacturer's standard. Thickness: 5/8", unless otherwise indicated Uses: at corridor wall partitions, above 8'-0"aff and where indicated.

TRIM ACCESSORIES:

<u>General</u>: Provide manufacturer's standard trim accessories of types indicated for drywall work, formed of galvanized steel unless otherwise indicated, with either knurled and perforated or expanded flanges for nailing or stapling, and beaded for concealment of flanges in joint compound. Provide corner beads, L type edge trim beads, U type edge trim beads, special L kerf type edge trim beads, and one piece control joint beads.

<u>Corner bead and Edge Trim for Interior Installation:</u> Comply with ASTM C 840 and the following:

<u>Corner bead</u> formed from zinc alloy, with flanges knurled and perforated or of fine mesh expanded metal.

<u>Steel Edge trim</u> formed from galvanized steel, types per Fig. 1 of ASTM C 840 as follows:

<u>"LC" Bead</u>, unless otherwise indicated. <u>"LK" Bead</u> with square nose for use with kerfed jambs. <u>"L" Bead</u> where indicated. <u>"U" Bead</u> where indicated.

<u>Plastic Edge Trim</u>: Manufacturers standard rigid or semi rigid PVC moldings shaped to provide resilient contact of gypsum board edges with other construction; friction fit, or pressure sensitive adhesive mounting.

<u>One Piece Control Joint:</u> Formed with perforated face flanges connected by vee shaped slot, 1/4 inch wide by approximately 7/16 inch deep and covered with removable tape, fabricated from the following material:

Roll formed zinc. Extruded vinyl. Either roll formed zinc or extruded vinyl.

JOINT TREATMENT MATERIALS:

<u>General</u>: ASTM C 475; type recommended by the manufacturer for the application indicated, except as otherwise indicated.

Joint Tape: Paper reinforcing type.

Joint Compound: Vinyl type powder or ready mixed vinyl type for interior use.

<u>Joint Compound</u>: On interior work provide chemical hardening type for bedding and filling, ready mixed vinyl type or vinyl type powder for topping.

MISCELLANEOUS MATERIALS:

<u>General</u>: Provide auxiliary materials for gypsum drywall work of the type and grade recommended by the manufacturer of the gypsum board.

<u>Laminating Adhesive</u>: Special adhesive or joint compound specifically recommended for laminating gypsum boards.

Gypsum Board Screws: Comply with ASTM C 646.

<u>Concealed Acoustical Sealant</u>: Nondrying, non-hardening, non-skinning, non-staining, non-bleeding, gunnable sealant for concealed applications per ASTM C 919.

Sound Attenuation Blankets: Refer to Section 07201 for sound attenuation blanket specification.

Corner Guards: Refer to Section 10260 for Clear Corner Guard specification.

<u>TEXTURE FINISH MATERIALS</u>: <u>Primer</u>: Of type recommended by manufacturer of texture finish.

Polystyrene Aggregated Finish: One of the following:

QT Imperial Texture Finish: United States Gypsum Co. Perfect Spray: Gold Bond Bldg. Products Div. Regular Texture Light Monterrey Medium Monterrey Orange Peel

PART 3 EXECUTION

<u>PREPARATION FOR METAL SUPPORT SYSTEMS</u> <u>Ceiling Anchorages</u>: Coordinate work with structural ceiling work to ensure that inserts and other structural anchorage provisions have been installed to receive ceiling hangers.

INSTALLATION OF METAL SUPPORT SYSTEMS:

General:

Metal Support Installation Standard: Comply with ASTM C 754.

<u>Do not bridge</u> building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

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Ceiling Support Suspension Systems:

<u>Secure hangers</u> to structural support by connecting directly to structure where possible, otherwise connect to inserts, clips or other anchorage devices or fasteners as indicated.

<u>Space main runners</u> 4' 0" o.c. and space hangers 4' 0" o.c. along runners, except as otherwise shown.

<u>Level main runners</u> to a tolerance of 1/8" in 12' 0", measured both lengthwise on each runner and transversely between parallel runners.

<u>Wire tie</u> or clip furring members to main runners and to other structural supports as indicated.

Space furring member 16" o.c., except as otherwise indicated.

Wall/Partition Support Systems:

<u>Install supplementary framing, blocking and bracing</u> at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar work to comply with details indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction handbook" published by United States Gypsum Co.

<u>Isolate stud system</u> from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.

<u>Install runner tracks</u> at floors, ceilings and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.

<u>Extend partition stud system</u> through acoustical ceilings and elsewhere as indicated to the structural support or substrate above the ceiling.

Space studs 16" o.c., unless otherwise indicated.

<u>Frame door openings</u> to comply with detailed indicated or if not otherwise indicated, to comply with applicable published recommendations of gypsum board manufacturer, or if not available, of "Gypsum Construction Handbook" published by United States Gypsum Com. Attach vertical studs at jambs with screws either directly to frames or to jamb anchor clips on door frames; install runner track section (for jack studs) at head and secure to jamb studs.

Extend vertical jamb studs through suspended ceilings and attach to underside of floor or roof structure above, unless otherwise indicated.

<u>Frame openings other than door openings</u> to comply with details indicated or if not indicated, in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads. <u>Space wall furring members</u> 16" o.c., unless otherwise indicated.

Erect thermal insulation vertically and hold in place with Z furring members spaced 24" GYPSUM DRYWALL 09250 - 6 o.c. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails or power drive fasteners spaced 24" o.c. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw attach short flange of furring channel to web of attached channel. Start from this furring member channel with standard width insulation panel and continue in regular manner. At interior corners, space second member no more than 12" from corner and cut insulation to fit. Until gypsum board is installed hold insulation in place with 10" staples fabricated from 18 gage tie wire and inserted through slot in web of member, or by an equally acceptable method.

<u>GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS</u>: <u>Gypsum Board Application and Finishing Standards</u>: ASTM C 840 and GA 216.

<u>Where handrails</u> are indicated for direct attachment to gypsum board shaft wall system, provide not less than a 0.0341 inch thick by 4 inch wide galvanized steel reinforcement strip, accurately positioned and secured behind not less than one gypsum board face layer of 1/2 inch or 5/8 inch thickness.

Install sound attenuation blankets as indicated, prior to gypsum board unless readily installed after board has been installed.

<u>Locate exposed end butt joints</u> as far from center of walls and ceilings as possible, and stagger not less than 1' 0" in alternate courses of board.

<u>Install ceiling boards</u> in the direction and manner which will minimize the number of end butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1' 0".

<u>Install wall/partition boards</u> vertically to avoid end butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs.

<u>Install exposed</u> gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16" open space between boards. Do not force into place.

Located either edge or end joints over supports, except in horizontal applications or where intermediate supports or gypsum board back blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill cut or field cut ends against mill cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

<u>Attach gypsum board to framing and blocking</u> as required for additional support at openings and cutouts.

<u>Form control joints</u> and expansion joints with space between edges of boards, prepared to receive trim accessories.

<u>Cover both faces</u> of steel stud partition framing with gypsum board in concealed spaces (above ceilings, etc.), except in chase walls which are properly braced internally.

Except where concealed application is required for sound, fire, air or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. area, and may be GYPSUM DRYWALL 09250 - 7

limited to not less than 75% of full coverage.

<u>Isolate perimeter</u> of non load bearing drywall partitions at structural abutments. Provide 1/4" to 1/2" space and trim edge with J type semi finishing edge trim. Seal joints with acoustical sealant. Do not fasten drywall directly to stud system runner tracks.

For double layer partition system, work above acoustical ceilings may be installed with base layer only.

Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

<u>METHODS OF GYPSUM DRYWALL APPLICATION:</u> <u>Single layer Application</u>: Install gypsum wallboard.

<u>On ceilings</u> apply gypsum board prior to wall/partition board application to the greatest extent possible.

<u>On partitions/walls</u> apply gypsum board vertically (parallel), unless otherwise indicated, and provide sheet lengths which will minimize end joints.

<u>Double Layer Fastening Methods</u>: Apply base layer of gypsum board and face layer to base layer as follows:

Fasten base layers to supports with screws. Stagger joints on face layers.

INSTALLATION OF DRYWALL TRIM ACCESSORIES:

<u>General</u>: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges by nailing or stapling in accordance with manufacturer's instructions and recommendations.

Install metal corner beads at external corners of drywall work.

<u>Install metal edge trim</u> whenever edge of gypsum board would otherwise be exposed or semi exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi finishing type is indicated. Install L type trim where work is tightly abutted to other work, and install special kerf type where other work is kerfed to receive long leg of L type trim. Install U type trim where edge is exposed, revealed, gasketed, or sealant filled (including expansion joints).

Install plastic edge trim where indicated on wall panels at juncture with ceilings.

<u>Install metal control joint</u> (beaded type) at all wall openings, at interior structural members and intervals not to exceed 30'-0", and where indicated otherwise.

FINISHING OF DRYWALL:

<u>General</u>: Apply treatment at gypsum board joints (both directions), flanges of trim accessories, penetrations, fastener heads, surface defects and elsewhere as required to prepare work for decoration. Pre-fill open joints and rounded or beveled edges, using type of compound recommended by manufacturer.

<u>Apply joint tape</u> at joints between gypsum boards, except where a trim accessory is GYPSUM DRYWALL 09250 - 8

indicated.

<u>Apply joint compound</u> in 3 coats (not including pre-fill of openings in base), and sand between last 2 coats and after last coat.

Refer to sections on painting, coatings and wall coverings in Division 9 for decorative finishes to be applied to drywall work.

APPLICATION OF TEXTURE FINISH:

<u>Surface Preparation and Primer</u>: Prepare and prime drywall and other surfaces in strict accordance with texture finish manufacturer's instructions. Apply primer of proper type to all surfaces to receive texture finish.

<u>Finish Application</u>: Mix and apply finish to drywall and other surfaces indicated to receive finish in strict accordance with manufacturer's instructions to produce a uniform texture without starved spots or other evidence of thin application, and free of application patterns.

Remove any texture droppings or overspray from door frames, windows and other adjoining work.

PROTECTION OF WORK:

Installer shall advise Contractor of required procedures for protecting gypsum drywall work from damage and deterioration during remainder of construction period.

SECTION 09720 - FIBERGLASS REINFORCED WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Prefinished polyester glass reinforced plastic sheets and adhered to unfinished gypsum wallboard.
 - 1. PC] trim.
- B. Products Not Furnished or Installed under This Section:
 - 1. Gypsum Substrate Board.
 - 2. Resilient Base.

1.2 RELATED SECTIONS

- A. Section 09250 Gypsum Drywall.
- B. Section 09220 Non-Structrural Metal Stud Framing
- C. Section 09300 Ceramic Tile

1.3 REFERENCES

- A. American Society for Testing and Materials: Standard Specifications (ASTM)
 - 1. ASTM D 256 Izod Impact Strengths (ft #/in)
 - 2. ASTM D 570 Water Absorption (%)
 - 3. ASTM D 638 Tensile Strengths (psi) & Tensile Modulus (psi)
 - 4. ASTM D 790 Flexural Strengths (psi) & Flexural Modulus (psi)
 - 5. ASTM D 2583- Barcol Hardness
 - 6. ASTM D 5319 Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
 - 7. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials.

1.4 SUBMITTALS

- A. Product Data: Submit sufficient manufacturer's data to indicate compliance with these specifications, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- B. Shop Drawings: Submit elevations of each wall showing location of paneling and trim members with respect to all discontinuities in the wall elevation.
- C. Selection Samples: Submit manufacturer's standard color pattern selection samples representing manufacturer's full range of available colors and patterns.

- D. Samples for Verification: Submit appropriate section of panel for each finish selected indicating the color, texture, and pattern required.
 - 1. Submit complete with specified applied finish.
 - 2. For selected patterns show complete pattern repeat.
 - 3. Exposed Molding and Trim: Provide samples of each type, finish, and color.
- E. Manufacturers Material Safety Data Sheets (MSDS) for adhesives, sealants and other pertinent materials prior to their delivery to the site (available as downloads for most Marlite's products at <u>http://www.marlite.com/tech-details.aspx</u> or by contacting Marlite at <u>info@marlite.com</u>).

1.5 QUALITY ASSURANCE

- A. Conform to building code requirements for interior finish for smoke and flame spread requirements as tested in accordance with:
 - 1. ASTM E 84 (Method of test for surface burning characteristics of building Materials)
 - a. Wall Required Rating Class A.
- B. Sanitary Standards: System components and finishes to comply with:
 - 1. United States Department of Agriculture (USDA) requirements for food preparation facilities, incidental contact.
 - 2. Food and Drug Administration (FDA) 1999 Food Code 6-101.11.
 - 3. Canadian Food Inspection Agency (CFIA) requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials factory packaged on strong pallets.
- B. Store panels and trim lying flat, under cover and protected from the elements. Allow panels to acclimate to room temperature (range of 60 to 75°F) for 48 hours prior to installation.

1.7 PROJECT CONDITIONS

- A. Environmental Limitations: Building are to be fully enclosed prior to installation with sufficient heat (70°) and ventilation consistent with good working conditions for finish work
- B. During installation and for not less than 48 hours before, maintain an ambient temperature and relative humidity within limits required by type of adhesive used and recommendation of adhesive manufacturer.
 - 1. Provide ventilation to disperse fumes during application of adhesive as recommended by the adhesive manufacturer.

1.8 WARRANTY

A. Furnish one year guarantee against defects in material and workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURER

- A. Marlite; 1 Marlite Drive, Dover, OH 44622. 800-377-1221 FAX (330) 343-4668 Email: info@marlite.com <u>www.marlite.com</u>.
- B. Product:
 - 1. Standard FRP

2.2 PANELS

- A. Fiberglass reinforced thermosetting polyester resin panel sheets complying with ASTM D 5319.
 - 1. Coating: Multi-layer print, primer and finish coats or applied over-layer.
 - 2. Dimensions:
 - a. Thickness 0.090 " (2.29mm) nominal
 - b. Width 4'-0" (1.22m) nominal
 - a. Length 10'-0" (3.0m)nominal, As indicated on the drawings
 - 2. Tolerance:
 - a. Length and Width: +/-1/8 " (3.175mm)
 - b. Square Not to exceed 1/8 " for 8 foot (2.4m) panels or 5/32 " (3.96mm) for 10 foot (2.4m) panels
- B. Properties: Resistant to rot, corrosion, staining, denting, peeling, and splintering.
 - 1. Flexural Strength 1.0 x 10⁴ psi per ASTM D 790. (7.0 kilogram-force/square millimeter)
 - 2. Flexural Modulus 3.1 x 10⁵ psi per ASTM D 790. (217.9 kilogram-force/square millimeter)
 - 3. Tensile Strength 7.0 x 10³ psi per ASTM D 638. (4.9 kilogram-force/square millimeter)
 - 4. Tensile Modulus 1.6 x 10⁵ psi per ASTM D 638. (112.5 kilogram-force/square millimeter)
 - 5. Water Absorption 0.72% per ASTM D 570.
 - 6. Barcol Hardness (scratch resistance) of 35 55 as per ASTM D 2583.
 - 7. Izod Impact Strength of 72 ft. lbs./in ASTM D 256
- C. Back Surface: Smooth. Imperfections which do not affect functional properties are not cause for rejection.
- D. Front Finish: In accordance with sample.

2.2 MOLDINGS

- A. PVC Trim: Thin-wall semi-rigid extruded PVC.
 - 1. M 350 Inside Corner, 10' length
 - 2. M 360 Outside Corner, 10' length
 - 3. M 365 Division, 10' length
 - 4. M 370 Edge, 10' length
 - 5. Color: White

2.1 ACCESSORIES

- A. Fasteners: Non-staining nylon drive rivets.
 - 1. Match panel colors.
 - 2. Length to suit project conditions.
- B. Adhesive: Either of the following construction adhesives complying with ASTM C 557.
 - 1. Marlite C-551 FRP Adhesive Water- resistant, non-flammable adhesive.
 - 2. Marlite C-915 Construction Adhesive Flexible, water-resistant, solvent based adhesive, formulated for fast, easy application.
 - 3. Titebond Advanced Polymer Panel Adhesive VOC compliant, non-flammable, environmentally safe adhesive.
- C. Sealant:
 - 1. Marlite Brand MS-250 Clear Silicone Sealant.
 - 2. Marlite Brand MS-251 White Silicone Sealant.
 - 3. Marlite Brand Color Match Sealant.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Examine backup surfaces to determine that corners are plumb and straight, surfaces are smooth, uniform, clean and free from foreign matter, nails countersunk, joints and cracks filled flush and smooth with the adjoining surface.
 - 1. Verify that stud spacing does not exceed 24" (61cm) on-center.
- B. Repair defects prior to installation.
 - 1. Level wall surfaces to panel manufacturer's requirements. Remove protrusions and fill indentations.

2.2 INSTALLATION

- A. Comply with manufacturer's recommended procedures and installation sequence.
- B. Cut sheets to meet supports allowing 1/8" (3 mm) clearance for every 8 foot (2.4m) of panel.
 - 1. Cut and drill with carbide tipped saw blades or drill bits, or cut with shears.
 - 2. Pre-drill fastener holes 1/8" (3mm) oversize with high speed drill bit.
 - a. Space at 8" (200mm) maximum on center at perimeter, approximately 1" from panel edge.
 - b. Space at in field in rows 16' (40.64cm) on center, with fasteners spaced at 12" (30.48 cm) maximum on center.
- C. Apply panels to board substrate, above base, vertically oriented with seams plumb and pattern aligned with adjoining panels.
 - 1. Install panels with manufacturer's recommended gap for panel field and corner joints.
 - a. Adhesive trowel and application method to conform to adhesive manufacturer's recommendations.
 - b. Drive fasteners for snug fit. Do not over-tighten.

- D. Apply panel moldings to all panel edges using silicone sealant providing for required clearances.
 - 1. All moldings must provide for a minimum 1/8 " (3mm) of panel expansion at joints and edges, to insure proper installation.
 - 2. Apply sealant to all moldings, channels and joints between the system and different materials to assure watertight installation.

2.3 CLEANING

- A. Remove excess sealant from panels and moldings. Wipe panel down using a damp cloth and mild soap solution or cleaner.
- B. Refer to manufacturer's specific cleaning recommendations Do not use abrasive cleaners.

SECTION 11400 - FOOD SERVICE EQUIPMENT

PART 1 GENERAL

SCOPE:

This section includes furnishing all material, labor, equipment and services required to complete food service equipment shown on the drawings and described herein:

RELATED WORK SPECIFIED ELSEWHERE:

Plumbing (refer to Division 15) including:

- Rough In: Piping for supply and waste lines.
- Traps, grease traps, line strainers, tail pieces, valves, stops, shut offs and miscellaneous fittings required for complete installation.
- Final Connections.
- Ventilation (refer to Division 15)
- Roof mounted fans and connecting ductwork not shown as part of the kitchen equipment.

Electrical (refer to Division 16) including:

- Rough in:
- Conduit, wiring, line and disconnect switches, safety cut offs and fittings, control panels, fuses, boxes and fittings required for complete installation.
- Final connections including mounting and wiring of starters and switches furnished as part of the food service equipment (unless otherwise indicated on the drawings).

QUALITY ASSURANCE:

Food Service equipment suppliers shall submit satisfactory evidence of compliance with the following qualifications and conditions to be approved.

Successful completion of jobs of comparable scope.

Have manufacturer's authorization to distribute and install specified factory items of equipment.

Maintain a permanent staff experienced in the installation of food service equipment and preparation of professional style shop drawings and brochures.

Maintain or have access to shop meeting N.S.F. requirements. If other than food service equipment suppliers on shop, obtain approval of shop desired to be used.

Maintain or have access to a readily available stock of repair and replacement parts, together with authorized service personnel.

SUBMITTALS:

Shop Drawings:

Submit to the Consultant for preliminary review within six (6) weeks after notification of award, one sepia and one blue line print of professionally prepared detailed arrangement plans (not traced from the Contract Documents) and mechanical rough-in plans showing dimensions locations, sizes, elevations and capacities of all services required for each item of equipment.

Submittal shall include bound brochures containing item flysheets, illustrations, specifications, line drawings and rough-in information on all brand name items (items not of his manufacture) herein after specified.

Two (2) preliminary brochures shall be submitted with arrangement plans, rough-in plans and shop drawings as hereinafter specified, for preliminary approval. After approval, drawings and brochures are to be submitted in the number as required by the Architect.

Professionally prepare detailed shop drawings at a minimum scale of 3/4" to the foot, plus necessary cross sections at a scale of 1-1/2" to the foot, showing complete detail of each item of specifically fabricated equipment. These drawings shall be based on the floor plans and the following item specifications.

Drawings shall include accurately dimensions layouts and locations for all masonry bases or recesses if required or called for hereinafter and shall furthermore, if applicable, include accurately dimensions, details and locations of any special wall openings that are required where items of equipment extend through walls.

Do not begin fabrication until shop drawings have been approved.

Food service equipment supplier shall furnish three (3) bound sets of dimensional prints, data sheets, spare parts lists, and operating instructions for each piece of mechanical equipment. These are to be prepared and submitted to Architect before demonstration of equipment (refer to 3.43).

All brochures shall be bound in hard durable covers bearing the job name and date of submission.

PRODUCT DELIVERY, STORAGE AND HANDLING:

Delivery: Equipment shall be delivered only after the building is weather and vandal safe.

<u>Storage:</u> Store equipment in an area convenient to the point of installation in such a way that it can be protected from the weather and job hazards.

<u>Protection</u>: Wrapping and protective coverings shall remain on all items until ready for use and in the case of stainless steel items, until installation is complete and the job is ready for cleaning.

JURISDICTION TRADE AGREEMENTS AND RESTRICTIONS:

Include the work specified, shown or reasonably inferable as part of food service equipment. Portions of this work may be subcontracted to those qualified to do such work, as may be necessary because of jurisdictional trade agreements and restrictions.

REGULATION AND CODES:

In addition to complying with applicable laws, statutes, building codes and regulations of public authorities, comply with the following.

National Sanitation Foundation (to bear label) National Electric Code Underwriters' Laboratories, Inc. American Gas Association Laboratories National Fire Protection Association Occupational Safety and Health Act

WARRANTIES:

Warrantee in writing all equipment and fabrication against defects and workmanship for a period of one (1) year from date of acceptance, unless noted otherwise.

<u>KITCHEN EQUIPMENT LIST:</u> <u>Item No. 1 – Kitchen Exhaust Hood – Refer to MEP</u>

Item No. 2 – Fryer Quantity: One (1)

Manufacturer/Model: Vulcan 1GR45A Series Fryer

Furnish and set in place per plans, elevations and manufacturer's specifications.

- 45-50 lbs Capacity
- Solid state analog temperature controls.
- Stainless steel cabinet with cast casters, all swivel and front two (2) Locking
- Stainless steel fry tank with four heat exchanger tubes
- 11/4" full port ball type drain valve.
- Twin fry baskets with plastic coated handles.
- 120,000 BTU/hr. input. solid state analog (A)control system.
- Tank brush, stainless steel crumb scoop and clean-out rod.
- Natural Gas
- Stainless steel tank cover
- Basket connecting kit
- Set of large and twin baskets
- 3/4" flexible gas hose with quick disconnect
- Stainless steel removable splash guards.
- Second year extended limited parts and labor warranty contract.

Item No. 3 – Heavy Duty Gas Range Two (2)

Manufacturer/Model: Vulcan Model V6B36S or preapproved equal

Furnish and set in place per plans, elevations and manufacturer's specifications.

- 1-1,⁄4" diameter front gas manifold with 11/4" rear gas connection (capped)
- Stainless steel front, front top ledge, burner box, sides, base, and stub back
- 35,000 BTU/hr. open top burners with lift off heads
- 50,000 BTU/hr. standard oven burner
- Individual pilots and controls for each burner
- Heavy-duty cast grates
- 4" stainless steel stub riser
- 6" adjustable stainless steel legs for "S", "C", and "B" models (no legs for modular model)
- Stainless steel cabinet base door
- Universal rack guides, one removable shelf (cabinet base)
- One year limited parts and labor warranty
- Stainless Steel oven cavity
- 650°F oven thermostat and steel hearth
- Set of four casters, two locking
- Flexible gas hose, quick disconnect & restraining device.

Item No. 4 – Griddle Quantity: One (1)

Manufacturer/Model: Vulcan Model VCRG48-T Gas Griddle

Furnish and set in place per plans, elevations and manufacturer's specifications.

- 1" thick polished steel griddle plate welded to 3-1/4" stainless steel back, tapered side splashes and stainless steel grease trough.
- Fully welded stainless and aluminized steel chassis frame.
- 12 1/2" cooking height on 4" adjustable legs.
- One 25,000 BTU/hr. "U" shaped aluminized steel burner for every 12" of griddle width.
- One embedded, mechanical snap action thermostat per burner for high performance and optimal response time.
- Temperature adjust from 200° to 450°F.
- One pilot safety valve for every two burners. Safety will completely shut off gas to pilot and burners if pilot extinguishes.
- High capacity 4-1/2 quart capacity grease can.
- 3/4" rear gas connection and convertible gas pressure regulator for LP service.
- Constructed standard for natural gas service.
- One year limited parts and labor warranty.
- Quick disconnect and flexible gas hose
- Provide Avantco Refrigeration Model No. 178CBE52 refrigerated base unit with two drawers

Item No. 5 – Charbroiler Quantity: One (1)

Manufacturer/Model: Cooking Performance Group Model no.CBR-36

- Furnish and set in place per plans, elevations and manufacturer's specifications.
 - Stainless steel construction and finish
 - Heavy duty cast iron top grates provide attractive char-broiler markings. Grate sections are reversible and remove easily for cleaning. The angled side helps channel oil toward the drip tray.
 - Top grates can be used in flat or sloped position
 - Independent, manually controlled cooking zones
 - 40,000 BTU stainless steel "U" shape burners
 - Each burner has a continuous pilot for instant ignition
 - Removable cast iron radiants prevent clogging of burners and provide even broiling
 - Removable full width waste tray
 - Heavy duty adjustable 3' (914 mm) Rubber Drain Hose with 10' (3048 mm) 1/4" Inlet Tubing
 - Quick disconnect and flexible gas hose
 - Provide Avantco Refrigeration Model No. 178CBE36 refrigerated base unit with two drawers

Item No. 6 – Pot Rack /Shelf Quar

Quantity: Two (2)

Manufacturer/Model: Advance Tabco PT 15-72 / SCT-72 15" Shelf and Pot Rack Furnish and set in place per plans, elevations and manufacturer's specifications

• Shelf, 72"x 15" wide top flat top, constructed of 14-gauge stainless steel with midmount pot rack with hooks



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SCHOOL

July 18, 2019

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TOC - I Ethos Engineering, 119 West Van Buren, Suite 101, Harlingen, TX 78550

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Date: 07/18/2019

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 22 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, and is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Contract Documents were prepared for the Project by: Ethos Engineering, 119 West Van Buren, Suite 101 Harlingen, Texas 78550 Phone Number: (956) 230-3435
- C. Scope of Work: Refer to drawings for a detailed Scope of Work. Provide all materials and labor associated with new fully-operational plumbing systems for the project "Idea HQ Kitchen Upgrades", including but not limited to the following:
 - 1. Demolition Work:
 - a. Demolish existing plumbing as indicated and prepare services for new plumbing fixtures, otherwise cap and seal services at a concealed location.
 - b. Coordinate with new work and retain existing plumbing lines that are to be reused.
 - c. Seal unused openings in floors, roofs and walls, as indicated in the drawings.
 - 2. New Work:
 - a. With Architect coordinate any saw cutting of floors as noted on drawings and as needed.
 - b. Plumbing fixtures and appliances such hardware and specialties.
 - c. Natural gas distribution piping, service connections and accessories. Coordinate with Division 23.
 - d. <u>Painting</u>: See Division 9 specifications. Paint all exposed piping, insulation, hangers, accessories in interior exposed areas. Paint exterior pipe supports. Coordinate paint type, color and scope of work with Architect.

1.3 ALLOWANCES

A. See Division 0 Specifications. Coordinate provision of LPG tank under Allowance.

1.4 COORDINATION

- A. All plumbing work shall be done under sub-contract to a General Contractor. Plumbing Contractor shall coordinate all work through General Contractor, who is ultimately responsible for the entire project.
- B. <u>Prior to bidding</u>, Plumbing Contractor shall coordinate all work in Division-22 for integration with civil work, mechanical work, electrical work, irrigation work and general construction. A detailed list of inclusion and exclusions shall be provided to General Contractors at least three days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by Architect/Engineer as needed.
 - 1. Coordinate water line diameter, tap size, meter size and backflow preventer size with MEP Engineer. While meter size may be smaller, water line diameter, tap, backflow preventer sizes shall match or be larger than the connection sizes shown on Plumbing drawings. If the distance from the water mains is too large, upsize line, valve sizes to minimize pressure drops. Coordinate details with Engineer.
- C. All electrical work required for operation of plumbing systems shall be coordinated through the General Contractor <u>prior to bidding</u> to ensure that all starters, disconnects, conduit and wiring are provided as part of the project. All components needed for a full operational installation of systems shall be provided.
- D. All Building Automation Systems (BAS) required for operation of plumbing systems shall be coordinated through the General Contractor <u>prior to bidding</u>, to ensure that all equipment, materials, valves, sensors, devices and labor are provided as part of the project. All components needed for a full operational installation of systems shall be provided.
- E. Plumbing Contractor shall coordinate and supervise installation of all controls systems, and coordinate with electrical contractors and equipment suppliers as needed. All components needed for a full operational installation of systems shall be provided.
- F. Contractor shall coordinate with other divisions for power and control of plumbing systems. It is not the intent of this specification to dictate who will conduct work, only to state the requirements of conducting the work.
- G. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.
- H. Coordinate with Div. 1 for work sequence and optimization of construction schedule.
- I. Coordinate with Div. 23 for Mechanical System.
- J. Coordinate with Div. 26 electrical contractor for providing power to plumbing equipment, and for Fire Alarm Systems interface with plumbing systems.
- K. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is contractor's responsibility to make sure Engineer receives notification.
 - 1. Upon completion of underground piping installation and prior to testing or covering up.
 - 2. Upon completion of all water piping installation and prior to insulation and/or testing.
 - 3. Upon completion of ductwork and prior to testing and insulating.

- 4. Above ceiling inspections prior to ceiling tile installation.
- 5. When ready to request manufacturer's start-up of each piece of equipment.
- 6. When ready for Substantial Completion Inspection.
- 7. When ready for Final Inspection.

L. General

- 1. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.
- 2. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.
- 3. The Mechanical, Electrical, Plumbing, and associated Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.
- 4. When the mechanical, electrical and plumbing drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

1.5 WORK SEQUENCE

- A. Locate Utilities:
 - 1. Coordinate with power, water, sewer, telephone, communications, and other utilities as well as designated Owner's personnel to locate all utilities prior to digging in any area.
 - 2. Obtain any approvals required from utilities to relocate utilities.
 - 3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
- B. Coordinate with Division 1 requirements to optimize construction schedule.
- C. Provide equipment and material submittals, coordination drawings and shop drawings as required by specifications.
- D. Submit detailed plumbing Schedule of Values with Submittals. Plumbing Submittals will not be accepted without a detailed Schedule of Values.

E. Sequence construction in coordination with work by other disciplines.

1.6 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Driveways and Entrances: Keep driveways and entrances to construction site clear and available to other Contractors, Owner, and A/E personnel at all times. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.
- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
 - 1. Temporary fencing around construction areas.
 - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
 - 3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

- A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project.
- B. Provide all plumbing submittals at the same time in one or multiple bound volumes. Include originals from manufacturer. All submittals shall be in native pdf and searchable format. Faxes and copies of faxes are not acceptable.
- C. Provide sufficient copies of approved data, with the engineer's approved stamp, for inclusion in the operations and maintenance manuals.
- D. Provide detailed coordination drawings showing how plumbing system components will be installed in coordination with work by others. Engineer's drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1.8 SCHEDULE OF VALUES -Special Requirements

- A. Plumbing Contractor shall submit a Schedule of Values reflecting the total value of Plumbing Work in the Contract, and broken down into the following items as a minimum, with a line-item for Materials/Equipment and another for Labor:
 - 1. Plumbing fixtures and equipment
 - 2. Plumbing materials
 - 3. Plumbing labor
 - 4. Allowances.

- 5. Miscellaneous
- 6. Administrative and project management.
- B. Schedule of Values shall be included with bound submittals. Submittals without a Schedule of Values shall not be reviewed.

1.9 EQUIPMENT MANUFACTURERS

- A. Plumbing design is based on equipment and materials scheduled and specified. These are used as the basis for performance characteristics, quality, and physical dimensions/weight.
- B. Equipment and materials by other APPROVED manufacturers may be provided by Contractor. In doing so, Contractor assumes responsibility for the performance, quality, and physical dimensions of the proposed units.
- C. Any costs associated with modifications to the design due to submittal of equipment and/or materials other than those used as the basis of design are the Contractor's responsibility. This includes any design time, production of drawings, and time delays.
- D. Where use of equipment and/or materials other than those used as the basis of design impact other disciplines, Contractor shall assume responsibility for all costs associated with any APPROVED modifications. This may include resizing of electrical circuits, modifying openings in the structure, relocating floor drains, etc.

1.10 OPERATIONS AND MAINTENANCE MANUALS & TRAINING

- A. Submit Operations and Maintenance Manuals two weeks prior to Substantial Completion Inspection. Engineer will not conduct a Substantial Completion Inspection without having reviewed Operations and Maintenance Manuals.
- B. Use Operations and Maintenance Manuals as a guide for conducting training of Owner's personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

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.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 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.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
 - 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.

SECTION 220517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 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.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves
 - Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system.
 a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system
 - 3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system.
 - a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves
 - 5. Interior Partitions: Galvanized-steel-pipe sleeves

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. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

SECTION 220518 - ESCUTCHEONS FOR PLUMBING PIPING

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with roughbrass finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

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. Thermal-hanger shield inserts.
 - 4. Fastener systems.
 - 5. Pipe stands.
 - 6. Equipment supports.
- B. Related Sections:
 - 1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
 - 3. Section 220548 "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.
1.5 ACTION 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.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 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 METAL FRAMING SYSTEMS

- A. MFMA Manufacturer Metal Framing Systems:
 - 1. Manufacturers:
 - 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.
 - g. Wesanco, Inc.
 - 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. Plastic Coating: PVC.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers:
 - 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: ASTM C 552, Type II cellular glass 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, 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.

2.6 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. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.

- 4. Horizontal Member: Protective-coated-steel channel.
- 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structuralsteel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.7 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.8 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbonsteel shapes.

2.9 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 Section 077200 "Roof Accessories" for curbs.
- G. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.
- H. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.
- I. Equipment Support Installation: Fabricate from welded-structural-steel shapes.
- J. 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.
- 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 weightdistribution 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 weightdistribution 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 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. 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.

3.4 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 Section 099113 "Exterior Painting." Section 099123 "Interior Painting." Section 099600 "High-Performance Coatings."
- C. 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 metal framing systems and attachments for general service applications.
- F. Use stainless-steel pipe hangers and attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.

- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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. 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.
 - 3. 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.
 - 4. 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.
 - 5. 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.
 - 6. 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.
- K. 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.
- L. 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.
- M. 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. 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 Ibeams for heavy loads.
- 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams 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. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. 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.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.
- R. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

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. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Elastomeric hangers.
 - 5. Spring hangers.
- B. Related Requirements:
 - 1. Section 210548.13 "Vibration Controls for Fire-Suppression Piping and Equipment" for devices for fire-suppression equipment and systems.
 - 2. Section 230548.13 "Vibration Controls for HVAC" for devices for HVAC equipment and systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 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 vibration isolation device type required.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment.
- C. Delegated-Design Submittal: For each vibration isolation device.
 - 1. Include design calculations for selecting vibration isolators.

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for plumbing piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
- B. Elastomeric Isolation Pads:
 - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 2. Size: Factory or field cut to match requirements of supported equipment.
 - 3. Pad Material: Oil and water resistant with elastomeric properties.
 - 4. Surface Pattern: Ribbed, Waffle, non-slip pattern.
 - 5. Infused nonwoven cotton or synthetic fibers.
 - 6. Load-bearing metal plates adhered to pads.
 - 7. Sandwich-Core Material: Resilient and elastomeric.
- C. Double-Deflection, Elastomeric Isolation Mounts:
 - 1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

- 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- D. Restrained Elastomeric Isolation Mounts:
 - 1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- E. 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 steel plate for bolting to structure with an elastomeric isolator pad attached to the 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. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
 - 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. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
 - a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
 - b. Top housing with threaded mounting holes and internal leveling device, elastomeric pad.
- G. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
 - 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.
- H. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

- 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-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 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. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
- 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
- 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

2.2 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-control devices to indicate capacity range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- 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. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static within specified loading limits.

SECTION 220548.13 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

3.3 VIBRATION CONTROL 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 033000 "Cast-in-Place Concrete." Section 033053 "Miscellaneous Cast-in-Place Concrete."
- B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 220548.13

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. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Stencils.
 - 5. Valve tags.
 - 6. Warning tags.

1.3 ACTION 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 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-quarters 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, 1/8 inch thick, and having predrilled holes for attachment hardware.
 - 2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
 - 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
 - 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
 - 5. Fasteners: Stainless-steel rivets or self-tapping screws.
 - 6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- C. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.
- D. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. 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; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1/2 inch.

2.4 STENCILS

- A. Stencils for Piping:
 - 1. Lettering Size: Size letters according to ASME A13.1 for piping.
 - 2. Stencil Paint: Exterior, gloss, alkyd enamel in colors complying with recommendations in ASME A13.1 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. Paint may be in pressurized spray-can form.

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 minimum thickness, and having predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass beaded 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.

2.6 WARNING TAGS

- A. Description: 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: Safety 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 GENERAL INSTALLATION REQUIREMENTS

- 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.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

A. Piping Color Coding: Painting of piping is specified in Section 099123 "Interior Painting." and Section 099600 "High-Performance Coatings."

- 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, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations 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. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

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 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: 1-1/2 inches, round.
 - b. Hot Water: 1-1/2 inches, round.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

END OF SECTION 220553

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 23 Specification Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

- A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, and is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
- B. Mechanical Contract Documents were prepared for the Project by: Ethos Engineering, 119 West Van Buren, Suite 101 Harlingen, Texas 78550 Phone Number: (956) 230-3435
- C. Scope of Work: Refer to drawings for a detailed Scope of Work. Provide all materials and labor associated with new fully-operational mechanical and controls systems for the project "Idea HQ Kitchen Renovations".
 - 1. Demolition Work:
 - a. Remove HVAC equipment and materials as indicated. The Owner has right of first refusal. Dispose of equipment and materials that Owner no longer wishes to retain.
 - b. Retain for reuse existing HVAC equipment and materials as indicated.
 - c. Demolish existing hardware, controls, ductwork, air-devices, and accessories as indicated and that will no longer be needed.
 - d. Refer to Architectural drawings for coordination.
 - 2. New Work: Provide all materials and labor associated with new fully-operational mechanical and controls systems, including but not limited to the following:
 - a. Kitchen hood, kitchen ventilation system, associated grease duct and fire suppression system.
 - b. Existing kitchen exhaust and makeup air fans will be reused.
 - c. Natural gas piping, and related accessories, to serve kitchen equipment. Provide a complete and functional system. Coordinate with Div. 22 for division of responsibilities.
 - d. Controls, and accessories for a complete and operational system.
 - e. Building exhaust fans and associated louvers.
 - f. Ductwork, diffusers, grilles, dynamic fire dampers, control dampers, zone dampers, OA intake louvers, and other accessories.
 - g. Controls: Coordinate JCI BAS to provide fully integrated and operational controls, including controls and graphics upgrades, controllers, software, programmable, sensors, training, etc.

SECTION 230010 – SUMMARY OF MECHANICAL WORK

- h. Testing, Adjusting, & Balancing (TAB) shall not be provided under the mechanical contract. General contractor to provide TAB. Coordinate work.
- i. Shop drawing submittals for all mechanical systems including but not limited to equipment, ductwork and piping.
- j. Coordination drawings for placing of mechanical systems in relation to work by other disciplines.
- k. Coordinate electrical work with Div. 26 as required.
- 1. Coordinate fire alarm related work with Fire Alarm Contractor. Provide smoke detectors, wiring and controls for units, 2000 cfm and larger, where none exist.
- 3. <u>Painting</u>: See Division 9 specifications. Paint all exposed piping, ductwork, insulation, hangers, accessories in interior exposed areas. Paint exterior pipe supports. Coordinate paint type, color and scope of work with Architect.

1.3 ALLOWANCES

A. Allowances are included in the Division 1 specifications.

1.4 COORDINATION

- A. All mechanical work shall be done under sub-contract to a General Contractor. Mechanical Contractor shall coordinate all work through General Contractor, who is ultimately responsible for the entire project.
- B. <u>Prior to bidding</u>, Mechanical Contractor shall coordinate all work in Division-23 for integration with TAB, plumbing, electrical, controls work and general construction. A detailed list of inclusion and exclusions shall be provided to General Contractors at least three days prior to the end of the period set aside to request clarifications so that coordination of any missing items may be addressed and clarified by Architect/Engineer as needed.
- C. All electrical work required for operation of mechanical systems shall be coordinated through the General Contractor <u>prior to bidding</u> to ensure that all starters, disconnects, VFD's, conduit and wiring are provided as part of the project. All components needed for a full operational installation of systems shall be provided.
- D. All controls required for operation of mechanical systems shall be coordinated <u>prior to bidding</u>, to ensure that all equipment, materials, sensors, devices and labor are provided as part of the project. All components needed for a full operational installation of systems shall be provided. Mechanical Contractor shall coordinate and supervise installation of all controls systems.
- E. All questions, requests for information, submittals, and correspondence from the Div. 23 Contractor shall be submitted via the General Contractor, who will forward to the Architect, who will then forward to the Engineer.
- F. Div. 23 Contractor shall not make any changes to design without written authorization from the Engineer. If changes are requested by the Owner, Architect, General Contractor, Suppliers, Manufacturers, or any others, Contractor should issue a written RFI for response by the Engineer.

SECTION 230010 – SUMMARY OF MECHANICAL WORK

- G. Div. 23 Contractor shall issue seven days written notice prior to any activities that require the presence of the Engineer at the job-site. This applies to all inspections required by specifications, and particularly to those where work will be covered.
- H. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract. Ensure that systems are ready for controls and electrical connections when needed so as to not delay construction.
- I. Contractor shall coordinate with other divisions for power and control of mechanical systems. It is not the intent of this specification to dictate who will conduct work, only to state the requirements of conducting the work.
- J. Coordinate with Div. 1 for work sequence and optimization of construction schedule.
- K. Coordinate with Div. 21 for Fire Suppression System.
- L. Coordinate with Div. 22 for Plumbing System.
- M. Coordinate with Div. 26 electrical contractor for providing power to mechanical equipment, and for Fire Alarm Systems interface with mechanical systems.
- N. Coordinate TAB activities with TAB Contractor.
- O. Coordinate commissioning activities with Commissioning Agent.
- P. Issue written notification of the following tasks and allow five (5) days for Engineer to respond and schedule an inspection as required. Failure to issue written notification may result in work having to be redone to allow for proper inspection. It is contractor's responsibility to make sure Engineer receives notification.
 - 1. Upon completion of ductwork and prior to testing and insulating.
 - 2. Metal duct leakage testing.
 - 3. Above ceiling inspections prior to ceiling tile installation.
 - 4. When ready to request manufacturer's start-up of each piece of equipment.
 - 5. When ready for Systems Readiness Checklists (Commissioning).
 - 6. When ready for Functional Performance testing (Commissioning).
 - 7. When ready for an inspection by TAB contractor prior to developing detailed TAB Plan.
 - 8. When ready to conduct complete Automation System software demonstration.
 - 9. When ready for Substantial Completion Inspection.
 - 10. When ready for Final Inspection.
- Q. General
 - 1. The Contractor shall execute all work hereinafter specified or indicated on accompanying Drawings. Contractor shall provide all equipment necessary and usually furnished in connection with such work and systems whether or not mentioned specifically herein or on the Drawings.
 - 2. The Contractor shall be responsible for fitting his material and apparatus into the building and shall carefully lay out his work at the site to conform to the structural conditions, to avoid all obstructions, to conform to the details of the installation and thereby to provide an integrated satisfactory operating installation.
 - 3. The Mechanical, Electrical, Plumbing, and associated Drawings are necessarily diagrammatic by their nature, and are not intended to show every connection in detail or

SECTION 230010 - SUMMARY OF MECHANICAL WORK

every pipe or conduit in its exact location. These details are subject to the requirements of standards referenced elsewhere in these specifications, and structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be organized and laid out so that it will be concealed in furred chases and suspended ceilings, etc., in finished portions of the building, unless specifically noted to be exposed. All exposed work shall be installed parallel or perpendicular to the lines of the building unless otherwise noted.

4. When the mechanical, electrical and plumbing drawings do not give exact details as to the elevation of pipe, conduit and ducts, the Contractor shall physically arrange the systems to fit in the space available at the elevations intended with proper grades for the functioning of the system involved. Piping, exposed conduit and the duct systems are generally intended to be installed true and square to the building construction, and located as high as possible against the structure in a neat and workmanlike manner. The Drawings do not show all required offsets, control lines, pilot lines and other location details. Work shall be concealed in all finished areas.

1.5 WORK SEQUENCE

A. Locate Utilities:

- 1. Coordinate with power, water, sewer, telephone, communications, and other utilities as well as designated Owner's personnel to locate all utilities prior to digging in any area.
- 2. Obtain any approvals required from utilities to relocate utilities.
- 3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.
- 4. Where several new utilities must share a common area or path, coordinate with other trades so that the proper clearances are maintained and utilities may be installed in compliance with all requirements.
- 5. Refer to Civil Plans for coordination of connection points from site utilities to buildings.
- B. Coordinate with Division 1 requirements to optimize construction schedule.
- C. Provide equipment and material submittals, coordination drawings and shop drawings as required by specifications.
- D. Submit detailed mechanical Schedule of Values with Submittals. Mechanical Submittals will not be accepted without a detailed Schedule of Values.
- E. Sequence construction in coordination with work by other disciplines.

1.6 CONTRACTOR USE OF PREMISES

- A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.
 - 1. Driveways and Entrances: Keep driveways and entrances to construction site clear and available to other Contractors, Owner, and A/E personnel at all times. Do not use these

areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

- B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:
 - 1. Temporary fencing around construction areas.
 - 2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
 - 3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

- A. Manufacturer's standard dimensioned drawings, performance and product data shall be edited to delete reference to equipment, features, or information which is not applicable to the equipment being supplied for this project.
- B. Provide all mechanical submittals at the same time in one or multiple bound volumes. Include originals from manufacturer. All submittals shall be in native pdf and searchable format. Faxes and copies of faxes are not acceptable.
- C. Provide sufficient copies of approved data, with the engineer's approved stamp, for inclusion in the operations and maintenance manuals.
- D. Provide detailed coordination drawings showing how mechanical system components will be installed in coordination with work by others. Engineer's drawing files will be made available to Contractor for producing coordination and as-built drawings upon request.

1.8 SCHEDULE OF VALUES -Special Requirements

A. Mechanical Contractor shall submit a Schedule of Values reflecting the total value of Mechanical Work in the Contract, and broken down into the following items as a minimum, with a line-item for Materials/Equipment and another for Labor:

MECHANICAL

- 1. HVAC equipment
- 2. HVAC materials (ductwork, piping, dampers)
- 3. HVAC labor
- 4. Controls equipment
- 5. Controls labor
- 6. Controls engineering and programming
- 7. Controls commissioning and closeout (minimum 10% of total controls cost)
- 8. Controls training (minimum 5% of total controls cost)
- 9. TAB
- 10. Commissioning related activities
- 11. Allowances.
- 12. Miscellaneous
- 13. Administrative and project management.

SECTION 230010 – SUMMARY OF MECHANICAL WORK

B. Schedule of Values shall be included with bound submittals. Submittals without a Schedule of Values shall not be reviewed.

1.9 EQUIPMENT MANUFACTURERS

- A. Mechanical design is based on equipment and materials scheduled and specified. These are used as the basis for performance characteristics, quality, and physical dimensions/weight.
- B. Equipment and materials by other APPROVED manufacturers may be provided by Contractor. In doing so, Contractor assumes responsibility for the performance, quality, and physical dimensions of the proposed units.
- C. Any costs associated with modifications to the design due to submittal of equipment and/or materials other than those used as the basis of design are the Contractor's responsibility. This includes any design time, production of drawings, and time delays.
- D. Where use of equipment and/or materials other than those used as the basis of design impact other disciplines, Contractor shall assume responsibility for all costs associated with any APPROVED modifications. This may include resizing of electrical circuits, modifying openings in the structure, relocating floor drains, etc.

1.10 OPERATIONS AND MAINTENANCE MANUALS & TRAINING

- A. Submit Operations and Maintenance Manuals two weeks prior to Substantial Completion Inspection. Engineer will not conduct a Substantial Completion Inspection without having reviewed Operations and Maintenance Manuals.
- B. Use Operations and Maintenance Manuals as a guide for conducting training of Owner's personnel.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 230010

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 general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.3 COORDINATION

- A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:
 - 1. Motor controllers.
 - 2. Torque, speed, and horsepower requirements of the load.
 - 3. Ratings and characteristics of supply circuit and required control sequence.
 - 4. Ambient and environmental conditions of installation location.

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.
- C. Comply with IEEE 841 for severe-duty motors.

2.2 MOTOR CHARACTERISTICS

- A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.
- B. 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.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2.3 POLYPHASE MOTORS

- A. Description: NEMA MG 1, Design B, medium induction motor.
- B. Efficiency: Energy efficient, as defined in NEMA MG 1.
- C. Service Factor: 1.15.
- D. Multispeed Motors: Variable torque. Unless otherwise noted, windings shall be:
 - 1. For motors with 2:1 speed ratio, consequent pole, single winding.
 - 2. For motors with other than 2:1 speed ratio, separate winding for each speed.
- E. Multispeed Motors: Separate winding for each speed.
- F. Rotor: Random-wound, squirrel cage.
- G. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
- H. Temperature Rise: Match insulation rating.
- I. Insulation: Class F.
- J. 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.
- K. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

- A. Motors Used with Reduced-Voltage and Multispeed 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. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
 - 2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - 3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - 4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.
- C. Severe-Duty Motors: Comply with IEEE 841, with 1.15 minimum service factor.

SECTION 230513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

2.5 SINGLE-PHASE MOTORS

- A. Motors larger than 1/20 HP shall be one of the following, to suit starting torque and requirements of specific motor application:
 - 1. Permanent-split capacitor.
 - 2. Split phase.
 - 3. Capacitor start, inductor run.
 - 4. Capacitor start, capacitor run.
- B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
- C. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
- D. Motors 1/20 HP and Smaller: Shaded-pole type.
- E. 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.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

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.
 - 2. Stack-sleeve fittings.
 - 3. Sleeve-seal systems.
 - 4. Sleeve-seal fittings.
 - 5. Grout.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 SLEEVES

- A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.
- B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.
- C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.
- D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 STACK-SLEEVE FITTINGS

- A. Manufacturers:
 - 1. Smith, Jay R. Mfg. Co.
 - 2. Zurn Specification Drainage Operation; Zurn Plumbing Products Group.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

- B. Description: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring, bolts, and nuts for membrane flashing.
 - 1. Underdeck Clamp: Clamping ring with setscrews.

2.3 SLEEVE-SEAL SYSTEMS

- A. Manufacturers:
 - 1. Advance Products & Systems, Inc.
 - 2. CALPICO, Inc.
 - 3. Metraflex Company (The).
 - 4. Pipeline Seal and Insulator, Inc.
 - 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 - 1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 2. Pressure Plates: Carbon steel.
 - 3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.4 SLEEVE-SEAL FITTINGS

- A. Manufacturers:
 - 1. Presealed Systems.
- B. Description: Manufactured plastic, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall. Unit has plastic or rubber waterstop collar with center opening to match piping OD.

2.5 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.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 - 2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 - 1. Cut sleeves to length for mounting flush with both surfaces.
 - 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."
- E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 STACK-SLEEVE-FITTING INSTALLATION

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 076200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using grout, seal the space around outside of stack-sleeve fittings.

SECTION 230517 - SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

B. Fire-Barrier Penetrations: Maintain indicated fire rating of floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.3 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.4 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.

3.5 SLEEVE AND SLEEVE-SEAL SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves.
 - 2. Exterior Concrete Walls below Grade: Cast-iron wall sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs-on-Grade: Cast-iron wall sleeves with sleeve-seal system. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves.
 - 5. Interior Partitions: Galvanized-steel-pipe sleeves.

END OF SECTION 230517

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. Escutcheons.
 - 2. Floor plates.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

- A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.
- B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.
- C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.
- D. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

- A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- B. Split-Casting Floor Plates: Cast brass with concealed hinge.

SECTION 230518 - ESCUTCHEONS FOR HVAC PIPING

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.
- B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. Escutcheons for New Piping:
 - a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
 - b. Insulated Piping: One-piece, stamped-steel type.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, castbrass type with polished, chrome-plated finish.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with roughbrass finish.
 - f. Bare Piping in Equipment Rooms: One-piece, cast-brass type with rough-brass finish.
 - 2. Escutcheons for Existing Piping:
 - a. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
 - b. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
 - d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
 - e. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-plate, stamped-steel type with concealed hinge.
 - f. Bare Piping in Unfinished Service Spaces: Split-casting brass type with roughbrass finish.
 - g. Bare Piping in Equipment Rooms: Split-casting brass type with rough-brass finish.
- C. Install floor plates for piping penetrations of equipment-room floors.
- D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 - 1. New Piping: One-piece, floor-plate type.
 - 2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

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. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
 - 2. Section 230516 "Expansion Fittings and Loops for HVAC Piping" for pipe guides and anchors.
 - 3. Section 230548.13 "Vibration Controls for HVAC" for vibration isolation devices.
 - 4. Section 233113 "Metal Ducts" and Section 233116 "Nonmetal 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.

SECTION 230529 - HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 ACTION 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. Pipe stands.
 - 4. 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.

1.6 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.7 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.
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:
 - 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.
 - g. Wesanco, Inc.
 - 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: Epoxy.

2.4 THERMAL-HANGER SHIELD INSERTS

- A. Manufacturers:
 - 1. Carpenter & Paterson, Inc.
 - 2. ERICO/Michigan Hanger Co.
 - 3. PHS Industries, Inc.
 - 4. Pipe Shields, Inc.
 - 5. Rilco Manufacturing Company, Inc.
 - 6. Value Engineered Products, Inc.
- B. Insulation-Insert Material for Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.
- C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.
- D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.
- E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.5 FASTENER SYSTEMS

A. 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.

2.6 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 stainless-steel base unit with plastic roller, for roof installation without membrane penetration.
- D. High-Type, Single-Pipe Stand:
 - 1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
 - 2. Base: Plastic.
 - 3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
 - 4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainlesssteel, roller-type pipe support.
- E. High-Type, Multiple-Pipe Stand:
 - 1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
 - 2. Bases: One or more; plastic.
 - 3. Vertical Members: Two or more protective-coated-steel channels.
 - 4. Horizontal Member: Protective-coated-steel channel.
 - 5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.
- F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structuralsteel 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 carbonsteel 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 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 Section 077200 "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 weightdistribution 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 weightdistribution 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 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. 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.

3.4 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 Sections.
- C. 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 stainless-steel pipe hangers and stainless-steel attachments for hostile environment applications.
- G. Use copper-plated pipe hangers and copper attachments for copper piping and tubing.
- H. Use padded hangers for piping that is subject to scratching.
- I. Use thermal-hanger shield inserts for insulated piping and tubing.
- J. 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 Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steelpipe base stanchion support and cast-iron floor flange or carbon-steel plate.
 - 3. 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.
 - 4. 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.
 - 5. 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.
 - 6. 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.
 - 7. 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.
- K. 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.
- L. 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.
- M. 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. 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 Ibeams for heavy loads.
 - 10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel Ibeams 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. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.
- N. 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.
- O. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.
- P. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.
- Q. Use mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

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. Elastomeric isolation pads.
 - 2. Elastomeric isolation mounts.
 - 3. Restrained elastomeric isolation mounts.
 - 4. Housed-restrained-spring isolators.
 - 5. Elastomeric hangers.
 - 6. Spring hangers.
 - 7. Vibration isolation equipment bases.
- B. Related Requirements:
 - 1. Section 210548.13 "Vibration Controls for Fire Suppression" for devices for firesuppression equipment and systems.
 - 2. Section 220548.13 "Vibration Controls for Plumbing" for devices for plumbing equipment and systems.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 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 vibration isolation device type required.
- B. Shop Drawings:
 - 1. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
 - 2. 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 each vibration isolation device.

- 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
- D. Wind-Restraint Details:
 - 1. Basic Wind Speed: Refer to Arch.
 - 2. Building Classification Category: Refer to Arch.
 - 3. Code recommended wind pressure multiplied by the maximum area of the HVAC component projected on a vertical plane that is normal to the wind direction, and 45 degrees either side of normal.
 - 4. Design Analysis: To support selection and arrangement of **wind** restraints. Include calculations of combined tensile and shear loads.
 - 5.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
- B. Qualification Data: For testing agency.
- C. Welding certificates.
- 1.5 CLOSEOUT SUBMITTALS
 - A. Operation and Maintenance Data: Provide operation and maintenance manuals.
- 1.6 QUALITY ASSURANCE
 - A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code Steel."

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.

- 8. Vibration Isolation.
- 9. Vibration Mountings & Controls, Inc.
- B. Elastomeric Isolation Pads:
 - 1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
 - 2. Size: Factory or field cut to match requirements of supported equipment.
 - 3. Pad Material: Oil and water resistant with elastomeric properties.
 - 4. Surface Pattern: Ribbed or Waffle pattern.
 - 5. Infused nonwoven cotton or synthetic fibers.
 - 6. Load-bearing metal plates adhered to pads.
 - 7. Sandwich-Core Material: Resilient and elastomeric.
 - a. Surface Pattern: Ribbed or Waffle pattern.
 - b. Infused nonwoven cotton or synthetic fibers.
- C. Double-Deflection, Elastomeric Isolation Mounts:
 - 1. Mounting Plates:
 - a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded.
 - b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
 - 2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- D. Restrained Elastomeric Isolation Mounts
 - 1. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
 - a. Housing: Cast-ductile iron or welded steel.
 - b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.
- E. 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 steel plate for bolting to structure with an elastomeric isolator pad attached to the 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. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
 - 1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

- a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
- b. Top plate with threaded mounting holes elastomeric pad.
- c. Internal leveling bolt that acts as blocking during installation.
- 2. Restraint: 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. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
 - 1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
 - 2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.
- H. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
 - 1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-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 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. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
 - 7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
 - 8. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.
- I. Steel Rails: Factory-fabricated, welded, structural-steel rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

- J. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

2.2 VIBRATION ISOLATION EQUIPMENT BASES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Isolation Technology, Inc.
 - 4. Kinetics Noise Control.
 - 5. Mason Industries.
 - 6. Vibration Eliminator Co., Inc.
 - 7. Vibration Isolation.
 - 8. Vibration Mountings & Controls, Inc.
- B. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
 - 1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails.
 - a. Include supports for suction and discharge elbows for pumps.
 - 2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
 - 3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
 - 4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- 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.

3.3 VIBRATION ISOLATION EQUIPMENT BASES 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 Division 03 Sections.

3.4 VIBRATION-CONTROL AND WIND-RESTRAINT DEVICE INSTALLATION

- A. Comply with requirements in Division 07 Section "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.
- B. Install cables so they do not bend across edges of adjacent equipment or building structure.
- C. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.
- 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.

3.5 ADJUSTING

- A. Adjust isolators after piping system is at operating weight.
- B. Adjust active height of spring isolators.

END OF SECTION 230548.13

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. Equipment labels.
 - 2. Warning signs and labels.
 - 3. Pipe labels.
 - 4. Duct labels.
 - 5. Stencils.
 - 6. Warning tags.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- 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.

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. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- 3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- 4. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- 5. Fasteners: Stainless-steel rivets or self-tapping screws.
- 6. 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), and 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) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

- A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction according to ASME A13.1.
- B. 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; also include pipe size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

2.4 DUCT LABELS

- A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
- B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
- C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
- D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the size of principal lettering.
- E. Fasteners: Stainless-steel rivets or self-tapping screws.
- F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.
- G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
 - 1. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.
 - 2. Lettering Size: At least 1-1/2 inches high.

2.5 WARNING TAGS

- A. Description: 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: Safety-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 GENERAL INSTALLATION REQUIREMENTS

- 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.

3.3 EQUIPMENT LABEL INSTALLATION

- A. Install or permanently fasten labels on each major item of mechanical equipment.
- B. Locate equipment labels where accessible and visible.

3.4 PIPE LABEL INSTALLATION

- A. Piping Color Coding: Painting of piping is specified in Division 09 Sections.
- 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, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- C. Pipe Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Near each valve and control device.
 - 2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
 - 3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
 - 4. At access doors, manholes, and similar access points that permit view of concealed piping.
 - 5. Near major equipment items and other points of origination and termination.
 - 6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.

- 7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.
- D. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.
- E. Pipe Label Color Schedule: Coordinate with Owner.

3.5 DUCT LABEL INSTALLATION

- A. Install self-adhesive duct labels with permanent adhesive on air ducts in the following color codes: Coordinate with Owner.
- B. Locate labels near points where ducts enter into and exit from concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or concealed by removable ceiling system.

3.6 WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7 PAINTING

- A. Clarification: In exposed areas (with no acoustic ceiling tiles), piping and piping insulation shall be painted. Although Division 9 may not specifically call for painting of MEP items, it states paint type and requirements for different materials. To extent possible coordinate painting with Division 9 and with Architect. Where adequate specifications are not available, use the following general guidelines:
 - 1. Ferrous Metal: Semi-Gloss, Alkyd-Enamel Finish: 2 finish coats over an enamel undercoat and primer.
 - a. Primer: Quick-drying, rust-inhibitive, alkyd-based or epoxy-metal primer, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.5 mils. S-W: Kem Kromik Universal Metal Primer B50NZ6/B50WZ1.
 - b. Undercoat: Alkyd, interior enamel undercoat or semi-gloss, interior, alkyd-enamel finish coat, as recommended by the manufacturer for this substrate, applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils. S-W: Pro-mar 200 Interior Alkyd Enamel B34W200 Series.
 - c. Finish Coat: Same as undercoat. Semi-gloss, alkyd, interior enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils.
 - 2. ASJ Jacket: Semi-Gloss, Acylic-Enamel Finish: 2 finish coats.
 - a. Undercoat: Semi-gloss acrylic latex enamel applied at spreading rate recommended by manufacturer to achieve a dry film thickness of 2.0 mils. S-W: Pro-Mar Interior Latex Egg-Shell Enamel B20W200.

- b. Finish Coat: Same as undercoat. Semi-gloss, acrylic latex enamel applied at spreading rate recommended by the manufacturer to achieve a total dry film thickness of not less than 1.2 mils
- B. Final colors shall be coordinated with Owner and Architect during construction.

END OF SECTION 230553

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. Third party TAB Contractor shall be contracted by the Prime Contractor. Coordinate activities and assist TAB Contractor as needed.
- B. Section Includes:
 - 1. Balancing Air Systems:
 - a. Constant-volume air systems.
 - 2. Testing, Adjusting, and Balancing Equipment:
 - a. Motors.
 - b. Condensing units.
 - c. Heat-transfer coils.
 - 3. Testing, adjusting, and balancing existing systems and equipment.
 - 4. Duct leakage tests.
 - 5. Control system verification.
 - 6. Other tests as specified.
- 1.3 DEFINITIONS
 - A. AABC: Associated Air Balance Council.
 - B. BAS: Building automation systems.
 - C. TAB: Testing, adjusting, and balancing.
 - D. TABB: Testing, Adjusting, and Balancing Bureau.
 - E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB specialist and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
- B. Certified TAB reports.

- C. Sample report forms.
- D. Instrument calibration reports, to include the following:
 - 1. Instrument type and make.
 - 2. Serial number.
 - 3. Application.
 - 4. Dates of use.
 - 5. Dates of calibration.

1.5 QUALITY ASSURANCE

- A. TAB 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 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 "Air Balancing."
- D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 "System Balancing."

1.6 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.
- 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 operating safety interlocks and controls on HVAC equipment.
- O. 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.

3.2 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.

3.3 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.

3.4 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."

3.5 SENSOR ACCURACY TESTING

- A. Measure accuracy of all sensors (temperature, humidity, dewpoint, pressure, carbon dioxide (CO2), etc.) associated with air conditioning systems and the Building Automation System (BAS).
- B. Provide a written report, separate from and prior to the final TAB report, to include the following:
 - 1. List of each different type of sensor, manufacturer and model, and its accuracy as stated by manufacturer.
 - 2. List of every sensor in the project, identified by room number and associated HVAC unit name.
 - 3. Reading of sensor as measured by TAB, and as simultaneously reported by the BAS and/or other HVAC system, and difference between. (Example format for temperature sensor below.)

| Temperature Sensors | | | |
|---------------------|-----------|-----------|------------|
| | BAS read- | TAB read- | |
| | ing | ing | |
| ID | deg F | deg F | Difference |
| Room 100 / RTU-100 | 72.4 | 72.5 | -0.1 |
| Room 124 / RTU-124 | 72.1 | 71.7 | 0.4 |
| Room 124 / RTU-124 | 73.5 | 71.6 | 1.9 |

4. List observations regarding sensors installation which may impact satisfactory operation of HVAC systems, such as improper location of sensors.

C. At direction of Engineer, BAS and/or HVAC systems providers will be required to replace or calibrate sensors based upon this TAB sensors accuracy report. Subsequent to such replacement and calibration, re-measure accuracy of those sensors which were calibrated or replaced and submit report per directions above.

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 SPACE PRESSURIZATION MEASUREMENTS AND ADJUSTMENTS

- A. Before testing for space pressurization, observe the space to verify the integrity of the space boundaries. Verify that windows and doors are closed and applicable safing, gaskets, and sealants are installed. Report deficiencies and postpone testing until after the reported deficiencies are corrected.
- B. Measure, adjust, and record the pressurization of each room, each zone, and each building by adjusting the supply, return, and exhaust airflows to achieve the indicated conditions.
- C. Measure space pressure differential where pressure is used as the design criteria, and measure airflow differential where differential airflow is used as the design criteria for space pressurization.
 - 1. For pressure measurements, measure and record the pressure difference between the intended spaces at the door with all doors in the space closed. Record the high-pressure side, low-pressure side, and pressure difference between each adjacent space.
 - 2. For applications with cascading levels of space pressurization, begin in the most critical space and work to the least critical space.
 - 3. Test room pressurization first, then zones, and finish with building pressurization.
- D. To achieve indicated pressurization, set the supply airflow to the indicated conditions and adjust the exhaust and return airflow to achieve the indicated pressure or airflow difference.
- E. For spaces with pressurization being monitored and controlled automatically, observe and adjust the controls to achieve the desired set point.
 - 1. Compare the values of the measurements taken to the measured values of the control system instruments and report findings.
 - 2. Check the repeatability of the controls by successive tests designed to temporarily alter the ability to achieve space pressurization. Test overpressurization and underpressurization, and observe and report on the system's ability to revert to the set point.
 - 3. For spaces served by variable-air-volume supply and exhaust systems, measure space pressurization at indicated airflow and minimum airflow conditions.

- F. In spaces that employ multiple modes of operation, such as normal mode and emergency mode or occupied mode and unoccupied mode, measure, adjust, and record data for each operating mode.
- G. Record indicated conditions and corresponding initial and final measurements. Report deficiencies.

3.8 PROCEDURES FOR INDOOR-AIR QUALITY MEASUREMENTS

- A. After air balancing is complete and with HVAC systems operating at indicated conditions, perform indoor-air quality testing.
- B. Observe and record the following conditions for each HVAC system:
 - 1. The distance between the outside-air intake and the closest exhaust fan discharge, flue termination, or vent termination.
 - 2. Specified filters are installed. Check for leakage around filters.
 - 3. Cooling coil drain pans have a positive slope to drain.
 - 4. Cooling coil condensate drain trap maintains an air seal.
 - 5. Evidence of water damage.
 - 6. Insulation in contact with the supply, return, and outside air is dry and clean.

3.9 DUCT LEAKAGE TESTS

- A. Duct leakage testing will be performed by mechanical installation contractor.
- B. Witness the duct pressure testing and provide written report on results immediately thereafter.
 - 1. Verify that proper test methods are used and that leakage rates are within specified tolerances.
 - 2. Report results of all testing and any deficiencies observed. Provide floor plans in report indicating sections of duct tested, and test criterion.

3.10 CONTROLS VERIFICATION

- A. In conjunction with system balancing, perform the following:
 - 1. Verify temperature control system is operating within the design limitations.
 - 2. Verify the operation of lockout or interlock systems.
 - 3. Verify the operation of valve and damper actuators.
 - 4. Verify that controlled devices travel freely and are in position indicated by controller: open, closed, or modulating.
 - 5. Verify location and installation of sensors to ensure that they sense only intended temperature, humidity, or pressure.
 - 6. Verify damper leakage is in accordance with submitted performance and not so excessive that it prevents system operation in accordance with design intent.
 - 7. Confirm that the sequences of operation are in compliance with Contract Documents.

3.11 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.
- B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.12 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 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.

3.13 FINAL REPORT

- A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
 - 1. Report shall be in pdf format where all data in the entire report is searchable. Reports containing PDF scans of paper copies are not acceptable and will be rejected without review.
- B. Report Format:
 - 1. Title page.
 - a. Project name and location.
 - b. Name and address of:
 - 1) TAB specialist.
 - 2) General Contractor.
 - 3) Architect's name and address.
 - 4) Engineer's name and address.
 - 5) General Contractor's name and address.
 - c. Date of report submission.

- 2. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
- 3. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer, certifying validity and accuracy of field data. Include signature of TAB supervisor who certifies the report.
- 4. Include a page summarizing equipment, devices, and systems which cannot be balanced to specified conditions, reasons why they cannot be so balanced, and recommendations for resolving these issues.
- 5. Provide a summary list of every air handler and fan, with a column for its design and actual CFM, and % deviation from design CFM.
- 6. Include a list of instruments used for procedures, along with proof of calibration.
- 7. Certified field-report data.
- 8. List of abbreviations used in report.
- 9. Nomenclature and data sheets for each item of equipment, including manufacturer's name, type, size. Include, at minimum:
 - a. Fan curves.
 - b. Pump curves.
 - c. Manufacturers' test data.
 - d. Field test reports prepared by system and equipment installers.
 - e. Other information relative to equipment performance; do not include Shop Drawings and Product Data.
- C. Final Report Contents: In addition to items listed above, include:
 - 1. Original test report of sensor accuracy testing.
 - 2. Duct leakage test report.
 - 3. Summary of observations on proper drainage of condensate drain pans for every item of equipment having a condensate drainage system.
 - a. Proper pan slope and pan condensate evacuation.
 - b. Adequate condensate trap depth versus static requirement.
 - c. Adequate slope and lack of 'bellies' in condensate pipe drainage system.
 - d. Proper pumped condensate operation.
 - 4. Field observations list of conditions of filters (verify construction filters are removed and final filters are clean) and filter racks.
 - 5. Field measurements and observations regarding leakage of outdoor air and control air dampers.
 - 6. Certified field-report data for each balanced system, including specified versus final performance, notable characteristics of systems, description of system operation sequence if it varies from the Contract Documents
 - 7. Layouts of air and hydronic distribution systems from construction as-built drawings.
 - a. Number all air / water devices and systems referenced in report body.
 - b. Scans of paper drawings are not acceptable. Hand-written notes for numbering devices, duct runs, etc., are permissible, but the basic floor plans and duct / piping layouts, equipment and devices locations, etc., must be from original pdf files.
 - c. Indicate duct, outlet, and inlet sizes, pipe and valve sizes and locations, locations of major equipment items such as air handlers, fans, air terminal units, pumps, etc., balancing stations.

- D. Air-Handling-Unit Test Reports: For air-handling units with coils, 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. Cooling-coil static-pressure differential in inches wg.
 - g. Heating-coil static-pressure differential in inches wg.
 - h. Outdoor airflow in cfm.
 - i. Return airflow in cfm.
 - j. Outdoor-air damper position.
 - k. Return-air damper position.
 - 1. Settings for outdoor-, return-, and exhaust-air dampers.
 - 1) Air handling units / RTU's <u>may</u> be designed to operate with fan varying from high to low speed depending upon compressor operation.
 - 2) For such units, TAB must measure required outside air damper (& return, where applicable) position for intake of design ventilation air not only at full fan speed, but at low fan speed as well. Report results in final TAB report.
 - 3) Convey required damper positions to BAS contractor as soon as they are known, prior to submission of final TAB report.
- E. 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.
 - k. Barometric pressure in psig.
- F. Indoor-Air Quality Measurement Reports for Each HVAC System:
 - 1. HVAC system designation.
 - 2. Date and time of test.
 - 3. Outdoor temperature, relative humidity, wind speed, and wind direction at start of test.
 - 4. Room number or similar description for each location.
 - 5. Measurements at each location.
 - 6. Observed deficiencies.
- G. Instrument Calibration Reports:
 - 1. Report Data:
 - a. Instrument type and make.
 - b. Serial number.
 - c. Application.
 - d. Dates of use.
 - e. Dates of calibration.

3.14 SYSTEMS TO BE BALANCED THIS PROJECT

- A. Systems of this project to receive TAB services (along with related and ancillary items which must be incorporated to achieve balance) include the following:
 - 1. Air distribution systems (ducts, dampers, outlets, etc.)
 - 2. Kitchen hood exhaust and make up air systems.
 - 3. Exhaust fans.
 - 4. Fresh air CFM to match and exceed Exhaust Air CFM.

END OF SECTION 230593

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section includes insulating the following duct services:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, concealed return located in unconditioned space.
- B. Related Sections:
 - 1. Section 230719 "HVAC Piping Insulation."
 - 2. Section 233113 "Metal Ducts" for duct liners.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).
- 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.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified Installer.
- B. Field quality-control reports.

1.5 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.

SECTION 230713 - DUCT INSULATION

- 1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
- 2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.7 COORDINATION

- A. Coordinate sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."
- B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.
- C. Coordinate installation and testing of heat tracing.

1.8 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, and are limited to, the following:
 - 1. Mineral-Fiber Insulation:
 - a. CertainTeed
 - b. Manson.
 - c. Knauf FiberGlass GmbH.
 - d. Owens-Corning Fiberglas Corp.
 - e. Schuller International, Inc.

2.2 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.

SECTION 230713 - DUCT INSULATION

- 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 II for sheet materials.
- 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. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

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. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- 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. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

- A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.
 - 1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
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. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fireresistant lagging cloths over duct insulation.
 - 3. Service Temperature Range: 0 to plus 180 deg F.
 - 4. Color: White.

2.6 SEALANTS

- A. FSK and Metal Jacket Flashing Sealants:
 - 1. Materials shall be compatible with insulation materials, jackets, and substrates.
 - 2. Fire- and water-resistant, flexible, elastomeric sealant.
 - 3. Service Temperature Range: Minus 40 to plus 250 deg F.
 - 4. Color: Aluminum.
 - 5. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 6. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

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. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.8 FIELD-APPLIED JACKETS

- A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
- B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

2.9 TAPES

- A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.
 - 1. Width: 4 inches.
 - 2. Thickness: 6.5 mils.
 - 3. Adhesion: 90 ounces force/inch in width.
 - 4. Elongation: 2 percent.
 - 5. Tensile Strength: 40 lbf/inch in width.

6. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

2.10 SECUREMENTS

- A. Bands:
 - 1. Stainless Steel: ASTM A 167 or ASTM A 240/A 240M, Type 304 or Type 316; 0.015 inch thick, 3/4 inch wide.
- B. Insulation Pins and Hangers:
 - 1. Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated.
 - 2. 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. 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: 0.062-inch soft-annealed, stainless steel.

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 Roof Penetrations: Install insulation continuously through roof penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
 - 4. Seal jacket to roof flashing with flashing sealant.
- B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
 - 1. Seal penetrations with flashing sealant.
 - 2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
 - 3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
 - 4. Seal jacket to wall flashing with flashing sealant.
- C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.
- D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.
 - 1. Comply with requirements in Section 078413 "Penetration Firestopping" and fire-resistive joint sealers.
- E. Insulation Installation at Floor Penetrations:
 - 1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
 - 2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.5 INSTALLATION OF 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, capacitordischarge-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 vaporbarrier 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.

3.6 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; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. 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 o.c. and at end joints.

3.7 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.
 - 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. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.
- C. Do not field paint aluminum or stainless-steel jackets.

3.8 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.
- C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

- A. Plenums and Ducts Requiring Insulation:
 - 1. Indoor, concealed supply and outdoor air.
 - 2. Indoor, exposed supply and outdoor air.
 - 3. Indoor, concealed return located in unconditioned space.
 - 4. Indoor, exposed return located in unconditioned space.
 - 5. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
 - 6. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
 - 7. Outdoor, concealed supply and return.
 - 8. Outdoor, exposed supply and return.
- B. Items Not Insulated:
 - 1. Fibrous-glass ducts.
 - 2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
 - 3. Factory-insulated flexible ducts.
 - 4. Factory-insulated plenums and casings.
 - 5. Flexible connectors.
 - 6. Vibration-control devices.
 - 7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

- A. Service: Round & rectangular, supply-air ducts concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 3 inches (R-8 min).
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- B. Service: Round & rectangular, return, outside-air and fume hood exhaust ducts concealed.
 - 1. Material: Mineral-fiber blanket.
 - 2. Thickness: 2 inches (R-6 min).
 - 3. Number of Layers: One.
 - 4. Field-Applied Jacket: Foil and paper.
 - 5. Vapor Retarder Required: Yes.
- C. Service: Round supply, make-up, and outside-air ducts, exposed in conditioned space.

- 1. Double wall, with 2" insulation thickness, and painted.
- D. Service: Return air duct, exposed in conditioned space: No insulation. Paint duct.
- E. Service: Ten feet of supply and return air ducts closest to AHU or FCU.
 - 1. Material: In addition to exterior wrap, provide internal liner for sound attenuation purposes.
 - 2. Thickness: 1 inches.
- F. Service: Ten feet of exhaust air duct closest to where duct penetrates the exterior envelope.
 - 1. Material: Exterior wrap.
 - 2. Thickness: 2 inches.
- G. Where ductwork is not completely concealed, paint all ductwork and insulation. Coordinate color and finish with Architect.

END OF SECTION 230713

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 control sequences for HVAC systems, subsystems, and equipment. Provide controls and operating sequences for the following HVAC systems at the <u>Idea Public</u> <u>School, Head Quarters Facility, Kitchen Renovations</u>:
 - 1. Retain sequences for all existing equipment, unless noted otherwise.
 - 2. Exhaust fan start/stop and status for Kitchen Hood fans.
 - 3. Ventilation sequences for AHUs 7, 8, 9 using building pressurization sensors.
- B. <u>**Prior to bidding**</u>, Controls contractor (JCI) shall notify general, mechanical and electrical contractor of any work required for operational installation of controls devices that will not be conducted by Controls Contractor. This includes, but is not limited to: installation of controls devices in piping (sensors, valves, taps), electrical equipment (VFD), as well as any needs for power wiring and/or conduit.

1.3 GENERAL CONTROL SEQUENCES

- A. A list of the minimum number and type of control points required is given as a general guideline, and is not all inclusive. Provide any additional points, sensors, gateways, interface cards, etc. as required to achieve sequences, whether specifically called for in Points List or not.
- B. Provide all hardware, software, and labor required to achieve specified sequences.

1.4 VENTILATION SEQUENCES

- A. Design Intent:
 - 1. The Training Building has several exhaust air systems with high exhaust airflow CFM. Fans operate at different schedules when kitchens are in operation. The design intent is to keep building pressurization positive by introducing adequate OA flow into the building via the existing AHUs 7, 8, 9.
 - a. Provide a building pressurization sensor to measure differential pressure at the Cafeteria. Initial setpoint shall be 0.05" (adj).
 - 2. AHU 8 serving Cafeteria and AHU 9 serving Kitchen: Constant Volume Fresh Air Ventilation
 - a. Disable CO2 based demand-controlled ventilation sequences, and configure units to bring in constant volume of OA when unit is commanded ON.

- b. Coordinate modulation of OA and RA damper positions with TAB at different fan VFD speeds (minimum, 50%, 75%, maximum fan speed), such that scheduled OA CFM is drawn during the full range of fan speeds.
- c. When Kitchen Hood Fans are enabled, ensure that these AHUs are enabled, and open OA dampers to bring in scheduled fresh air volume.
- 3. AHU 7 serving training rooms: Ventilation Sequence
 - a. When Kitchen Hood fans are OFF, AHU 7 shall utilize existing sequences with CO2 based Demand-Controlled Ventilation.
 - b. When Kitchen Hood exhaust fans are ON, disable DCV sequences. Unit shall bring in the design scheduled OA CFM. Sequentially modulate OA open, and RA closed, as needed to meet the building pressurization setpoint.
- B. Alarms:
 - 1. Issue alarm if the building pressurization setpoint is not being met. Send alarm to a designated cell phone.

1.5 OTHER SEQUENCES

- A. Alarms: System shall issue alarm at COS upon failure of fan or failure to achieve setpoint within specified time (15 min. adj.)
- B. Provide up to 8 hours of programming to account for additional control sequences and finetuning above sequences, during the course of the project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Pipes, tubes, and fittings.
 - 2. Piping specialties.
 - 3. Piping and tubing joining materials.

1.3 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.

1.4 PERFORMANCE REQUIREMENTS

- A. Minimum Operating-Pressure Ratings:
 - 1. Piping and Valves: **100 psig** minimum unless otherwise indicated.
 - 2. Service Regulators: 65 psig minimum unless otherwise indicated.
 - 3. Minimum Operating Pressure of Service Meter: **5 psig**.
- B. Natural-Gas System Pressures: Two pressure ranges. Primary pressure is more than 2 psig but not more than 10 psig, and is reduced to secondary pressure of more than 0.5 psig but not more than 2 psig. Verify pressures on site and with equipment and appliances.
- C. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.5 SUBMITTALS

A. Product Data: For each type of the following:1. Piping specialties.

- 2. Corrugated, stainless-steel tubing with associated components.
- 3. Valves. Include pressure rating, capacity, settings, and electrical connection data of selected models.
- 4. Pressure regulators. Indicate pressure ratings and capacities.
- 5. Dielectric fittings.
- B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.
 - 1. Detail mounting, supports, and valve arrangements for pressure regulator assembly.
- C. Coordination Drawings: Plans and details, drawn to scale, on which natural-gas piping is shown and coordinated with other installations, using input from installers of the items involved.
- D. Site Survey: Plans, drawn to scale, on which natural-gas piping is shown and coordinated with other services and utilities.
- E. Qualification Data: For qualified professional engineer.
- F. Welding certificates.
- G. Field quality-control reports.
- H. Operation and Maintenance Data: For **pressure regulators** to include in emergency, operation, and maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Steel Support 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.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Handling Flammable Liquids: Remove and dispose of liquids from existing natural-gas piping according to requirements of authorities having jurisdiction.
- B. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and to prevent entrance of dirt, debris, and moisture.
- C. Store and handle pipes and tubes having factory-applied protective coatings to avoid damaging coating, and protect from direct sunlight.

D. Protect stored PE pipes and valves from direct sunlight.

1.8 PROJECT CONDITIONS

- A. Perform site survey, research public utility records, and verify existing utility locations. Contact utility-locating service for area where Project is located.
- B. Interruption of Existing Natural-Gas Service: Do not interrupt natural-gas service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide purging and startup of natural-gas supply according to requirements indicated:
 - 1. Notify **Architect** no fewer than seven days in advance of proposed interruption of natural-gas service.
 - 2. Do not proceed with interruption of natural-gas service without **Architect's** written permission.

1.9 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate requirements for access panels and doors for valves installed concealed behind finished surfaces. Comply with requirements in Division 08 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

- A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
 - 2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
 - 3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
 - 4. Forged-Steel Flanges and Flanged Fittings: ASME B16.5, minimum Class 150, including bolts, nuts, and gaskets of the following material group, end connections, and facings:
 - a. Material Group: 1.1.
 - b. End Connections: Threaded or butt welding to match pipe.
 - c. Lapped Face: Not permitted underground.
 - d. Gasket Materials: ASME B16.20, metallic, flat, asbestos free, aluminum o-rings, and spiral-wound metal gaskets.
 - e. Bolts and Nuts: ASME B18.2.1, carbon steel aboveground and stainless steel underground.
 - 5. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

- a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.
- 6. Mechanical Couplings:
 - a. **Steel** flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.
 - c. **Steel** bolts, washers, and nuts.
 - d. Coupling shall be capable of joining PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe to steel pipe.
 - e. Steel body couplings installed underground on plastic pipe shall be factory equipped with anode.
- B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.
 - 1. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - 2. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 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.
 - 3. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - 4. Striker Plates: Steel, designed to protect tubing from penetrations.
 - 5. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
- C. PE Pipe: ASTM D 2513, SDR 11.
 - 1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
 - 2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
 - 3. Transition Service-Line Risers: Factory fabricated and leak tested.
 - a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
 - b. Outlet shall be threaded or flanged or suitable for welded connection.
 - c. Bridging sleeve over mechanical coupling.
 - d. Factory-connected anode.
 - e. Tracer wire connection.
 - f. Ultraviolet shield.
 - g. Stake supports with factory finish to match steel pipe casing or carrier pipe.
 - 4. Steel Mechanical Couplings: Capable of joining plain-end PE pipe to PE pipe, steel pipe to PE pipe, or steel pipe.
 - a. **Steel** flanges and tube with epoxy finish.
 - b. Buna-nitrile seals.

- c. **Steel** bolts, washers, and nuts.
- d. Factory-installed anode for steel-body couplings installed underground.

2.2 PIPING SPECIALTIES

- A. Appliance Flexible Connectors:
 - 1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
 - 2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
 - 3. Corrugated stainless-steel tubing with polymer coating.
 - 4. Operating-Pressure Rating: 0.5 psig.
 - 5. End Fittings: Zinc-coated steel.
 - 6. Threaded Ends: Comply with ASME B1.20.1.
 - 7. Maximum Length: 72 inches.
- B. Quick-Disconnect Devices: Comply with ANSI Z21.41.
 - 1. Copper-alloy convenience outlet and matching plug connector.
 - 2. Nitrile seals.
 - 3. Hand operated with automatic shutoff when disconnected.
 - 4. For indoor or outdoor applications.
 - 5. Adjustable, retractable restraining cable.
- C. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

- A. Joint Compound and Tape: Suitable for natural gas.
- B. 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.
- C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8 /A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

- A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.
- B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.
 - 1. CWP Rating: **125 psig**.
 - 2. Threaded Ends: Comply with ASME B1.20.1.
 - 3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
 - 4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.

- 5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
- 6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.
- C. General Requirements for Metallic Valves, NPS 2-1/2 and Larger: Comply with ASME B16.38.
 - 1. CWP Rating: **125 psig**
 - 2. Flanged Ends: Comply with ASME B16.5 for steel flanges.
 - 3. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Service Mark: Initials "WOG" shall be permanently marked on valve body.
- D. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.
 - 1. Body: Bronze, complying with ASTM B 584.
 - 2. Ball: Chrome-plated bronze.
 - 3. Stem: Bronze; blowout proof.
 - 4. Seats: Reinforced TFE.
 - 5. Packing: Threaded-body packnut design with adjustable-stem packing.
 - 6. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 7. CWP Rating: 600 psig.
 - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- E. Bronze Plug Valves: MSS SP-78.
 - 1. Body: Bronze, complying with ASTM B 584.
 - 2. Plug: Bronze.
 - 3. Ends: Threaded, socket, or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 4. Operator: Square head or lug type with tamperproof feature where indicated.
 - 5. Pressure Class: 125 psig.
 - 6. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 7. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- F. Cast-Iron, Nonlubricated Plug Valves: MSS SP-78.
 - 1. Body: Cast iron, complying with ASTM A 126, Class B.
 - 2. Plug: Bronze or nickel-plated cast iron.
 - 3. Seat: Coated with thermoplastic.
 - 4. Stem Seal: Compatible with natural gas.
 - 5. Ends: Threaded or flanged as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
 - 6. Operator: Square head or lug type with tamperproof feature where indicated.
 - 7. Pressure Class: 125 psig.
 - 8. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
 - 9. Service: Suitable for natural-gas service with "WOG" indicated on valve body.
- G. PE Ball Valves: Comply with ASME B16.40.

- 1. Body: PE.
- 2. Ball: PE.
- 3. Stem: Acetal.
- 4. Seats and Seals: Nitrile.
- 5. Ends: Plain or fusible to match piping.
- 6. CWP Rating: **80 psig**
- 7. Operator: Nut or flat head for key operation.
- 8. Include plastic valve extension.

H. Valve Boxes:

- 1. Cast-iron, two-section box.
- 2. Top section with cover with "GAS" lettering.
- 3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
- 4. Adjustable cast-iron extensions of length required for depth of bury.
- 5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 PRESSURE REGULATORS

- A. General Requirements:
 - 1. Single stage and suitable for natural gas.
 - 2. Steel jacket and corrosion-resistant components.
 - 3. Elevation compensator.
 - 4. End Connections: Threaded for regulators NPS 2 and smaller; flanged for regulators NPS 2-1/2 and larger.
- B. Line Pressure Regulators: Comply with ANSI Z21.80.
 - 1. Body and Diaphragm Case: Cast iron or die-cast aluminum.
 - 2. Springs: Zinc-plated steel; interchangeable.
 - 3. Diaphragm Plate: Zinc-plated steel.
 - 4. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
 - 5. Orifice: Aluminum; interchangeable.
 - 6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 7. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.
 - 8. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
 - 9. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
 - 10. Maximum Inlet Pressure: **10 psig**.
- C. Appliance Pressure Regulators: Comply with ANSI Z21.18.
 - 1. Body and Diaphragm Case: Die-cast aluminum.
 - 2. Springs: Zinc-plated steel; interchangeable.
 - 3. Diaphragm Plate: Zinc-plated steel.
 - 4. Seat Disc: Nitrile rubber.
 - 5. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
 - 6. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.

7. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.

2.6 DIELECTRIC FITTINGS

- A. Dielectric Unions:
 - 1. Minimum Operating-Pressure Rating: **150 psig**.
 - 2. Combination fitting of copper alloy and ferrous materials.
 - 3. Insulating materials suitable for natural gas.
 - 4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- B. Dielectric Flanges:
 - 1. Minimum Operating-Pressure Rating: **150 psig**.
 - 2. Combination fitting of copper alloy and ferrous materials.
 - 3. Insulating materials suitable for natural gas.
 - 4. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.
- C. Dielectric-Flange Kits:
 - 1. Minimum Operating-Pressure Rating: 150 psig
 - 2. Companion-flange assembly for field assembly.
 - 3. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or PE bolt sleeves, phenolic washers, and steel backing washers.
 - 4. Insulating materials suitable for natural gas.
 - 5. Combination fitting of copper alloy and ferrous materials with threaded, brazed-joint, plain, or welded end connections that match piping system materials.

2.7 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for natural-gas piping system to verify actual locations of piping connections before equipment installation.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Close equipment shutoff valves before turning off natural gas to premises or piping section.
- B. Inspect natural-gas piping according to NFPA 54 and the International Fuel Gas Code to determine that natural-gas utilization devices are turned off in piping section affected.
- C. Comply with NFPA 54, and the International Fuel Gas Code requirements for prevention of accidental ignition.

3.3 OUTDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Division 31 Section "Earth Moving" for excavating, trenching, and backfilling.
 - 1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.
- C. Install underground, PE, natural-gas piping according to ASTM D 2774.
- D. Steel Piping with Protective Coating:
 - 1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
 - 2. Replace pipe having damaged PE coating with new pipe.
- E. Install fittings for changes in direction and branch connections.

3.4 INDOOR PIPING INSTALLATION

- A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.
- B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are 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.
- C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.
- D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.
- E. 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.

- F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.
- G. Locate valves for easy access.
- H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.
- I. Install piping free of sags and bends.
- J. Install fittings for changes in direction and branch connections.
- K. Verify final equipment locations for roughing-in.
- L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.
- M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.
 - 1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.
- N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.
- O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.
- P. Concealed Location Installations: Except as specified below, install concealed natural-gas piping and piping installed under the building in containment conduit constructed of steel pipe with welded joints as described in Part 2. Install a vent pipe from containment conduit to outdoors and terminate with weatherproof vent cap.
 - 1. In Floors: Install natural-gas piping with welded or brazed joints and protective coating in cast-in-place concrete floors. Cover piping to be cast in concrete slabs with minimum of 1-1/2 inches of concrete. Piping may not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Do not embed piping in concrete slabs containing quick-set additives or cinder aggregate.
 - 2. In Walls or Partitions: Protect tubing installed inside partitions or hollow walls from physical damage using steel striker barriers at rigid supports.
 - a. Exception: Tubing passing through partitions or walls does not require striker barriers.
 - 3. Prohibited Locations:
 - a. Do not install natural-gas piping in or through circulating air ducts, clothes or trash chutes, chimneys or gas vents (flues), ventilating ducts, or dumbwaiter or elevator shafts.
 - b. Do not install natural-gas piping in solid walls or partitions.

- Q. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.
- R. Connect branch piping from top or side of horizontal piping.
- S. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment. Unions are not required at flanged connections.
- T. Do not use natural-gas piping as grounding electrode.
- U. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.
- V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Division 23 Section "Sleeves and Sleeve Seals for HVAC Piping."
- X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Division 23 Section "Escutcheons for HVAC Piping."

3.5 VALVE INSTALLATION

- A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing, aluminum, or copper connector.
- B. Install underground valves with valve boxes.
- C. Install regulators and overpressure protection devices where required and with maintenance access space adequate for servicing and testing.
- D. Install anode for metallic valves in underground PE piping.

3.6 PIPING JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints:
 - 1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
 - 2. Cut threads full and clean using sharp dies.
 - 3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
 - 4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.

- 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. Welded Joints:
 - 1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
 - 2. Bevel plain ends of steel pipe.
 - 3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.
- E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.
- F. Flanged Joints: Install gasket material, size, type, and thickness appropriate for natural-gas service. Install gasket concentrically positioned.
- G. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.7 HANGER AND SUPPORT INSTALLATION

- A. Comply with requirements for pipe hangers and supports specified in Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."
- B. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:
 - 1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
 - 2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
 - 4. NPS 2-1/2 to NPS 3-1/2: Maximum span, 10 feet; minimum rod size, 1/2 inch.
 - 5. NPS 4and Larger: Maximum span, 10 feet; minimum rod size, 5/8 inch.

3.8 CONNECTIONS

- A. Connect to gas main according to utility's procedures and requirements.
- B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.
- C. Install piping adjacent to appliances to allow service and maintenance of appliances.

- D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inchesof each gas-fired appliance and equipment. Install union between valve and appliances or equipment.
- E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.9 LABELING AND IDENTIFYING

A. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 PAINTING

- A. Comply with requirements in Division 09 painting Sections for painting interior and exterior natural-gas piping.
- B. Paint exposed, exterior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Alkyd System: MPI EXT 5.1D.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Exterior alkyd enamel matching topcoat.
 - c. Topcoat: Exterior alkyd enamel.
 - d. Color: Coordinate with Owner.
- C. Paint exposed, interior metal piping, valves, service regulators, service meters and meter bars, earthquake valves, and piping specialties, except components, with factory-applied paint or protective coating.
 - 1. Latex Over Alkyd Primer System: MPI INT 5.1Q.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior latex matching topcoat.
 - c. Topcoat: Interior latex.
 - d. Color: Coordinate with Owner.
 - 2. Alkyd System: MPI INT 5.1E.
 - a. Prime Coat: Alkyd anticorrosive metal primer.
 - b. Intermediate Coat: Interior alkyd matching topcoat.
 - c. Topcoat: Interior alkyd.
 - d. Color: Coordinate with Owner.
- D. Damage and Touchup: Repair marred and damaged factory-applied finishes with materials and by procedures to match original factory finish.

SECTION 231123 - FACILITY NATURAL-GAS PIPING

3.11 CONCRETE BASES

- A. Concrete Bases: Anchor equipment to concrete base.
 - 1. Construct concrete bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on **18-inch**centers around the full perimeter of the base.
 - 3. Install epoxy-coated anchor bolts for supported equipment that extend through concrete base, and anchor into structural concrete floor.
 - 4. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 5. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 6. Use **3000-psig**, 28-day, compressive-strength concrete and reinforcement.]

3.12 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.
- C. Natural-gas piping will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.

3.13 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain earthquake valves.

3.14 OUTDOOR PIPING SCHEDULE

- A. Underground natural-gas piping shall be the following:
 - 1. PE pipe and fittings joined by heat fusion, or mechanical couplings; service-line risers with tracer wire terminated in an accessible location.
- B. Aboveground natural-gas piping shall be the following:1. Steel pipe with malleable-iron fittings and threaded joints.
- C. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.15 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES LESS THAN 0.5 PSIG

- A. Aboveground, branch piping **NPS 1** and smaller shall be the following:
 - 1. Steel pipe with malleable-iron fittings and threaded joints.

- B. Aboveground, distribution piping shall be the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
- C. Underground, below building, piping shall be the following:1. Steel pipe with malleable-iron fittings and threaded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.16 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 0.5 PSIG AND LESS THAN 5 PSIG

- A. Aboveground, branch piping NPS 1 and smaller shall be the following:
 1. Steel pipe with malleable-iron fittings and threaded joints.
- B. Aboveground, distribution piping shall be the following:1. Steel pipe with malleable-iron fittings and threaded joints.
- C. Underground, below building, piping shall be the following:1. Steel pipe with malleable-iron fittings and threaded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat underground pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.17 INDOOR PIPING SCHEDULE FOR SYSTEM PRESSURES MORE THAN 5 PSIG

- A. Aboveground, Branch Piping: Steel pipe with steel welding fittings and welded joints.
- B. Aboveground, distribution piping shall be the following:1. Steel pipe with steel welding fittings and welded joints.
- C. Underground, below building, piping shall be the following:1. Steel pipe with malleable-iron fittings and threaded joints.
- D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
- E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.18 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.
- B. Underground:
 - 1. PE valves.
 - 2. NPS 2 and Smaller: Bronze plug valves.
 - 3. NPS 2-1/2 and Larger: Cast-iron, plug valves.

3.19 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

- A. Valves for pipe sizes NPS 2 and smaller shall be Bronze plug valve.
- B. Valves for pipe sizes NPS 2-1/2 and larger shall Cast-iron plug valve.

END OF SECTION 231123

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. Section Includes:
 - 1. Single-wall rectangular ducts and fittings.
 - 2. Single-wall, spiral-seam, round ducts and fittings.
 - 3. Double-wall, round and flat-oval spiral-seam ducts and formed fittings.
 - 4. Sheet metal materials.
 - 5. Duct liner.
 - 6. Sealants and gaskets.
 - 7. Hangers and supports.
 - 8. Kitchen hood exhaust grease duct, dishwasher hood duct.
- B. Related Sections:
 - 1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
 - 2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, ductmounting access doors and panels, turning vanes, and flexible ducts.
 - 3. Section 233813 "Commercial Kitchen Hoods".

1.3 PERFORMANCE REQUIREMENTS

- A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.
- B. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards Metal and Flexible"
- C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- D. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by Architect. Accompany requests for layout modifications with calculations showing that proposed layout will provide original design results without increasing system total pressure.

SECTION 233113 - METAL DUCTS

E. Kitchen exhaust duct shall be pre-fabricated, double wall grease duct according to this specification.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of the following products:
 - 1. Liners and adhesives.
 - 2. Sealants and gaskets.
 - 3. Fire-Stopping Materials.
- 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 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.

1.5 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.
- C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 "Systems and Equipment" and Section 7 "Construction and System Start-up."
- D. 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, ductsupport 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."

SECTION 233113 - METAL DUCTS

2.2 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. Round, Spiral Lock-Seam Ducts.
- B. 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:
 - a. Lindab Inc.
 - b. McGill AirFlow LLC.
 - c. SEMCO Incorporated.
 - d. Sheet Metal Connectors, Inc.
 - e. Spiral Manufacturing Co., Inc.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).
- D. Duct Joints:
 - 1. Ducts up to 20 Inches in Diameter: Interior, center-beaded slip coupling, sealed before and after fastening, attached with sheet metal screws.
 - 2. Ducts 21 to 72 Inchesin Diameter: Three-piece, gasketed, flanged joint consisting of two internal flanges with sealant and one external closure band with gasket.
 - 3. Round Ducts: Prefabricated connection system consisting of double-lipped, EPDM rubber gasket. Manufacture ducts according to connection system manufacturer's tolerances.
 - a. Manufacturers:
 - 1) Ductmate Industries, Inc.
 - 2) Lindab Inc.
- E. 90-Degree Tees and Laterals and Conical Tees: Fabricate to comply with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," with metal thicknesses specified for longitudinal-seam straight ducts.
- F. Diverging-Flow Fittings: Fabricate with reduced entrance to branch taps and with no excess material projecting from fitting onto branch tap entrance.
- G. Fabricate elbows using die-formed, gored, pleated, or mitered construction. Unless elbow construction type is indicated, fabricate elbows as follows:
 - 1. Mitered-Elbow Radius and Number of Pieces: Welded construction complying with SMACNA's "HVAC Duct Construction Standards--Metal and Flexible," unless otherwise indicated.
 - 2. Round Mitered Elbows with Aerofoil Vanes: Welded construction with the following metal thickness for pressure classes from minus 2- to plus 2-inch wg:
 - a. Ducts 3 to 36 Inches in Diameter: 0.034 inch.
 - b. Ducts 37 to 50 Inches in Diameter: 0.040 inch.
 - 3. 90-Degree, 2-Piece, Mitered Elbows: Use only for supply systems or for materialhandling Class A or B exhaust systems and only where space restrictions do not permit using radius elbows. Fabricate with single-thickness turning vanes.
 - 4. Round Elbows 8 Inchesand Less in Diameter: Fabricate die-formed elbows for 45- and 90-degree elbows and pleated elbows for 30, 45, 60, and 90 degrees only. Fabricate

nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.

- 5. Round Elbows 9 through 14 Inchesin Diameter: Fabricate gored or pleated elbows for 30, 45, 60, and 90 degrees unless space restrictions require mitered elbows. Fabricate nonstandard bend-angle configurations or nonstandard diameter elbows with gored construction.
- 6. Round Elbows Larger than 14 Inches in Diameter and All Flat-Oval Elbows: Fabricate gored elbows unless space restrictions require mitered elbows.
- 7. Die-Formed Elbows for Sizes through 8 Inches in Diameter and All Pressures 0.040 inch thick with 2-piece welded construction.
- 8. Round Gored-Elbow Metal Thickness: Same as non-elbow fittings specified above.
- 9. Pleated Elbows for Sizes through 14 Inches in Diameter and Pressures through 10-Inch wg: 0.022 inch.

2.3 DOUBLE-WALL ROUND AND FLAT-OVAL DUCTS AND FITTINGS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. Lindab Inc.
 - 2. <u>McGill AirFlow LLC</u>.
 - 3. <u>SEMCO Incorporated</u>.
- B. Ducts: Prefabricated double-wall (insulated) ducts with an outer shell and an inner duct. Dimensions indicated are for inner ducts.
- C. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension) of the inner duct.
- D. 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."
 - 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."

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1.

- E. Inner Duct: Minimum 0.028-inch solid sheet steel.
- F. Fittings: Fabricate double-wall (insulated) fittings with an outer shell and an inner duct.
 - Solid Inner Ducts: Use the following sheet metal thicknesses:
 - a. Ducts 3 to 34 Inches in Diameter: 0.028 inch.
 - b. Ducts 35 to 58 Inches in Diameter: 0.034 inch.
 - c. Ducts 60 to 88 Inches in Diameter: 0.040 inch.
- G. 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: 0.26 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. Terminate insulation where double-wall duct connects to single-wall externally insulated duct, and reduce outer shell diameter to inner duct diameter.
 - 4. Coat insulation with antimicrobial coating.
 - 5. Cover insulation with polyester film complying with UL 181, Class 1.
 - 6. Supply and Make-Up Air Ducts: **2 inches** thick.
 - 7. **Painted for indoor application.** Coordinate final finish with architect.

2.4 SHEET METAL MATERIALS

- A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.
- B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 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. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.
- 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.

2.5 DUCT LINER

1.

- A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
 - Manufacturers:
 - a. Owens Corning's Aeroflex Plus Duct Liner or Equal.
 - 2. Materials: ASTM C 1071; surfaces exposed to airstream shall be coated to prevent erosion of glass fibers.
 - a. Maximum Thermal Conductivity:
 - b. Thickness: 1 inch for sound attenuation, and R8 for thermal insulation.
 - c. Thermal Conductivity (k-Value): 0.26 at 75 deg Fmean temperature.
 - d. Fire-Hazard Classification: Maximum flame-spread index of 25 and smokedeveloped index of 50 when tested according to ASTM E84.
 - e. Water-Based Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B. 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).
 - f. Mechanical Fasteners: Galvanized steel suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in duct.
 - 1) Tensile Strength: Indefinitely sustain a 50-lb-tensile, dead-load test perpendicular to duct wall.
 - 2) Fastener Pin Length: As required for thickness of insulation and without projecting more than 1/8 inch into airstream.
 - 3) Adhesive for Attaching Mechanical Fasteners: Comply with fire-hazard classification of duct liner system.
 - 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.

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: 4 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.
- 10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- 11. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- 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. Flanged Joint Sealant: Comply with ASTM C 920.
 - 1. General: Single-component, acid-curing, silicone, elastomeric.
 - 2. Type: S.
 - 3. Grade: NS.
 - 4. Class: 25.
 - 5. Use: O.
 - 6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 - 7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.
- F. Round Duct Joint O-Ring Seals:
 - 1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-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 FIRE-STOPPING

- A. Fire-Resistant Sealant: Provide two-part, foamed-in-place, fire-stopping silicone sealant, onepart elastomeric sealant, formulated for use in a through-penetration fire-stop system for filling openings around duct penetrations through walls and floors, having fire-resistance ratings indicated as established by testing identical assemblies per ASTM E 814 by Underwriters Laboratory, Inc. or other testing and inspecting agency acceptable to authorities having jurisdiction.
- B. Products: Subject to compliance with requirements, products that may be incorporated in the Work are limited to, the following:
 - 1. "Dow Corning Fire Stop Foam"; Dow Corning Corp.
 - 2. "Dow Corning Fire Stop Sealant"; Dow Corning Corp.
 - 3. "3M Fire Barrier Caulk CP-25"; Electrical Products Div./3M.
- C. Seams and laps arranged on top of duct.

2.9 INSULATED, PRE-FABRICATED GREASE DUCT (KITCHEN HOOD EXHAUST DUCT)

A. See Section 233533 Listed Kitchen Ventilation System Exhaust Ducts.

2.9 STAINLESS STEEL DUCT (DISHWASHER EXHAUST DUCT)

- A. Construction, installation and testing shall be per applicable codes.
- B. Dishwasher Hood Exhaust Ducts:
 - 1. Type 304, stainless steel with finish to match kitchen equipment and range hood.
 - 2. Rated for transportation of steam and heat laden vapors from commercial dishwashing operation.
 - 3. Weld and flange seams and joints. Seams and laps arranged on top of duct.

- 4. Include all supports, roof penetrations, fan adapters, square-to-round transitions, hood connectors, drain fittings and expansion joints required to install duct.
- 5. Roof penetration pieces shall be UL listed products. Where roof is pitched (up to 12:12), roof penetration pieces shall be of the pitched type so that it is not necessary to provide a horizontal roof curb.
- 6. Comply with NFPA 96.

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 and flat-oval 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 Section 233300 "Air Duct Accessories" for fire and smoke dampers.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."
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3.2 INSTALLATION OF EXPOSED DUCTWORK

- A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.
- B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.
- C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.
- D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.
- E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DISHWASHER EXHAUST DUCTS, SPECIAL INSTALLATION REQUIREMENTS

- A. Install ducts to allow for thermal expansion through temperature range.
- B. Install ducts without dips or traps that may collect residues unless traps have continuous or automatic residue removal.
- C. Install access openings at each change in direction and at intervals defined by NFPA 96; locate on sides of duct a minimum of 1-1/2 inches from bottom; and fit with air-tight covers of same material as duct.

3.4 APPLICATION OF LINER IN RECTANGULAR DUCTS

- A. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
- B. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
- C. Butt transverse joints without gaps and coat joint with adhesive.
- D. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
- E. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and standard liner product dimensions make longitudinal joints necessary.
- F. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
- G. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.

- H. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
 - 1. Fan discharges.
 - 2. Intervals of lined duct preceding unlined duct.
 - 3. Upstream edges of transverse joints in ducts where air velocities are greater than 2500 fpm or where indicated.
- I. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

3.5 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", and as defined below.
 - 1. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible."
 - 2. All Ducts U.N.O: Seal Class A.
 - 3. Unconditioned Space, Return-Air Ducts: Seal Class B.
 - 4. Conditioned Space, Return-Air Ducts: Seal Class C.

3.6 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. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
- 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.

3.7 CONNECTIONS

- A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.8 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 Sections.

3.9 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Leakage Tests:
 - 1. <u>Comply with requirements for Leakage Class A for sealing all ducts.</u> Refer to SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
 - 2. Test the following systems:
 - a. Supply, Return, Exhaust, Outdoor Ducts with a Pressure Class of 2-Inch wg or Higher: Test representative duct sections, selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
 - b. Engineer will randomly designate two supply duct systems for testing in accordance with Section 4 of SMACNA HVAC Air Duct Leakage Test Manual, current edition. If leakage test results exceed SMACNA allowable leakage rates, then additional two systems shall be tested. Supply duct test section shall include main trunk line from the mechanical room to the farthest VAV box. For systems without VAV boxes, main trunk shall be determined on site
 - 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.

3.10 DUCT CLEANING

- A. Clean new and existing duct system(s) before testing, adjusting, and balancing.
- B. Use service openings for entry and inspection.
 - 1. Create new openings and install access panels appropriate for duct static-pressure class if required for cleaning access. Provide insulated panels for insulated or lined duct. Patch insulation and liner as recommended by duct liner manufacturer. Comply with Section 233300 "Air Duct Accessories" for access panels and doors.
 - 2. Disconnect and reconnect flexible ducts as needed for cleaning and inspection.
 - 3. Remove and reinstall ceiling to gain access during the cleaning process.
- C. Particulate Collection and Odor Control:
 - 1. When venting vacuuming system inside the building, use HEPA filtration with 99.97 percent collection efficiency for 0.3-micron-size (or larger) particles.
 - 2. When venting vacuuming system to outdoors, use filter to collect debris removed from HVAC system, and locate exhaust downwind and away from air intakes and other points of entry into building.
- D. Clean the following components by removing surface contaminants and deposits:
 - 1. Air outlets and inlets (registers, grilles, and diffusers).
 - 2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
 - 3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
 - 4. Coils and related components.
 - 5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
 - 6. Supply-air ducts, dampers, actuators, and turning vanes.
 - 7. Dedicated exhaust and ventilation components and makeup air systems.
- E. Mechanical Cleaning Methodology:
 - 1. Clean metal duct systems using mechanical cleaning methods that extract contaminants from within duct systems and remove contaminants from building.
 - 2. Use vacuum-collection devices that are operated continuously during cleaning. Connect vacuum device to downstream end of duct sections so areas being cleaned are under negative pressure.
 - 3. Use mechanical agitation to dislodge debris adhered to interior duct surfaces without damaging integrity of metal ducts, duct liner, or duct accessories.
 - 4. Clean fibrous-glass duct liner with HEPA vacuuming equipment; do not permit duct liner to get wet. Replace fibrous-glass duct liner that is damaged, deteriorated, or delaminated or that has friable material, mold, or fungus growth.

- 5. Clean coils and coil drain pans according to NADCA 1992. Keep drain pan operational. Rinse coils with clean water to remove latent residues and cleaning materials; comb and straighten fins.
- 6. Provide drainage and cleanup for wash-down procedures.
- 7. Antimicrobial Agents and Coatings: Apply EPA-registered antimicrobial agents if fungus is present. Apply antimicrobial agents according to manufacturer's written instructions after removal of surface deposits and debris.
- 3.11 START UP
 - A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.12 DUCT SCHEDULE

- A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
- A. Supply Ducts:
 - 1. Ducts Connected to Fan Coil Units, and Terminal Units:
 - a. Pressure Class: Positive 2-inch wg.
 - b. Minimum SMACNA Seal Class: A
- B. Return Ducts:
 - 1. Ducts Connected to Fan Coil Units, and Terminal Units
 - a. Pressure Class: Positive or negative 2-inch wg
 - b. Minimum SMACNA Seal Class: B.
 - 2. Ducts Connected to Air-Handling Units
 - a. Pressure Class: Positive or negative 3-inch wg
 - b. Minimum SMACNA Seal Class: B
- 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
 - 2. Ducts Connected to Dishwasher Hoods:
 - a. Type 304, stainless-steel sheet.
 - b. Welded seams and flanged joints with watertight EPDM gaskets.
 - c. Pressure Class: Positive or negative 2-inch wg
 - d. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
 - e. SMACNA Leakage Class: 3.
 - 3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.
 - a. Duct shall be factory fabricated.
 - b. Exposed to View: Type 304, stainless-steel sheet
 - c. Concealed: Type 304, stainless-steel sheet, No. 2D finish
 - d. Welded seams and joints.
 - e. Pressure Class: Positive or negative 3-inch wg
 - f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.

- g. SMACNA Leakage Class: 3.
- D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:
 - Ducts Connected to AHUs, Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units

 Pressure Class: Positive or negative 2-inch wg
 - b. Minimum SMACNA Seal Class: A
- E. Double-Wall Duct Interstitial Insulation:
 - 1. Supply Air Ducts: 2 inches thick, unless noted otherwise on drawings.
- F. Elbow Configuration:
 - 1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards -Metal and Flexible," Figure 2-2, "Rectangular Elbows."
 - a. Double Skin vaned elbows. See drawings.
 - 2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible," Figure 3-3, "Round Duct Elbows."
 - 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) 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.
- G. 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

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. Backdraft and pressure relief dampers.
 - 2. Barometric relief dampers.
 - 3. Manual volume dampers.
 - 4. Control dampers.
 - 5. Fire dampers.
 - 6. Flange connectors.
 - 7. Turning vanes.
 - 8. Remote damper operators.
 - 9. Duct-mounted access doors.
 - 10. Flexible connectors.
 - 11. Flexible ducts.
 - 12. Duct accessory hardware.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.
 - 1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances; and method of field assembly into duct systems and other construction. Include the following:
 - a. Special fittings.
 - b. Manual volume damper installations.
 - c. Control-damper installations.
 - d. Fire-damper, ceiling, and corridor damper installations, including sleeves; and duct-mounted access doors and remote damper operators.
 - e. Wiring Diagrams: For power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which ceiling-mounted access panels and access doors required for access to duct accessories are shown and coordinated with each other, using input from Installers of the items involved.

B. Source quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For air duct accessories to include in operation and 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. Fusible Links: Furnish quantity equal to 10 percent of amount installed.

1.7 QUALITY ASSURANCE

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with AMCA 500-D testing for damper rating.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

- A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."
- B. Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

- A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
 - 1. Galvanized Coating Designation: G90.
 - 2. Exposed-Surface Finish: Mill phosphatized.
- B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304.
- C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.
- D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

- E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.
- F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Greenheck Fan Corporation</u>.
 - 2. <u>Nailor Industries Inc</u>.
 - 3. <u>Pottorff</u>.
 - 4. <u>Ruskin Company</u>.
- B. Description: Gravity balanced. Blades of maximum 6-inch width, with sealed edges, assembled in rattle-free manner, steel ball bearings, and axles.
- C. Frame: Hat-shaped, 0.05-inch-thick, galvanized sheet steel, with welded corners and mounting flange.
- D. Blades: Multiple single-piece blades, 0.050-inch-thick aluminum sheet with sealed edges.
- E. Blade Action: Parallel.
- F. Blade Seals: Neoprene, mechanically locked.
- G. Blade Axles:1. Material: Galvanized steel.
- H. Tie Bars and Brackets: Galvanized steel.
- I. Return Spring: Adjustable tension.
- J. Accessories:
 - 1. Adjustment device to permit setting for varying differential static pressure.
 - 2. Counterweights and spring-assist kits for vertical airflow installations.
 - 3. Electric actuators, where noted.
 - 4. Chain pulls.
 - 5. Screen Mounting: Front mounted in sleeve.
 - a. Sleeve Thickness: 20 gage minimum.
 - b. Sleeve Length: 6 inches minimum.
 - 6. Screen Mounting: Rear mounted.
 - 7. Screen Material: Stainless steel.
 - 8. Screen Type: Bird.
 - 9. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

- A. Standard, Steel, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>Flexmaster U.S.A., Inc</u>.
 - b. <u>McGill AirFlow LLC</u>.
 - c. <u>Nailor Industries Inc</u>.
 - d. <u>Pottorff</u>.
 - e. <u>Ruskin Company</u>.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames:
 - a. Frame: Hat-shaped, 0.094-inch-thick, galvanized sheet steel.
 - b. Mitered and welded corners.
 - c. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized-steel, 0.064 inch thick.
 - 6. Blade Axles: Galvanized steel.
 - 7. Tie Bars and Brackets: Galvanized steel.
- B. Standard, Aluminum, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>McGill AirFlow LLC</u>.
 - b. <u>Nailor Industries Inc</u>.
 - c. <u>Pottorff</u>.
 - d. <u>Ruskin Company</u>.
 - 2. Standard leakage rating, with linkage outside airstream.
 - 3. Suitable for horizontal or vertical applications.
 - 4. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
 - 5. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.

- e. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
- 6. Blade Axles: Galvanized steel.
- 7. Tie Bars and Brackets: Aluminum.
- C. Low-Leakage, Steel, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>Pottorff</u>.
 - b. <u>Ruskin Company</u>.
 - 2. Comply with AMCA 500-D testing for damper rating.
 - 3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 4. Suitable for horizontal or vertical applications.
 - 5. Frames:
 - a. Hat shaped.
 - b. 0.094-inch-thick, galvanized sheet steel.
 - c. Mitered and welded corners.
 - d. Flanges for attaching to walls and flangeless frames for installing in ducts.
 - 6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Stiffen damper blades for stability.
 - d. Galvanized, roll-formed steel, 0.064 inch thick.
 - 7. Blade Axles: Galvanized steel.
 - 8. Blade Seals: Neoprene.
 - 9. Tie Bars and Brackets: Galvanized steel.
 - 10. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- D. Low-Leakage, Aluminum, Manual Volume Dampers:
 - 1. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - a. <u>Pottorff</u>.
 - b. <u>Ruskin Company</u>.
 - 2. Comply with AMCA 500-D testing for damper rating.
 - 3. Low-leakage rating, with linkage outside airstream, and bearing AMCA's Certified Ratings Seal for both air performance and air leakage.
 - 4. Suitable for horizontal or vertical applications.

- 5. Frames: Hat-shaped, 0.10-inch-thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
- 6. Blades:
 - a. Multiple or single blade.
 - b. Parallel- or opposed-blade design.
 - c. Roll-Formed Aluminum Blades: 0.10-inch-thick aluminum sheet.
 - d. Extruded-Aluminum Blades: 0.050-inch-thick extruded aluminum.
- 7. Blade Axles: Galvanized steel.
- 8. Blade Seals: Neoprene.
- 9. Tie Bars and Brackets: Aluminum.
- 10. Accessories:
 - a. Include locking device to hold single-blade dampers in a fixed position without vibration.
- E. Jackshaft:
 - 1. Size: 1-inch diameter.
 - 2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
 - 3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.
- F. Damper Hardware:
 - 1. 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.
 - 2. Include center hole to suit damper operating-rod size.
 - 3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Greenheck Fan Corporation</u>.
 - 2. <u>Pottorff</u>.
 - 3. <u>Ruskin Company</u>.
 - 4. <u>Young Regulator Company</u>.
- 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. 0.094-inch-thick, galvanized sheet steel.
- 3. Mitered and welded corners.
- D. Blades:
 - 1. Multiple blade with maximum blade width of 6 inches.

- 2. Opposed-blade design.
- 3. Galvanized-steel.
- 4. 0.064 inch thick single skin.
- 5. Blade Edging: Closed-cell neoprene.
- 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. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Greenheck Fan Corporation</u>.
 - 2. <u>Pottorff</u>.
 - 3. <u>Ruskin Company</u>.
- B. Type: Dynamic; rated and labeled according to UL 555 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 hours.
- E. Frame: Curtain type with blades outside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.
- F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.
 - 1. Minimum Thickness: 0.138 inch thick, as indicated, and of length to suit application.
 - 2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.
- G. Mounting Orientation: Vertical or horizontal as indicated.
- H. 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.
- I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.
- J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 FLANGE CONNECTORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Ductmate Industries, Inc</u>.
 - 2. <u>Nexus PDQ</u>.
 - 3. <u>Ward Industries, Inc</u>.
- B. Description: Factory-fabricated, slide-on transverse flange connectors, gaskets, and components.
- C. Material: Galvanized steel.
- D. Gage and Shape: Match connecting ductwork.

2.8 TURNING VANES

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Ductmate Industries, Inc</u>.
 - 2. <u>METALAIRE, Inc</u>.
 - 3. <u>SEMCO Incorporated</u>.
 - 4. <u>Ward Industries, Inc</u>.
- B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
 - 1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.
- C. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."
- D. Vane Construction: Double wall.

2.9 REMOTE DAMPER OPERATORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. Pottorff.
 - 2. <u>Young Regulator Company</u>.
- B. Description: Cable system designed for remote manual damper adjustment.
- C. Tubing: Brass.
- D. Cable: Stainless steel.

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E. Wall-Box Cover-Plate Material: Stainless steel.

2.10 DUCT-MOUNTED ACCESS DOORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Flexmaster U.S.A., Inc</u>.
 - 2. <u>Greenheck Fan Corporation</u>.
 - 3. <u>Pottorff</u>.
- 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.

2.11 FLEXIBLE CONNECTORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Ductmate Industries, Inc</u>.
 - 2. <u>Duro Dyne Inc</u>.
 - 3. <u>Ward Industries, Inc</u>.
- 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 5-3/4 inches wide attached to two 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.
- F. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.
 - 1. Minimum Weight: 24 oz./sq. yd..

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- 2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
- 3. Service Temperature: Minus 50 to plus 250 deg F.
- G. High-Temperature System, Flexible Connectors: Glass fabric coated with silicone rubber.
 - 1. Minimum Weight: 16 oz./sq. yd..
 - 2. Tensile Strength: 285 lbf/inch in the warp and 185 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.
- H. High-Corrosive-Environment System, Flexible Connectors: Glass fabric with chemical-resistant coating.
 - 1. Minimum Weight: 14 oz./sq. yd..
 - 2. Tensile Strength: 450 lbf/inch in the warp and 340 lbf/inch in the filling.
 - 3. Service Temperature: Minus 67 to plus 500 deg F.

2.12 FLEXIBLE DUCTS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by the following:
 - 1. Flexmaster U.S.A., Inc.
 - 2. Thermaflex
- A. Where acoustical flexible duct is shown on drawings, provide Flexmaster Type 8M (or Thermaflex M-KE) UL 181 Class I Air Duct or equal.
- B. The duct shall be constructed of a CPE fabric supported by helical wound galvanized steel. The fabric shall be mechanically locked to the steel helix without the use of adhesives or chemicals.
- C. The internal working pressure rating shall be at least 6" w.g. positive and 4" w.g. negative through 16" diameter, and 1" w.g. negative for 18" and 20" diameters, with a bursting pressure of at least 2 ¹/₂ time the working pressure.
- D. The duct shall be rated for a velocity of at lease 4000 feet per minute.
- E. The duct must be suitable for continuous operation at a temperature range of -20° F to $+250^{\circ}$ F.
- F. Factory insulate the flexible duct with fiberglass insulation. The R-value shall be at least 8 at a mean temperature of 75° F.
- G. Cover the insulation with a fire retardant metalized vapor barrier jacket reinforced with crosshatched scrim having a permeance of not greater than 0.05 perms when tested in accordance with ASTM E96, Procedure.
- H. Sound attenuation Properties: Acoustical performance, when tested by an independent laboratory in accordance with the Air Diffusion Council's <u>Flexible Air Duct Test Code FD 72-</u>R1, Section 3.0, Sound Properties, shall be as follows:

| Octave Band | 2 | 3 | 4 | 5 | 6 | 7 |
|--------------|-----|-----|-----|------|------|------|
| Hz. | 125 | 250 | 500 | 1000 | 2000 | 4000 |
| 6" diameter | 7 | 31 | 40 | 38 | 40 | 27 |
| 8" diameter | 13 | 29 | 36 | 35 | 38 | 22 |
| 12" diameter | 21 | 28 | 29 | 33 | 26 | 12 |

- I. 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.

2.13 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 INSTALLATION

- A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.
- B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.
- C. Install backdraft dampers (control dampers for fans 2,000CFM and larger) at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.
- D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.
 - 1. Install steel volume dampers in steel ducts.
 - 2. Install aluminum volume dampers in aluminum ducts.
- E. Set dampers to fully open position before testing, adjusting, and balancing.
- F. Install test holes at fan inlets and outlets and elsewhere as indicated.
- G. Install fire and smoke dampers according to UL listing.
- H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
 - 1. On both sides of duct coils.
 - 2. Upstream from duct filters.
 - 3. At outdoor-air intakes and mixed-air plenums.
 - 4. At drain pans and seals.
 - 5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.

- 6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
- 7. At each change in direction and at maximum 50-foot spacing.
- 8. Upstream from turning vanes.
- 9. Upstream or downstream from duct silencers.
- 10. Control devices requiring inspection.
- 11. Elsewhere as indicated.
- I. Install access doors with swing against duct static pressure.
- J. Access Door Sizes:
 - 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.
- K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.
- L. Install flexible connectors to connect ducts to equipment.
- M. For fans developing static pressures of 5-inch wg and more, cover flexible connectors with loaded vinyl sheet held in place with metal straps.
- N. Connect terminal units to supply ducts directly, and for fan powered boxes with maximum 12inch lengths of flexible duct. Do not use flexible ducts to change directions.
- O. Connect flexible ducts to metal ducts with stainless steel draw bands.
- P. Install duct test holes where 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

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. Connection of new kitchen grease ducts and make up air ducts with existing Up-blast centrifugal roof ventilator and make up supply air fan (kitchen ventilation system). New fans are not required. Specification is added for connections, and testing, adjusting and balancing of airflow only.
 - 2. Provide fan speed controllers as noted on the drawings.

1.3 PERFORMANCE REQUIREMENTS

A. Not Applicable.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
 - 1. Fan speed controllers.
- B. Shop Drawings: 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.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from Installers of the items involved:
 - 1. Framing and support members relative to duct penetrations.
 - 2. Ceiling suspension assembly members.
 - 3. Size and location of initial access modules for acoustical tile.
 - 4. Ceiling-mounted items including light fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
 - 5. Roof framing and support members relative to duct penetrations.
- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Not Applicable.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Not Applicable.
- 1.8 QUALITY ASSURANCE
 - A. Not Applicable.

1.9 COORDINATION

A. Coordinate size and location of structural-steel support members, existing fans, and new ductwork.

1.10 WARRANTY

- A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.
- B. Special Warranty: A written warranty, executed by Contractor and signed by manufacturer, agreeing to replace components that fail in materials and workmanship within the specified warranty period, provided manufacturer's written instructions for installation, operation, and maintenance have been followed.
 - 1. Warranty Period: One (1) year parts and labor for fan and motor, including all components, from date of Substantial Completion.

1.11 EXTRA MATERIALS

A. Not Applicable.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. HVAC Power Ventilators: ubject to compliance with requirements, provide products by one of the following:
 - 1. Loren Cook Company.

2.2 VENTILATORS

- A. Existing.
- B. Accessories: Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
- 2.3 COMMERCIAL KITCHEN VENTILATION SYSTEMS:
 - A. Existing.
- 2.4 UP-BLAST CENTRIFUGAL EXHAUST VENTILATOR
 - A. Existing.
- 2.5 ROOF MOUNTED, FILTERED KITCHEN AIR SUPPLY FAN
 - A. Existing.
- 2.6 ROOF MOUNTED EQUIPMENT
 - A. Not Applicable.

2.7 MOTORS

- A. Not Applicable.
- 2.8 SOURCE QUALITY CONTROL
 - A. Not Applicable.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."
- B. Coordinate installation of kitchen ventilation fan systems with commercial kitchen ventilation hoods and duct systems. Install in accordance with manufacturer's instructions.
 - 1. Comply with all codes regarding the type of insulation required between the ventilation systems, wall and/or ceiling combustible material.
 - 2. Kitchen hood shall be hung level and lined up with roof exhaust openings.

3.2 CONNECTIONS

- A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."
- B. Install ducts adjacent to power ventilators to allow service and maintenance.
- C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Verify that shipping, blocking, and bracing are removed.
 - 2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
 - 3. Verify that cleaning and adjusting are complete.
 - 4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
 - 5. Adjust belt tension.
 - 6. Adjust damper linkages for proper damper operation.
 - 7. Verify lubrication for bearings and other moving parts.
 - 8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
 - 9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
 - 10. Shut unit down and reconnect automatic temperature-control operators.
 - 11. Remove and replace malfunctioning units and retest as specified above.
- B. Starting Procedures:
 - 1. Energize motor and adjust fan to indicated rpm.
 - 2. Measure and record motor voltage and amperage.
- C. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation. Remove malfunctioning units, replace with new units, and retest.
- D. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

- B. Adjust belt tension.
- C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.
- D. Replace fan and motor pulleys as required to achieve design airflow.
- E. Lubricate bearings.

3.5 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain power ventilators.
 - 1. Train Owner's maintenance personnel on procedures and schedules for starting and stopping, troubleshooting, servicing, and maintaining equipment and schedules.
 - 2. Review data in maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."
 - 3. Schedule training with Owner, through Architect, with at least seven days' advance notice.

END OF SECTION 233423

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. Listed grease ducts.
 - 2. Access doors.

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 listed grease ducts.
- B. Shop Drawings: For listed grease ducts.
 - 1. Include plans, elevations, sections, 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. Detail fabrication and assembly of hangers and seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code Steel," for hangers and supports.
 - 2. AWS D9.1/D9.1M, "Sheet Metal Welding Code," for shop and field welding of joints and seams in listed grease ducts and field-fabricated grease ducts.

SECTION 233533 - LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS

PART 2 - PRODUCTS

2.1 LISTED GREASE DUCTS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Metal-Fab, Inc</u>.
 - 2. <u>Selkirk Corporation</u>.
- B. Description: Factory-fabricated, -listed, and -labeled, double-wall ducts tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.
 - 1. For use with Type I kitchen hoods, as described in NFPA-96, for the transportation of air and grease-laden vapors from commercial cooking operations.
- C. Construction: Inner shell and outer jacket separated by at least a 1-inch annular space filled with high-temperature, ceramic-fiber insulation.
 - 1. Inner Shell: ASTM A 666, Type 304 stainless steel.
 - a. 0.035" thick for diameters 6" through 36"
 - b. 0.048" thick for diameters 38" through 48"
 - 2. Outer Jacket: Aluminized steel where concealed. Stainless steel where exposed.
 - a. 0.024" thick aluminized steel for sizes 6" through 24"
 - b. 0.034" thick for sizes 26" through 48"
 - 3. Inner and outer walls connected by means of spacer clips, which maintain the concentricity of the annular space and allow unobstructed differential thermal expansion of the inner and outer walls.
- D. Gaskets and Flanges: Ensure that gaskets and sealing materials are rated at 1500 deg F minimum. All inner pipe joints shall be held together by means of formed Vee bands and sealed with P080 Grease Duct Sealant.
- E. Hood Connectors: Constructed from same material as grease duct with internal or external continuously welded or brazed joints.
- F. Accessories: Tees, elbows, increasers, terminations, adjustable roof flashings, storm collars, support assemblies, thimbles, firestop spacers, and fasteners; fabricated from similar materials and designs as vent-pipe straight sections; all listed for same assembly. Include unique components required to comply with NFPA 96 including cleanouts, transitions, adapters, and drain fittings.
 - 1. Include all supports, roof penetrations, fan adapters, square-to-round transitions, hood connectors, drain fittings and expansion joints required to install insulated grease duct.
 - 2. Roof penetration pieces shall be UL listed products of the grease duct manufacturer. Where roof is pitched (up to 12:12), roof penetration pieces shall be of the pitched type so that it is not necessary to provide a horizontal roof curb.
- G. Grease Duct Supports: Construct duct bracing and supports from non-combustible material.

SECTION 233533 - LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS

- 1. Design bracing and supports to carry static and seismic loads within stress limitations of the International Building Code.
- 2. Ensure that bolts, screws, rivets and other mechanical fasteners do not penetrate duct walls.
- H. Comply with
 - 1. ASTM E 2336: Duct wall assembly tested and listed to 2 inches clearance to combustibles for 6 inch diameter, 3 inches clearance to combustibles for 8 to 18 inch diameters, and 4 inches clearance to combustibles for 20 to 24 inch diameters.
 - 2. ASTM E119 Fire Engulfment Test, ASTM E814 3-hour Fire Stop Test: Grease duct shall conform to requirements.
 - 3. Listed by the following agencies with the associated listed reports: UL 1978 (File MH8251) Grease Ducts for Restaurant Cooking Appliances.
- I. Factory Tests: Test and inspect fire resistance of grease duct system according to ASTM E 2336 in presence of Owner.
 - 1. Allow consultant two days' minimum notification before test is performed.

2.2 ACCESS DOORS

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>3M</u>.
 - 2. <u>Acudor Products, Inc</u>.
 - 3. <u>Ductmate Industries, Inc</u>.
- B. Description: Factory-fabricated, -listed, and -labeled, double-wall maintenance access doors tested according to UL 1978 and rated for 500 deg F continuously, or 2000 deg F for 30 minutes; with positive or negative duct pressure and complying with NFPA 211.
 - 1. Door Label: Mark door with uppercase lettering as follows: "ACCESS PANEL. DO NOT OBSTRUCT."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions 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 INSTALLATION

A. Coordinate installation of roof curbs, equipment supports, and roof penetrations. Comply with requirements in Section 077200 "Roof Accessories."

SECTION 233533 - LISTED KITCHEN VENTILATION SYSTEM EXHAUST DUCTS

- B. Coordinate connections to kitchen exhaust hoods with requirements in Section 233813 "Commercial-Kitchen Hoods."
- C. Coordinate connections to exhaust fans with requirements in Division 23 Sections.
- D. Coordinate firestopping where grease ducts penetrate fire separations with requirements in Section 078413 "Penetration Firestopping."
- E. Comply with minimum clearances from combustibles and minimum termination heights according to product listing or NFPA 211 and UL 2221, whichever is most stringent.
- F. Install airtight maintenance access doors where indicated.
- G. Seal between sections of grease exhaust ducts according to manufacturer's written installation instructions, using sealants recommended by manufacturer.
- H. Connections: Make grease duct connections according to the International Mechanical Code.
 - 1. Grease duct to exhaust fan connections: Connect grease ducts to inlet side of fan using flanges, gaskets, and bolts.
 - 2. Grease duct to hood connections:
 - a. Make grease duct to hood joints connections using internal or external continuously welded or brazed joints.
 - b. Make watertight grease duct to hood joints connections using flanges, gaskets, and bolts.
- I. Support ducts at intervals recommended by manufacturer to support weight of ducts and accessories, without applying loading on kitchen hoods.
 - 1. Securely attach supports and bracing to structure.
- J. Grease Duct Enclosures: Comply with requirements of the International Building Code and ASTM E 2336.
- K. Coordinate fire-rated enclosure construction with Section 092116.23 "Gypsum Board Shaft Wall Assemblies."
- L. Repair damage to adjacent materials caused by listed kitchen ventilation system exhaust ducts installation.

3.3 FIELD QUALITY CONTROL

- A. Perform air leakage test in presence of Owner before concealment of any portion of the grease duct system.
 - 1. Notify Owner a minimum of 7 days before test is performed.

END OF SECTION 233533

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 grilles, registers, diffusers, and other air devices
- B. Related Sections:
 - 1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
 - 2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, include the following:
 - 1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
 - 2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.
- B. Samples for Initial Selection: For diffusers, registers, and grilles with factory-applied color finishes.

1.4 INFORMATIONAL SUBMITTALS

- A. 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.
- B. Source quality-control reports.

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the manufacturers specified:
 - 1. Price Industries.
 - 2. Titus.

2.2 AIR DEVICES

- A. Rectangular and Square Ceiling Grilles, Registers, Diffusers: See schedules for material, finish, size, pattern, damper type, and accessories.
- B. Fire rated air devices: Plans indicate a "fire damper" designation on diffusers that need a fire rated air device. Coordinate with plans.

2.3 INSULATION

- A. All cold surfaces that are susceptible to condensation shall be insulated.
- B. Insulation may be provided by manufacturer or by installing Contractor. Coordinate with installing Contractor.

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

SECTION 233713 - DIFFUSERS, REGISTERS, AND GRILLES

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

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 Type I and Type II commercial-kitchen hoods.
- B. Related Requirements:
 - 1. Section 233533 "Listed Kitchen Ventilation System Exhaust Ducts" for fire-rated ducts connecting to kitchen hoods.

1.3 DEFINITIONS

- A. Listed Hood: A hood, factory fabricated and tested for compliance with UL 710 by a testing agency acceptable to authorities having jurisdiction.
- B. Standard Hood: A hood, usually field fabricated, that complies with design, construction, and performance criteria of applicable national and local codes.
- C. Type I Hood: A hood designed for grease exhaust applications.
- D. Type II Hood: A hood designed for heat and steam removal and for other nongrease applications.

1.4 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Standard hoods.
 - 2. Filters/baffles.
 - 3. Fire-suppression systems.
 - 4. Lighting fixtures.
- B. Shop Drawings: Signed and sealed by a qualified professional engineer.
 - 1. Shop Drawing Scale: 1/4 inch = 1 foot.
 - 2. Show plan view, elevation view, sections, roughing-in dimensions, service requirements, duct connection sizes, and attachments to other work.
 - 3. Show cooking equipment plan and elevation to confirm minimum code-required overhang.

- 4. Indicate performance, exhaust and makeup air airflow, and pressure loss at actual Projectsite elevation.
- 5. Show water-supply and drain piping connections.
- 6. Show control cabinets.
- 7. Show fire-protection cylinders, piping, actuation devices, and manual control devices.
- 8. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
- 9. Include diagrams for power, signal, and control wiring.
- 10. Duct Connections: Detail connections between ducts and hoods, including access doors and panels.
- 11. Piping Diagrams: Detail fire-suppression piping and components and differentiate between manufacturer-installed and field-installed piping. Include roughing-in requirements for drain connections. Show cooking equipment plan and elevation to illustrate fire-suppression nozzle locations.
 - a. Piping Diagram Scale: 1/4 inch = 1 foot.

1.5 INFORMATIONAL SUBMITTALS

- A. 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. Coordination Drawing Scale: 1/4 inch = 1 foot.
 - 2. Suspended ceiling assembly components.
 - 3. Structural members to which equipment will be attached.
 - 4. Roof framing and support members for duct penetrations.
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Moldings on hoods and accessory equipment.
- B. Welding certificates.
- C. Field quality-control reports.

1.6 QUALITY ASSURANCE

- A. Engineering Responsibility: Preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.
- B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D 1.1M, "Structural Welding Code - Steel," for hangers and supports; and AWS D9.1/D9.1M, "Sheet Metal Welding Code," for joint and seam welding.

SECTION 233813 - COMMERCIAL-KITCHEN HOODS

PART 2 - PRODUCTS

2.1 PERFORMANCE 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.

2.2 HOOD MATERIALS

- A. Stainless-Steel Sheet: ASTM A 666, Type 304.
 - 1. Minimum Thickness: Double wall, 18 gauge.
 - 2. Finish: Comply with SSINA's "Finishes for Stainless Steel" for recommendations for applying and designating finishes.
 - a. Finish shall be free from tool and die marks and stretch lines and shall have uniform, directionally textured, polished finish indicated, free of cross scratches. Grain shall run with long dimension of each piece.
 - 3. Concealed Stainless-Steel Surfaces: ASTM A 480/A 480M, No. 2B finish (bright, cold-rolled, unpolished finish).
 - 4. Exposed Surfaces: ASTM A 480/A 480M, No. 3 finish (intermediate polished surface).
 - 5. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- B. Sealant: ASTM C 920; Type S, Grade NS, Class 25, Use NT. Elastomeric sealant shall be NSF certified for commercial-kitchen hood application. Sealants, when cured and washed, shall comply with requirements in 21 CFR 177.2600, for use in areas that come in contact with food.
 - 1. Color: As selected by Architect from manufacturer's full range.
 - 2. Backer Rod: Closed-cell polyethylene, in diameter larger than joint width.
- C. Sound Dampening: NSF-certified, non-absorbent, hard-drying, sound-deadening compound for permanent adhesion to metal in minimum 1/8-inch thickness that does not chip, flake, or blister.
- D. Gaskets: NSF certified for end-use application indicated; of resilient rubber, neoprene, or PVC that is nontoxic, stable, odorless, nonabsorbent, and unaffected by exposure to foods and cleaning compounds, and that passes testing according to UL 710.

2.3 GENERAL HOOD FABRICATION REQUIREMENTS

- A. Welding: Use welding rod of same composition as metal being welded. Use methods that minimize distortion and develop strength and corrosion resistance of base metal. Make ductile welds free of mechanical imperfections such as gas holes, pits, or cracks.
 - 1. Welded Butt Joints: Full-penetration welds for full-joint length. Make joints flat, continuous, and homogenous with sheet metal without relying on straps under seams, filling in with solder, or spot welding.

- 2. Grind exposed welded joints flush with adjoining material and polish to match adjoining surfaces.
- 3. Where fasteners are welded to underside of equipment, finish reverse side of weld smooth and flush.
- 4. Coat concealed stainless-steel welded joints with metallic-based paint to prevent corrosion.
- 5. After zinc-coated steel is welded, clean welds and abraded areas and apply SSPC-Paint 20, high-zinc-dust-content, galvanizing repair paint to comply with ASTM A 780/A 780M.
- B. For metal butt joints, comply with SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
- C. Where stainless steel is joined to a dissimilar metal, use stainless-steel welding material or fastening devices.
- D. Form metal with break bends that are not flaky, scaly, or cracked in appearance; where breaks mar uniform surface appearance of material, remove marks by grinding, polishing, and finishing.
- E. Sheared Metal Edges: Finish free of burrs, fins, and irregular projections.
- F. In food zones, as defined in NSF, fabricate surfaces free from exposed fasteners.
- G. Cap exposed fastener threads, including those inside cabinets, with stainless-steel lock washers and stainless-steel cap (acorn) nuts.
- H. Fabricate pipe slots on equipment with turned-up edges sized to accommodate service and utility lines and mechanical connections.
- I. Fabricate enclosures, including panels, housings, and skirts, to conceal service lines, operating components, and mechanical and electrical devices including those inside cabinets unless otherwise indicated.
- J. Fabricate equipment edges and backsplashes according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines."
- K. Fabricate enclosure panels to ceiling and wall as follows:
 - 1. Fabricate panels on all exposed side(s) with same material as hood, and extend from ceiling to top of hood canopy and from canopy to wall.
 - 2. Wall Offset Spacer: Minimum of 3 inches.
 - 3. Wall Shelves and Overshelves: Fabricate according to SMACNA's "Kitchen Ventilation Systems & Food Service Equipment Guidelines," with minimum 0.0625-inch-thick, stainless-steel shelf tops.

2.4 TYPE I EXHAUST HOOD FABRICATION

A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:

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- 1. <u>Captive-Aire Systems</u>.
- 2. <u>Grease Master</u>.
- 3. <u>Greenheck Fan Corporation</u>.
- B. Weld all joints exposed to grease with continuous welds, and make filters/baffles or grease extractors and makeup air diffusers easily accessible for cleaning.
 - 1. Fabricate hoods according to NSF 2, "Food Equipment."
 - 2. Hoods shall be listed and labeled, according to UL 710, by a testing agency acceptable to authorities having jurisdiction.
 - 3. Hoods shall be designed, fabricated, and installed according to NFPA 96.
 - 4. Include access panels as required for access to fire dampers and fusible links.
 - 5. Duct Collars: Minimum 0.0598-inch-thick steel at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a 0.5-inch-wide duct flange.
 - 6. Duct-Collar Fire Dampers: Collar and damper shall comply with UL 710 testing and listing required for the entire hood.
 - a. Collar: Minimum 0.0598-inch-thick stainless steel, at least 3 inches long, continuously welded to top of hood and at corners. Fabricate a collar with a minimum 0.5-inch-wide duct flange.
 - b. Blades: Minimum 0.1046-inch-thick stainless steel, counterbalanced to remain closed after actuation.
 - c. Blade Pivot and Spring: Stainless steel.
 - d. Fusible Link: Replaceable, 212 deg F rated.
 - 7. Makeup Air Fire Dampers: Labeled, according to UL 555, by a testing agency acceptable to authorities having jurisdiction.
 - a. Fire Rating: 1-1/2 hours.
 - b. Frame: SMACNA with blades in airstream; fabricated with roll-formed, stainless steel; with mitered and interlocking corners.
 - c. Blades: Roll-formed, interlocking or folded, minimum 0.034-inch-thick, galvanized-steel sheet.
 - d. Horizontal Dampers: Include a blade lock and stainless-steel closure spring.
 - e. Fusible Link: Replaceable,
- C. Hood Configuration: Exhaust and makeup air.
 - 1. Makeup air shall be introduced through laminar-flow-type, perforated stainless steel panels on front of hood canopy.
- D. Hood Style: Wall-mounted canopy, or as scheduled.
- E. Filters/Baffles: Removable, aluminum. Exposed surfaces shall be pitched to drain to collection cup. Filters/baffles must be listed and meet UL Standard 1046. Mesh filters are NOT allowed to be used as listed grease filter/baffles. Filters/baffles shall be tested according to UL 1046, "Safety for Grease Filters for Exhaust Ducts," by an NRTL acceptable to authorities having jurisdiction.
- A. Lighting Fixtures: U.L. compact fluorescent light fixtures and globes shall be installed and prewired to a junction box. The light fixtures shall be installed with a maximum of 4'0" spacing on center. Light switches shall be mounted on front panel of hood canopy.

SECTION 233813 - COMMERCIAL-KITCHEN HOODS

- B. Light switches shall be mounted on front panel of hood canopy.1. Lighting Fixtures: Compact fluorescent complying with UL 1598.
- C. Hood Controls: Wall-mounting control cabinet, fabricated of stainless steel.
 - 1. Exhaust Fan: On-off switches shall start and stop the exhaust fan. Interlock exhaust fan with makeup air supply fan to operate simultaneously. Interlock exhaust fan with firesuppression system to operate fan(s) during fire-suppression-agent release and to remain in operation until manually stopped. Include red pilot light to indicate fan operation. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.
- D. Capacities and Characteristics: See construction schedules.

2.5 TYPE II EXHAUST HOOD FABRICATION

- A. <u>Manufacturers:</u> Subject to compliance with requirements, provide products by one of the following:
 - 1. <u>Captive-Aire Systems</u>.
 - 2. <u>Grease Master</u>.
 - 3. <u>Greenheck Fan Corporation</u>.
- B. Fabricate hoods according to NSF 2, "Food Equipment."
- C. Fabricate hoods to comply with SMACNA's "HVAC Duct Construction Standards: Metal and Flexible."
- D. Hood Configuration: Exhaust only.
- E. Hood Type: Heat and vapor removal.
- F. Hood Style: Wall-mounted canopy or as indicated.
- G. Condensate Hood Baffles: Removable, stainless-steel baffles to drain into a hood drain trough, and stainless-steel drain piping.
- H. Lighting Fixtures: U.L. listed compact fluorescent fixtures and lamps with lenses sealed vapor tight. Wiring shall be installed in stainless-steel conduit on hood exterior. Number and location of fixtures shall provide a minimum of 70 fc at 30 inches above finished floor.
 - 1. Light switches shall be mounted on front panel of hood canopy.
 - 2. Lighting Fixtures: Compact fluorescent complying with UL 1598.
- I. Capacities and Characteristics: See construction documents.

2.6 WET-CHEMICAL FIRE-SUPPRESSION SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
SECTION 233813 - COMMERCIAL-KITCHEN HOODS

- 1. Ansul Incorporated; a Tyco International Ltd. Company.
- 2. Approved NFPA 96 equal.
- B. Description: Engineered distribution piping designed for automatic detection and release or manual release of fire-suppression agent by hood operator. Fire-suppression system shall be listed and labeled for complying with NFPA 17A, "Wet Chemical Extinguishing Systems," by a qualified testing agency acceptable to authorities having jurisdiction.
 - 1. Steel Pipe, NPS 2 and Smaller: ASTM A 53/A 53M, Type S, Grade A, Schedule 40, plain ends.
 - 2. Malleable-Iron Threaded Fittings: ASME B16.3, Classes 150 and 300.
 - 3. Piping, fusible links and release mechanism, tank containing the suppression agent, and controls shall be factory installed. Controls shall be in stainless-steel control cabinet mounted on hood or wall. Furnish manual pull station for wall mounting. Exposed piping shall be covered with chrome-plated aluminum tubing. Exposed fittings shall be chrome plated.
 - 4. Liquid Extinguishing Agent: Noncorrosive, low-pH liquid.
 - 5. Furnish electric-operated gas shutoff valve with clearly marked open and closed indicator for field installation.
 - 6. Fire-suppression system controls shall be integrated with controls for fans, lights, and fuel supply and located in a single cabinet for each group of hoods immediately adjacent.
 - 7. Wiring shall have color-coded, numbered terminal blocks and grounding bar. Spare terminals for fire alarm, optional wiring to start fan with fire alarm, red pilot light to indicate fan operation, and control switches shall all be factory wired in control cabinet with relays or starters. Include spare terminals for fire alarm, and wiring to start fan with fire alarm.

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. Examine roughing-in for piping systems to verify actual locations of piping connections before equipment installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate equipment layout and installation with adjacent Work, including lighting fixtures, HVAC equipment, plumbing, and fire-suppression system components.
- B. Complete field assembly of hoods where required.
 - 1. Make closed butt and contact joints that do not require filler.

SECTION 233813 - COMMERCIAL-KITCHEN HOODS

- 2. Grind field welds on stainless-steel equipment smooth, and polish to match adjacent finish. Comply with welding requirements in "General Hood Fabrication Requirements" Article.
- C. Install hoods and associated services with clearances and access for maintaining, cleaning, and servicing hoods, filters/baffles, grease extractor, and fire-suppression systems according to manufacturer's written instructions and requirements of authorities having jurisdiction.
- D. Make cutouts in hoods where required to run service lines and to make final connections, and seal openings according to UL 1978.
- E. Securely anchor and attach items and accessories to walls, floors, or bases with stainless-steel fasteners unless otherwise indicated.
- F. Install hoods to operate free from vibration.
- G. Install trim strips and similar items requiring fasteners in a bed of sealant. Fasten with stainlesssteel fasteners at 48 inches o.c. maximum.
- H. Install sealant in joints between equipment and abutting surfaces with continuous joint backing unless otherwise indicated. Provide airtight, watertight, vermin-proof, sanitary joints.
- I. Install lamps, with maximum recommended wattage, in equipment with integral lighting.
- J. Set initial temperatures, and calibrate sensors.
- K. Set field-adjustable switches.

3.3 CONNECTIONS

- A. Where installing piping adjacent to hoods, allow space for service and maintenance.
- B. Connect ducts according to requirements in Section 233300 "Air Duct Accessories." Install flexible connectors on makeup air supply duct. Weld exhaust-duct connections with continuous liquidtight joint.
- C. Install fire-suppression piping for remote-mounted suppression systems according to NFPA 17A, "Wet Chemical Extinguishing Systems."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Test each equipment item for proper operation. Repair or replace equipment that is defective, including units that operate below required capacity or that operate with excessive noise or vibration.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

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- 3. Test water, drain, gas, and liquid-carrying components for leaks. Repair or replace leaking components.
- 4. Perform hood performance tests required by authorities having jurisdiction.
- 5. Perform fire-suppression system performance tests required by authorities having jurisdiction.
- B. Commercial-kitchen hoods will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial-kitchen hoods.

END OF SECTION 233813