SECTION 11400

FOOD SERVICE EQUIPMENT

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, are hereby made a part of this Section.

1.02 DESCRIPTION OF WORK

A. Provide all labor, equipment, implements and materials required to install food service equipment. Work of this section, which completed together with related work specified elsewhere shall render equipment ready for use.

B. The work occurs in a new building. It will be the responsibility of this contractor to be acquainted with the building and the equipment installation location.

1.03 RELATED WORK SPECIFIED ELSEWHERE

A. General Contractor: Wall openings, knock-outs and cut-outs in walls, floors and ceilings for mechanical and -electrical requirements, in-wall blocking for wall shelves. Entire refrigerator and freezer floor as indicated on plan.

B. Plumbing - Section 15400: Connect to all new equipment all gas, hot and cold water and wastes with all necessary shut-offs, grease traps, traps, etc. and interconnect hot water booster and dishwasher including all acce ries, disposers and controls, interconnect hose station components, install fire suppressi system automatic valve. Install all faucets as specified herein.

C. Heating and Ventilating - Section 15500: Provide size, shape, and location and connect to exhaust and make-up collars for hood vents and include all fans and ductwork.

D. Electrical - Section 16100: Connect to all the food service equipment and provide disconnect switches, interconnect hood lighting fixtures and supply control switches. Provide all wiring and conduit to all electrical devices in this section, interconnect fire protection, hoods, fans and shut-off devices, interconnect disposers and controls, interconnect the walk-in refrigeration compressors externally located with all wiring as indicated by the FSEC connection plans.

1.04 SERVICES AVAILABLE

A. Electrical characteristics - 120/208, 60-Hz, three phase, 4 wire.

B. Water pressure - 60 pounds

C. Hot water - 110 degrees F.

D. Gas - 1040 BTU Natural

1.05 ABBREVIATIONS

A. FSEC --- FOODSERVICE EQUIPMENT CONTRACTOR
NAFEM -- NORTH AMERICAN ASSOCIATION OF FOODSERVICE EQUIPMENT MANUFACTURERS
NSF ---- NATIONAL SANITATION FOUNDATION
OSHA --- OCCUPATIONAL SAFETY AND HEALTH ACT
NFPA --- NATIONAL FIRE PROTECTIVE ASSOCIATION
UL ----- UNDERWRITERS LABORATORIES
ASME --- AMERICAN SOCIETY OF MECHANICAL ENGINEERS
ASHRAE - AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS
ANSI --- AMERICAN NATIONAL STANDARDS INSTITUTE
NEC ---- NATIONAL ELECTRIC CODE
FEDA --- FOODSERVICE EQUIPMENT DISTRIBUTORS ASSOCIATION
MAFSI -- MARKETING AGENTS FOR THE FOODSERVICE INDUSTRY
AGA ---- AMERICAN GAS ASSOCIATION

1.06 CODES

A. Comply with all laws, ordinances, rules, regulations and orders of public authority bearing on the performance of work including, but not limited to: ANSI, OSHA, NSF, ASME, ASHRAE and UL.

B. Comply with the latest editions of all standards, codes, regulations, requirements, ordinances and rules having jurisdiction.

1.07 DRAWINGS

A. Drawings accompanying these specifications form an essential part thereof and indicate the general arrangement of equipment specified herein. In the event of any apparent discrepancy between the drawings and specifications, the owner reserves the right to accept either.

1.08 ELECTRICAL CHARACTERISTICS OF EQUIPMENT

A. Electrically operated equipment shall meet or exceed standards 0established by UL, NEC and Factory Mutual Research Corp.

B. Motors 1-HP and over shall be equipped with overload protection and magnetic starters.

C. Motor driven equipment shall be equipped with starting switches.

D. Furnish wiring diagrams for equipment as required by Contracting Officer.

E. Equipment shall be supplied with electrical characteristics as indicated.

1.09 MECHANICAL CHARACTERISTICS OF EQUIPMENT

A. Faucets as hereinafter specified.

B. When proper operating water or gas pressure as recommended by the manufacturer of the equipment is less than water or gas specified herein, furnish and install a suitable pressure reducing valve.

1.10 QUALITY ASSURANCE

A. Submit samples of finish, materials, etc., as required for approval.

B. Submit directly to the foodservice consultant, within seven days of notification of receipt of contract, itemized prices of the equipment, indicating by whom and where each piece of equipment is to be purchased or fabricated. The Government shall have access to these factories for the purpose of inspection.

C. Submit in writing to the Contracting Officer for approval by the Electrical Engineer, a schedule showing proposed electrical characteristics of each piece of equipment and disconnect means, if any, provided. Bind a photostatic copy of approved schedule into the proprietary products binder.

D. Submit directly to the general contractor within (20) days after receipt of contract the required number of sets of the following drawings on standard size sheets and photographic literature.

E. Provide 1/4" scale dimensioned sleeve location drawings showing all plumbing, electrical and ventilation requirements and indicate by spot, mechanical connections as they relate to sleeve location. Provide elevations and sections of all equipment for use of the respective trades. Drawings shall show only floor drains required for proper operation of the equipment. Other floor drains indicated are an instrument of service to the Plumbing Engineer.

F. Provide 1/4" scale drawings showing locations and sizes of openings, depressions and trenches.

G. Provide detailed working drawings of fabricated equipment in 3/4" and 1 1/2" scale.

H. Bind in book form manufacturer's photographic literature and equipment certification data on proprietary products and their accessories and include as first page a photostatic copy of the approved electrical schedule.

I. Submit to the contractor for his approval final corrected drawings and product literature within seven (7) days after preliminary approval.

J. Prior to fabrication of food service equipment, confer with the Contracting Officer, the Food Facilities Consultant and representatives of the related trades to coordinate and clarify plans and specifications.

1.11 MEASUREMENTS

A. Measurements for equipment shall be taken at the building from finished surfaces prior to starting fabrication.

1.12 WELDING

A. Welding may be accomplished by electric arc, spot or acetylene gas according to the most practical application. A proper flux and welding material shall be used as recommended by the manufacturer of the stainless steel to assure affinity and color.

1.13 GRINDING AND POLISHING

A. Grind and polish welds level to match adjoining surfaces and finish on two sides where exposed. Wherever sheared edges occur they shall be free of buckles, warps and surface imperfections after welding. Polishing shall be blended so entire surface appears as one sheet of metal.

1.14 MATERIALS

A. Steel base metals shall be U. S. Standard gauge and aluminum shall be B & S standard gauge. Weights, gauges, finishes and materials shall not be changed.

B. Stainless steel shall be Austenitic chromium nickel steel, 18-8, type #302, and shall be U. S. X., Armco, Enduro. Sheets shall be non-magnetic, free of buckles, warps and surface imperfections with a #4 MILL finish.

C. Galvanized iron shall be an approved grade of either pure wrought iron or copper bearing steel, Armco, Keystone Copper Bearing, U. S. X.

D. Coat exposed galvanized iron, black iron and iron pipe with Duco or Hammerloid (color as selected).

1.15 JOINTS

A. Weld, grind and polish joints as required for fabrication and installation of equipment, including factory and field joints. All fabricated equipment shall have joints welded, not caulked. Spot welded or butt joints are not acceptable and exposure of nuts, bolts or rivets, either in whole or in part is prohibited.

1.16 PROTECTION AGAINST CORROSION

A. Finish points of welding to eliminate the possibility of progressive corrosion.

1.17 MASTER SCHEDULE OF SPECIFIC DETAILS

A. No substitution of a manufacturer's own design or omission of essential detail, material or fabrication contained in this schedule will be allowed. CHG indicated below refers to Component Hardware Group, Inc.

B. All equipment shall be spaced 3" clear of wall or walls, except as specified and clearance shall be measured from the upturned back or ends and not from the exterior edge of the stiffening flange or rolled edge. Clearance shall be maintained by welded "Z" spacers. Equipment may be installed at a clearance less than 3" but not without prior approval.

C. Rolled edges shall be a minimum of 1 1/2" and a maximum of 2". Internal round corners such as sinks, drainboards, dishtables, drawers, etc., shall be a minimum of 3/4" and a maximum of 1 1/2" and intersections shall meet in a spherical section.

D. Table, cabinet and counter tops shall be #14 gauge stainless steel all welded one-piece construction, with threaded studs welded to underside of top in sufficient numbers to properly secure top to frame. Studs shall have cap nuts. Tops shall be reinforced with 1 1/4" x 1 1/4" x 1/8" welded angle frame, extending completely around perimeter with cross braces 2'-6" on centers. Exposed portion shall be stainless steel. Edges shall be equipped with roll rims on all sides where freestanding. Where abutting partitions or columns they shall be turned up a minimum of 4" and off 1/2" with ends filled. Corner at turn-up shall be rounded to a 3/4" internal radius. Dishtables shall have 3" raised rolled rims and 10" high rolled rims at walls.

E. Cabinets and counters shall have 1 1/4" x 1 1/4" x 3/16" welded angle frame with cross braces 2'-6" on centers and #16 gauge stainless steel exterior finish on fronts, backs and ends with all vertical stainless steel flush with counter or cabinet body.

F. Sliding doors shall be #16 gauge stainless steel, overlapping, 0horizontal, sliding with each door having (2) rubber covered rollers CHG #B-13-1010 riveted to door top extension and rolling in separate overhead tracks. Doors shall be removable. Bottom of doors shall be slotted and held in place with "U" shaped clip welded to shelf front. Door handles shall be preformed into door edges full vertical height as for drawers. Provide CHG #Q-26-4072 rubber stop bumpers on door edges.

G. Legs shall be constructed in three units comprising a top gusset, pipe leg and adjustable foot. Top gusset shall be completely enclosed and shall be stainless steel secured to top frame by welding. Leg shall be 1 5/8" OD #16 gauge stainless steel tubing fitting into top gusset and secured with set screws and threaded internally at bottom to receive foot. Foot shall be a stainless steel bullet foot, threaded to suit leg, having a minimum of 2" adjustment without the exposure of threads. Leg and foot shall be CHG #46-5 with a #20-0206 gusset. Submit sample as required. Where undershelves are not required legs shall be tied together by 1" OD #16 gauge stainless steel tubing on all sides welded to legs. Cabinet legs shall be CHG #A-77-5048 adjustable stainless steel 6" hex bottom bolted to cabinet frame.

H. Hinged doors shall be #16 gauge stainless steel double pan with top edge handle as for drawers. Hinges shall be CHG #M-74-2078. Doors shall fit flush with cabinet face.

I. Casters shall be CHG #C-13-3451, polyurethane swivel with brakes and zerks for tables and carts and CHG #C-11-3051, polyurethane swivel with brakes and zerks for cabinets.

J. Overshelves shall be #16 gauge stainless steel all welded one piece construction turned down 1" on front and ends and up 1" at back, corners welded. Wall brackets shall be #18 gauge stainless steel, 45 degree angle with 1" flanges welded to underside of shelf and bolted to wall with stainless steel bolts in shields. Brackets shall be not more than 3"-6" apart. All shelves shall be installed 2'-0" above top unless otherwise indicated. Provide plan for required in-wall blocking.

K. Undershelves shall be #16 gauge stainless steel one-piece construction turned down 1 1/2" and off 1/2" at 45 degrees, reinforced with concealed angle iron or channel where necessary. Corner of shelf shall be notched and welded to leg. Counter and cabinet shelves shall be #16 gauge stainless steel stationary with internal corners rounded a minimum of 3/4" radius.

L. Sinks shall be constructed of #14 gauge stainless steel. Back, bottom and front shall be constructed of one piece of metal with seams welded. Horizontal and vertical corners shall be rounded to a minimum 3/4" internal radius and bottoms shall be creased to drain. Body shall be flush on multiple compartment sinks. Face plates or filler pieces are not permitted as compartment divider.

Partition shall be double wall and welded to inside body of sink. Sink measurements shall be inside and at the water line. Equip each compartment with a 2" cast brass, polished chrome plated lever handle (not twist type) waste outlet. Each sink waste shall have a removable, perforated stainless steel strainer plate. The waste shall operate by a stainless steel handle and so constructed that it may be hand tightened. Equip each compartment with a stainless steel faced polished chrome-plated overflow connected to the waste outlet. Combination overflow, waste and interconnecting shall be CHG # #10-7415, 2" size with overflow. Waste outlet shall be installed not more than 1'-0" from vertical sink front on sinks wider than 2'-0". Freestanding sinks shall have a 10" high back adjacent to walls or partitions. High back shall extend full length of sink drainboard with ends filled. All other edges shall be turned up a minimum of 2 1/2". Weld table and counter sinks to fixture of which they are a component part. Drainboards shall have horizontal and vertical corners rounded and pitch to sink. Pitch shall be in the main body of the drainboard and welded to the sink body. Drainboards 2'-6" or less in length shall be supported by 1" O.D. #14 gauge stainless steel tubing welded to underside of drainboards and sink body. Drainboards longer than 2'-6" shall be supported by table legs with cross bracing.

M. Pre-wash sink shall be constructed as described for sinks and shall be approximately 1'-9" x 1'-9" x 10" deep welded to dish tables and equipped with two (2) 10" x 20" x 5" deep #18 gauge stainless steel all round cornered perforated baskets equipped with stainless steel bar handles and 1" stainless steel angle legs. Sink shall be equipped with one (1) approximately 1'-9" square removable rack guide to fit sink, constructed of 1 1/2" x 1 1/2" #12 gauge stainless steel angle with ends returning to main body of guide approximately 1" in diameter. Pre-wash sink shall be further equipped with one (1) T&S Model #B-129-156ADF pre-rinse

spray assembly, high back style, and wall brackets secured to wall with stainless steel bolts in shields AND HEREINAFTER SPECIFIED DISPOSER.

N. Dish tables shall be constructed as described for tables with 10" high backs at rear and ends as indicated and 3" high rolled rims on front and ends at work height. Provide "Z" spacers to maintain wall clearance.

O. Dishtable drainer shall be 4" wide x full width of table, 4" deep, constructed as for dish table, drain shall be CHG #E-18-1818 all stainless steel. Provide a 4" x 4" x full width with a perforated removable all welded round cornered #16 gauge stainless steel basket with stainless steel angle feet 1/2" high and three (3) 1" x 3/16" welded cross bars at top for racks to slide over.

P. Locate water inlets above the positive water level to prevent syphoning of liquids into the water system. Wherever conditions require water inlet to be below the positive water level install a suitable chrome plated vacuum breaker and chrome plated piping.

Q. Drawers shall measure 20" x 20" x 5" deep thermoplastic and shall be CHG #S90-0020 and equipped with slides having ball-bearing wheels with stainless steel wheels CHG #S52-0020 stainless steel and tops to prevent drawers from falling out. Construct front of drawer of #16 gauge stainless steel so that top edge shall act as a full-length handle. Cabinet drawers shall be flush with faces of cabinets. Drawers shall be removable without the use of tools.

R. Saucepan racks shall be constructed of 2" X 1/4" stainless steel flat bar all welded, rounded ends (2'-0" radius), equipped with thirty six (36) CHG Model #J77-4401 double prong hooks. Support shall be #16 gauge stainless steel tubular hangers with uprights with slot for flat bar. Hangers shall be secured to building structure with uni-strut frame and threaded rods and have anti-sway bars.

S. Table and counter heights shall be 4" unless otherwise indicated or specified.

T. Each piece of standard equipment shall be equipped with a name plate or other suitable designation permitting ready identification of manufacturer. Electrically operated equipment shall have suitable name plates outlining motor and other electrical characteristics. Nameplates attached to equipment shall indicate manufacturer not distributor.

1.18 INSPECTION

A. The Contracting Officer/Government or their representatives shall have access to the factory where the equipment is being fabricated for the purpose of inspection at any phase of construction.

B. Material delivered to the site may be inspected by the Contracting Officer or their authorized representatives. This contractor will, within a reasonable time after receiving written notice, remove all materials, fixtures or apparatus condemned by the architect/owner and/or take down and remove all portions of the work deemed failing to meet or conform to the drawings, specifications and the conditions of the contract.

C. The Contracting Officer has the right to order work wholly or partially stopped until the objectionable work, materials, fixtures or apparatus are removed or to declare the contract forfeited for non-performance or not being executed according to the intent of the plans and specifications.

1.19 SUBSTITUTION OF MATERIALS SPECIFIED

A. Materials and products specified herein shall be understood as establishing the minimum acceptable standards as to type, function, capacity, design, durability and quality.

B. Bidders proposing any substitutions are cautioned to examine the mechanical plans and conditions at the building site to determine if such substitutions will require changes in mechanical work already planned or installed. If proposed substitutions require such changes, this contractor shall include the cost in the bid.

PART 2 - PRODUCTS

ITEM #1 - DISHWASHER

One (1) Dishwasher Jackson Model ATEMPSTAR@, door type, stainless steel top and sides, 1.0 minute cycle, 1.0 gallon usage per rack, gauges, electro mechanical controls, auto-fill, auto-start, delime/manual wash switch, high limit thermostat, low water protection, built-in 70 degree rise hot water booster, 46.3 amps, 208 volts three phase.

ITEM #2 - SPARE NUMBER

ITEM #3 - SOILED AND CLEAN DISH TABLES

One (1) Lot of soiled and clean dish tables, 22'-0" linear feet X 2'-6" wide, size and shape as indicated on plan.

Soiled table 13'-6" long AL@ shaped, one (1) pre-wash sink, one (1) soiled dish slide opening 3'-4" X 4'-0" framed on all sides with a #16 gauge all welded stainless steel continuous frame with 2" flanges on all sides and installed in wall during wall erection, one (1) closure Raynor Model #CSS not less than #22 gauge stainless steel, manual operation, stainless steel guides, stainless steel hood, spring counterbalance, slide bolt, face mounted with shims and stainless steel bolts in shields, table adapted for guides, table top and high back shall extend through opening, top extension end shall have a 3/8" high inverted AV@ edge turned down 2 3/8" and flanged in, eight (8) legs.

Clean dish table shall be 7'-6" long AL@ shaped, one (1) dish table drainer, one (1) 7'-6" X 1'-0" wide overshelf, one (1) 7'-6" long full width undershelf, six (6) legs.

ITEM #4 - SPARE NUMBER

ITEM #5 - HAND SINKS

Three (3) Hand Sinks Tabco Model #7-PS-60, #K-59 wrist handle faucets, #K-26 lever drains, #7-PS-14 "P" traps, wall mounting brackets secured with stainless steel bolts in shields.

ITEM #6 - DISPOSER

One (1) Disposer Insinkerator Model #SS-200, 2.0 HP, #5 sink flange mounting in pre-wash sink, #CC-101 control center mounted on a stainless steel mounting frame welded to underside of drainboard, solenoid valve, time delay relay, 208 volts three phase.

ITEM #7 - SPARE NUMBER

ITEM #8 - TABLES

Three (3) Tables, 7'-0" x 2'-6", stainless steel tops. Each shall have one (1) drawer, four (4) legs, and full length undershelf.

ITEM #9 - FOOD CUTTER

One (1) Food Cutter, Robot Coupe Model #R4N, 1.0 HP, one (1) #C446S & one (1) #436S slicer plates, one (1) #C450GP & one (1) #433GP grating plates, one (1) #C462 Julienne plate, one (1) #C425D & one (1) # C427D dicing plates, 208 volts three phase.
ITEM #10 - RACKS

Two (2) Racks, Cres-Cor Model #207-1820, angle ledge, pan stops, corner bumpers, twenty (20) pan capacity, structural aluminum casters.

ITEM #11 - MIXER

One (1) Mixer, Hobart Model #A200, 1/2 HP, 20 quart, bowl guard, standard accessories including bowl, beater and whip, one (1) additional 20 quart bowl, 120 volts single phase.

ITEM #12 - TAQBLE

One (1) Table, 9'-0" X 2'-6", stainless steel top, $= high back and left end, two (2) drawers, full length undershelf, six (6) legs, one (1) 9'-0" X 1'-0" wide ivershelf as described ion master schedule.

ITEM #13 - RANGE

One (1) Garland Model #ST286E, 2'-0" wide, gas, flame failure protection, electric spark ignition, one (1) T&S Model #HG-4E-48-SK flexible connector with swivel disconnect, stainless steel restraining cables secured with stainless steel bolts, four (4) burners, oven, legs, overshelf, 120 volts single phase.

ITEM #14 - KETTLE

One (1) Kettles, Market Forge Model MT-25, modular, finished back, twenty five (25) gallon, power lift, tilting , double pantry faucet, two (2) T&S model #HW-4-B-48-SK flexible appliance water connectors, one piece hinged cover, tilting kettle accessory kit, pan carrier, steam supply from adjacent steamer Item #15, safety valve, steam shut-off, rear legs bolted to floor with stainless steel bolts in shields, 120 volts single phase.

ITEM #15 - STEAMER

One (1) Steamer, Market Forge Co., Model #3500M36G300A 300,000 BTU, with interconnecting piping to adjacent kettle, modular, two (2) compartment, finished back, constant steam switch, pilotless ignition, gas, one (1) T&S Model #HG-4E-48-SK flexible appliance gas connector with swivel disconnect, 120 volts single phase.

ITEM #16 - OVEN

One (1) Oven, Blodgett Model #DFG-100, cook & hold, gas, dual-flow, chrome racks, pilotless ignition, convection, modular, glass in doors, 25" legs, finished back, One (1) T&S Model # HG-4D-48-SK flexible gas connector, motors 120 volts single phase.

ITEM #17 - SPARE NUMBER

ITEM #18 - FRYERS
Two (2) Fryers, Pitco Frialator, Inc. Model #3-SG14S-FD, forty pound capacity, built-in filter assembly, tank covers, stainless steel tanks, filter heater, gas, gas connectors as described above in Item #15, cord and plug, 120 volts single phase.

ITEM #19 - GRIDDLE

One (1) Griddle, Garland Model # G24-36th, gas, stainless steel front, grease bucket, splash guards, thermostats, #CS24-36 floor stand, gas connector as described in above Item #15.

ITEM #20 - HOOD

One (1) Hood, Gaylord Model #GX-BDL-DS-MAR, 10'-6" x 8'-6", stainless steel, six (6) pendant type 100 watt incandescent lighting fixtures with bulbs and safety globes, make-up air registers with upward discharge, no fire damper, 400 CFM/FT exhaust per linear foot, 80% tempered make-up air, mounting tabs, hanging rods or angles to building structure, anti-sway bars, closure to ceiling four (4) sides, extractor removing tool.

ITEM #21 - FIRE SUPPRESSION SYSTEM

One (1) Fire Suppression System, Ansul Inc., #R-102 Ansulex low pH liquid agent, for Item #20 Hood to protect all grease-related flame-producing equipment. System shall operate both manually and automatically and shall meet all state and local codes including UL300. System shall be wired to automatic fuel electric and gas shutoff. System shall include stainless steel enclosure, Automan, tanks, piping (chrome plated where exposed), detectors, wall brackets, resets, one (1) year service and maintenance contract, five year product warranty, lifetime guarantee against leakage, certificate of inspection by the appropriate authority having jurisdiction. Provide both electric switch and gas shut-off valve for installation by the General Contractor.

ITEM #22 - REFRIGERATOR

One (1) Refrigerator, Traulsen, Model AHT2-32-WUT, two (2) section, self-contained, stainless steel exterior, half height doors, dial thermometer, twelve (12) type "U" universal pan slides upper left hand door, chrome floor racks, cord and plug, five year compressor warranty, 120 volts single phase.

ITEM #23 - SPARE NUMBER

ITEM #24 - SLICER

One (1) Slicer, Hobart Model #2712E, built-in sharpener, 12" blade, automatic, cord and plug, 120 volts single phase.

ITEM #25 - SPARE NUMBER

ITEM #26 -SPARE NUMBER

ITEM #27 -SPARE NUMBER

ITEM #28 - POT RACK

One (1) Pot Rack, one (1) shall be Eastern Steel Rack Model #60-R4-M, 5'-0" x 2'-3", four shelf, slotted shelves, #18 gauge stainless steel, lengthwise bracing, urethane casters.

ITEM #29 - POT SINK

One (1) Pot Sink, Three (3) compartment 7'-6" x 2'-3" x 1'-2" deep, six (6) T&S model #0700-CERAMA single sink faucets (H&C), two (2) 2'-6" x 2'-6" drainboards, ten (10) legs.

ITEM #30 - SINK HEATER

One (1) Sink Heater, Hatco Model #3CS9, 9.0 KW, switch and pilot light, built into cutout in Pot Sink Item #29, 208 volts three phase.

ITEM #31 - SPARE NUMBER

ITEM #32 - SAUCEPAN RACKS

Two (2) Saucepan Racks, ceiling mounted, 8'-0" x 2'-0", constructed as described in MASTER SCHEDULE.

ITEM #33 - UTILITY CART

One (1) Utility Cart, Servolift-Eastern, Model R-495-2, two shelf, urethane casters.

ITEM #34 - SPARE NUMBER

ITEM #35 - SPARE NUMBER

ITEM #36 -TRAY CART

One (1) Tray Cart, Caddy corp. Model #T-301 all stainless steel with Model #T-320 cutlery dispenser with four (4) seamless stainless steel rounded silver pans 11 1?2" X 6" X 4" deep, double folding hinged cover of reinforced fiberglas plastic, urethane casters.

ITEM #37 - SPARE NUMBER

ITEM #38 - CASHIERS STATION

One (1) Cashier Station, Caddy model #T-51, tray slide as indicated, open drawer, urethane casters.

ITEM #39 - SERVING COUNTERS

One (1) Lot of Serving Counters, Atlas Metal Industries, Model Aluminum #CAF-CART-LINE II, standard height, #16 gauge stainless steel tops integral locking devices, recessed casters, aluminum welded frames, plastic laminate front and end finishes including skirting, recessed casters with locks, #SLS tray slides where indicated, #US undershelves, enclosed bases.

#39A - Two (2) Model #CAFT-4, solid top with tray slides.
#39B - One (1) Model #CAIH-4-WIHD+M-PRC, four (4) hot wells, drains manifolded with petcocks, 208 volts single phase.
#39C - Two (2) Model #CARM-4-DDC-SLS-US-adaptor bars, cold pans, five year compressor warranty, refrigerated, 120 volts single phase.
#39D - Number not used.
#39E - Number not used.
#39F - Two (2) Model #CAFT-5, 6'-5" long solid top with tray slides.

Tray slides for the units outside of office are shown with tray slide folded down.

Special Note: Hot well drains fitted with individual drain shutoffs and manifolded to a point where they may be drained into a receptacle, 120 volts and 208 volts single phase.

ITEM #40 - SPARE NUMBER

ITEM #41 - MICROWAVE OVEN

One (1) Microwave Oven, Amana Model #RFS11B, 1.1 KW, power cord, 120 volt single phase.

ITEM #42 - SPARE NUMBER

ITEM #43 - SPARE NUMBER

ITEM #44 - HOT FOOD HOLDING CABINET

One)1) Hot Food Holding Cabinet Cres-Cor Model #H-149PB-1816, insulated, 2.0KW heaters, control panel, all stainless steel, 5" urethane casters, Lexan door, magnetic latches, corner bumpers, cord and plug, 120 volts single phase.

ITEM #45 - SPARE NUMBER

ITEM #46 - ICE MAKER

One (1) Ice Maker, Hoshizaki Model # F-250BAA, legs, 110# storage capacity, 3.7 AMPS, all stainless steel, drains piped to over floor drain, five year compressor warranty, 120 volts single phase.

ITEM #47 - STOREROOM SHELVING

One (1) Lot of Storeroom Shelving, Advance Tabco epoxy coated chrome finish, super heavy duty wire shelving, 1'-9" x 18'-0" linear feet, five tier, 84" posts, clips, plugs, sleeves, and clamps.

ITEM #48 - SPARE NUMBER

ITEM #49 - REFRIGERATOR SHELVING

One (1) Lot of Refrigerator Shelving, Advance Tabco green epoxy coated finish, super heavy duty wire shelving, 1'-9" wide, four tier, 36'-0" linear feet, 72" posts, clips, plugs, sleeves and clamps.

ITEM #50 - WALK-IN REFRIGERATORS AND REFRIGERATION

One (1) Lot of Walk-In Refrigerators, Emjac Industries Koolco 16'-6" x 8'-6" x 8'-6" high, two (2) compartment one (1) freezer 8'-6" x 8'-6" and one (1) cooler 8'-6" x 8'-6", shall be prefabricated of modular design. Standard wall, ceiling ar floor panels shall be 46" in width or less and shall be interchangeable with like panels. Corner panels shall be 90 degree angles with 12" exterior horizontal measurements. Panels shall consist of urethane insulation sandwiched between interior and exterior metal which has been dieformed and gauged for uniformity in size. Edges of panels shall be tongue and groove with locking facilities at time of fabrication.

Cooler and Freezer floor shall be provided by general contractor as described under "Related Work Specified Elsewhere". Each wall and ceiling panel shall be completely filled with rigid urethane having a thermal conductivity (K factor) of .118 BTU/hr./sq. ft. per degrees Fahrenheit/inch: and an overall co-efficient of heat transfer (U factor) of not more than .029. "R" factor shall be 34. Insulation shall have a 97% closed cell structure with an average in-place density of 2.3 lbs. per cubic foot, and a compression strength at yield point of 30 lbs. per square inch. Overall thickness shall be 4".

Panels shall have a fire hazard classification according to ASTM E-84 (UL723) and shall have a flame spread rating of 25 degrees or less w/a certifying Factory Mutual (FM) or UL label. Panel skins at Interior and Exterior Walls and Ceilings shall be .040 gauge stucco embossed aluminum on all walk-ins including screeds.

Assembly of walk-in shall be accomplished by Locks, and activated by a hex wrench provided by the manufacturer. Access ports to locking devices shall be covered by snap caps. Access ports shall be on interior to allow assembly of walk-in from the inside.

N. S. F. listed gaskets shall be on both interior and exterior. Gaskets shall be impervious to stains, greases, oils, mildew, etc.

Each walk-in shall be fitted with one standard 34" x 78" swing type entrance door. The door shall be flush type, finished in and out to match the frame in which located. Doors and door frame shall be listed by U. L. and equipped with a magnetic gasket, hydraulic door closer and latch to open the door by breaking the magnetic force of the gasket. Hardware shall have provisions for locking and safety release, which prevents entrapment of personnel within the box. Doors shall be self-closing with **three (3)** strap-type, cam-lift hinges, one (1) hinge spring loaded.

Each entrance door section shall be provided with an incandescent type vapor-proof light with bulbs, pilot light, switch and power supply box. Concealed wiring shall be standard on each entrance door section. A heavy gauge stainless steel threshold shall be provided with each door section. Heater wire shall be continuous beneath the threshold and around the entire door frame. A 2 1/2" diameter chrome-plated NSF listed dial thermometer shall be included with each door section to indicate inside temperature.
Mount at each door section one (1) National Controls Model #TM100 internally wired digital thermometer with high/low temperature alarm indicator with audio/visual system and shutoff/reset and power supply box.

Fabrication and finish of partition wall shall be the same as the walk-in walls and shall lock into wall, ceiling, and/or floor panels with locking assemblies. Tongue and groove foam fabrication shall provide the thermal break between cooler and freezer compartments. Wall "T" panels shall be 23" x 12" or 11 1/2" x 12" symmetrical tee. All walk-ins shall be fabricated to comply with National Sanitation Foundation No. 7. The N. S. F. label shall be affixed to the interior door frame. Provide pressure relief port vent heated to prevent moisture and/or frost accumulation. Door frames shall have heated thresholds. Install behind all entrance doors a clear strip curtain. Curtain shall be made to withstand operating extremes of -40 degrees F to 135 degrees F Curtron #M-200 Polar.

To prevent damage to walk-ins in heavy traffic areas provide 2" x 6" hat-shaped bumper fabricated from aluminized steel, field mounted on front and right end centered 10" from floor.

Provide embossed aluminum angle trim at walls and closure to ceilings to match panel finishes with die-formed louvers.

Condensing units shall be semi-hermetic type by Copeland. Refrigerant shall be environmentally acceptable for and shall be #134-A for Cooler and #R404-A for Freezer. Condensers shall be air-cooled, factory assembled and U. L. listed. Pad mounted where indicated. The general contractor shall provide suitable buried conduit piping to allow for installation of refrigerant piping.

Evaporators shall be Bohn forced air type. Air discharge shall be parallel to the walk-in ceilings. Fan motors, guards, multi-fin and tube-type coil, housed in heavy gauge aluminum housing. Units shall have drain pan with suitable drain line connection. Freezer evaporator shall have an automatic electric defrost system including heaters, time clock, fan delay control and heated drain pan. Defrost shall be

time initiated and temperature terminated with built-in fail-safe control. All evaporators shall be U. L. listed. These basic components shall be supplied by Koolco as follows: Pre-assembled semi-hermetic remote condensing unit, crankcase heater, winter controls, weatherproof enclosure, evaporator, freezer time clock, heat exchanger, expansion valve, drier, sight glass, vibration eliminator, pump-down solenoid, temperature control, drainline with heater (low temperature), drainline (normal temperature), audio/visual temperature alarm for freezer mounted on door frame, mounting rack with all parts mounted by Koolco. Remote pre-charged lines shall be supplied. Mount units on 4" X 4" treated wood sleepers in an approved location on concrete slab where architecturally indicated and according to local regulations. Provide appropriate refrigerant line sleeves through walls for installation by the General Contractor and seal water tight.

All refrigeration components and/or systems shall be factory assembled and tested in accordance with standard commercial procedures. Good commercial start-up and checkout procedures shall be used by a qualified refrigeration contractor. All components shall have a one- (1) year factory warranty. Capacities and voltage requirements shall be as shown on plan.

This Contractor shall provide suitable drain lines of type "L" hard drawn copper from evaporators. Drains outside the walk-ins shall be trapped and chrome plated. Freezer drain shall be heated and insulated to prevent freeze-up. All plumbing to be in accordance with local codes. Panels shall be free from defects in material and workmanship under normal use and service for a period of ten years from the date of original installation by an authorized representative.

All hardware and electrical components shall be warranted against defects in workmanship under normal use and service for a period of one year from date of installation. Cooler System shall be #1.50 and Freezer System shall be #300 3.0 HP. Compressor voltages 208 volts three phase.

ITEM #51 - SPARE NUMBER

ITEM #52 - TRAFFIC RAILS

One (1) Lot of Traffic Rails, United Showcase comprising five (5) Model #22CP chrome plated solid brass columns with black crackle bases, Model #20SW stainless steel chain with welded links, four (4) sections approximately 4'-6" long, #21C chrome plated brass snap hooks.

ITEM #53 - COFFEE MAKER

One (1) Coffee Maker, Bunn Model #CWTF-6, six (6) burners, twin brew systems, all stainless steel, hot water faucet, six (6) Model # 06100.0101 easy pour black stainless steel based decanters, one (1) Bunn Easy Clear #EQ-11-TL water quality filter, one (1) #20115.0000 one thousand filter pack, 120/208 volts single phase.

ITEM #54 - DRINK DISPENSER

One (1) Drink Dispenser Grindmaster Corp. Model #D15-3, three gallon, refrigerated, self-contained, cord, plug, 120 volts single phase.

ITEM #55 - DRINK DISPENSER
One (1) Drink Dispenser identical to Item #54 above.

PART 3 - EXECUTION

3.01 Deliver all materials and equipment to job site promptly and in such time as not to delay work of other trades. Make no delivery except in accordance with a schedule approved by the architect/owner. Cooperate with other trades in the proper installation of work under this section. Leave all equipment ready to receive mechanical and electrical connections provided under Related Work Described Elsewhere.

3.02 Manufacture equipment in strict accordance with drawings and specifications. Materials shall be the best of their respective kinds and shall be free of defects, which would mar their appearance and render them structurally unsound.

3.03 Provide two (2) sets of repair and maintenance instructions for each item of mechanically operated equipment.

3.04 Stack and remove all rubbish, wash material, crating, etc., resulting from this work and not needed, keeping the premises in a satisfactory condition. Upon completion of the work, thoroughly and finally clean the entire installation ready for use.

3.05 Make necessary cutouts and knockouts on equipment to accommodate electrical receptacles, switches and/or other electrical outlets and plumbing lines.

3.06 Workmanship shall be of the highest quality throughout and shall be in accordance with the best standard practice of the food service industry for this type of equipment. All parts shall fit accurately and shall be held tight where necessary. Where similar metals are joined, fastening devices and metals used for welding, shall be same material as parent metal being joined.

Where stainless steel is joined to a dissimilar metal, fastening devices and metal shall be corrosion-resisting metal. The use of adhesive where applicable will be allowed only if prior approval is authorized by the architect.

3.07 GUARANTEES AND WARRANTIES

A. Repair and/or replace any defective work or materials for a period of one (1) year from date of completion of all equipment. Parts proved defective during this one (1) year period shall be promptly replaced at no additional expense. The replacement shall include all labor, materials, freight, rigging, cutting and patching and alterations necessary to place equipment in good operating order. Provide, in triplicate, a list of companies servicing the equipment, enabling the owner to call for service and repair for each piece of equipment.

B. Equipment shall also include all standard guarantees, warranties and service including one (1) year free service and five (5) year warranty on all refrigerated equipment.

3.08 SUPERVISION AND DEMONSTRATION

A. A qualified mechanic shall supervise installation of the equipment, instruct the personnel in the proper operation of the equipment and make such tests as are required to demonstrate that the equipment is in full compliance with the plans and specifications.

B. The supervisor of the installation shall have one (1) complete set of specifications, approved photographic literature and drawings at hand during the equipment installation.

C. Have on the premises for a minimum of one (1) day, a mechanic capable of making repairs and adjustments to equipment when the installation is put into service

D. Submit to the owner, in triplicate, a signed statement that all of the equipment in this section shall have been thoroughly and finally cleaned and demonstrated to his complete satisfaction. Demonstration and start-up shall be according to the recommended guidelines established by NAFEM, FEDA, MAFSI and FCSI.

END OF SECTION 11400

SECTION 12710

FIXED AUDIENCE SEATING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Work of this Section consists of installing all materials furnished under this Section, including all equipment, labor, services, and incidental items required to complete work as shown on Drawings and specified in this Section.
   1. Fully upholstered chairs with self-rising seat mechanism.

1.03 SUBMITTALS

A. Product Data: Submit for each type of product specified, including installation methods for type of substrate.

B. Shop Drawings: Show seating layout, seat-numbering scheme, chair sizes, and aisle widths.

C. Samples for Verification Purposes: Submit for each exposed material from which seating units and accessories are composed, in each color, finish, pattern, and texture indicated, including following:
   1. Two-Seat Unit: Full size with finishes and accessories specified, approved sample may become part of completed work.
   2. Upholstery Fabric:
      a. Full width sample, min. 36 in. long, with specified treatments.
      b. Show complete pattern repeat.
      c. Mark top and right side.
   3. Baked enamel Finishes: Min. 3 in. sq.
   4. Number and Letter Plates: Sample letter and number marked.
   5. Exposed Fasteners: Each type specified.

D. Maintenance Data: Provide describing methods of maintaining upholstery fabric, precautions for cleaning materials, and methods detrimental to finishes and performance.

1.04 QUALITY ASSURANCE

A. Qualifications:
1. Installer: Engage experienced installer who is certified in writing by seating manufacturer as qualified to install manufacturer's seating.

B. Fire Performance Characteristics of Upholstered Seating:
1. Test Method: UL 1056 and NFPA 266.

C. Single Source Responsibilities: Obtain each type of seating, including accessories and mounting components from one source of single manufacturer.

D. Seating Layout:
1. Design and install seating with end standards aligning from first to last row and with backs and seats varied in width, optimizing sightlines.
2. Comply with ADA Rules and Regulations.

1.05 PROJECT CONDITIONS

A. Environmental Conditions:
1. Do not install seating until space is enclosed and weatherproof, wet work in space is complete and nominally dry, installation of finishes including painting is complete, and other units of work above ceiling are complete.
2. Do not install seating until ambient temperature and humidity conditions are continuously maintained at final occupancy values.

B. Field Measurements:
1. Check seating layout by field measurements before fabrication; show recorded measurements on shop drawings.
2. Coordinate fabrication schedule with construction progress to avoid delay in work.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: American Seating Co., Hussey Seating Co., Irwin Seating Co.

2.02 MATERIALS

A. Metals:
1. Gray Iron Castings: ASTM A48, Class 25, free of bow holes and hot checks with parting lines, ground smooth.
2. Steel Plates, Shapes, and Bars: ASTM A36.
3. Electrolytic Zinc-coated Steel Sheet: ASTM A591, commercial and drawing quality, Coating Class C, chemically treated for baked enamel finish, min. 0.0396 in. thick.

B. Concealed Plywood: Hardwood plywood complying with ANSI/HPMA HP or softwood plywood complying with ANSI/VOL. PROD. STD. PS 1, as standard with manufacturer.

C. Fabric: As selected by Contracting Officer for type of fabric, weight, color, pattern, texture; complete with polymer flame-resistant treatment.

2.03 FABRICATION

A. General: Fabricate chair backs of seating rows located immediately in front of cross aisles on sloped floors so back heights are min. 26 in. measured from walking surface of cross aisle immediately behind seating.

B. Mounting: Floor-type conforming to floor slope while maintaining seat and back in same angular relationship to standards throughout.

C. Metal Standards: One piece cast iron with integral mounting provisions and anchoring points for seat pivots, backs, and arm rests.

D. Upholstered Chairs:
1. End Panels: Upholstered, padded with min. 1/4 in. thick polyurethane foam and covered with fabric to match chair upholstery.
2. Self-lubricating compensating-type hinges with noiseless self-rising seat mechanism passing ASTM

F851 and to raise unoccupied seat automatically and directly to position perpendicular to floor line.

3. Arm Rests: Solid hardwood construction with molded foam padding glued to wood and covered with fabric matching chair upholstery.
4. Product: Irwin Seating Co. Model Marquee.

E. Ferrous Metal Finishes:
1. Comply with NAAMM Metal Finishes Manual for applying and designating finishes.
2. Clean surfaces of dirt, grease, and other contaminants followed by conversion coating of type suited to organic coating applied over it.
3. Baked Enamel Finish: Apply standard two-coat baked enamel finish, color and gloss as selected by Contracting Officer from manufacturer's standard choices for color and gloss.

PART 3 EXECUTION

3.01 INSTALLATION

A. Follow manufacturer's printed instruction for installation.

B. Anchor standards with min. 2 anchoring devices.

C. Install chairs using manufacturer's recommended hardware and fasteners.

D. Verify moving components operate smoothly and quietly.

3.02 ADJUSTING

A. Adjust self-rising seat mechanisms to ensure seats in each row are aligned when in upright position.

B. Repair minor abrasions and imperfections in painted finishes with coating matching factory applied finish.

C. Replace upholstery fabric damaged during installation; do not use extra stock for replacement.

END OF SECTION

SECTION 13046

PORTABLE STEEL GATE HOUSE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes: Work of this Section consists of installing all materials furnished under this Section, including all equipment, labor, services, and incidental items required to complete work as shown on Drawings and specified in this Section.
   1. Prefabricated guardhouse and canopy assembly, fully equipped as detailed.

B. Related Sections:
   1. 03300, Cast-In-Place Concrete; for concrete floor and foundations and installation of anchor bolts.
   2. 04200, Unit Masonry; for precast silicate stone veneer masonry exterior walls.
   3. 07901, Joint Sealers; for sealants and calking.
   4. 08710, Door Hardware; for finish hardware and provisions for masterkeying.
   5. 15400, Plumbing; for rough-ins and utility service connections.
   6. 16100, Electrical; for rough-ins and utility service connections.

1.03 SYSTEM DESCRIPTION

A. Engineer, design, fabricate, and erect pre-engineered building to withstand loads from winds, gravity, structural movement, including thermally induced movement, and to resist in-service use conditions that building will experience, including exposure to weather, without failure.

B. Design Loads:
   1. In addition to dead load, basic design loads include live load, wind load, and seismic load.

2. Auxiliary loads include dynamic live loads, such as those generated by cranes and materials handling equipment.

1.04 SUBMITTALS

A. Product Data: Submit consisting of building system manufacturer's product information for building components and accessories.

B. Shop Drawings: Submit for building structural framing system, roofing, and other building system components and accessories not fully detailed or dimensioned in manufacturer's product data.
   1. Structural Framing:
      a. Furnish complete erection drawings prepared by or under supervision of professional engineer legally authorized to practice in jurisdiction where Project is located.
      b. Include details showing fabrication and assembly of building system.
   2. Building Accessory Components: Provide details of metal building accessory components to clearly indicate methods of installation including following:
      a. Personnel Doors: Provide elevations and details of each type of door and frame, including anchors and reinforcement; show location and installation requirements for finish hardware; include schedule of doors and frames using same reference numbers for details and openings as those indicated on Drawings; include complete hardware schedule.
      b. Aluminum Windows: Provide 1/4 in. scale elevations of window units and min. 3/4 in. scale details showing anchors, hardware, operators, and glazing details.
   3. Wiring Diagrams: Submit from manufacturer of motor-operated overhead service doors detailing power, signal, and control systems, differentiating clearly between field-installed and manufacturer-installed wiring.

C. Samples for Verification Purposes: Submit sample panels 12 in. long by actual panel width, in profile, style, color, and texture indicated, including clips, battens, fasteners, closures, and other panel accessories.

1.05 QUALITY ASSURANCE

A. Qualifications:
1. Installer: Engage experienced installer to erect pre-engineered building who has specialized in erection and installation of building systems similar to that required for this Project and is certified in writing by building system manufacturer as qualified for erection of manufacturer's products.
2. Manufacturer: Provide pre-engineered buildings as produced by manufacturer with min. 5 years successful experience in fabrication of pre-engineered buildings of type and quality required.

PART 2 PRODUCTS

2.01 MATERIALS AND FABRICATION

A. Metals:
1. Extruded Bars and Shapes: ASTM B221, 6063-T6.
2. Extruded Pipe and Tubes: ASTM B429, 6063-T6.
3. Aluminum-Coated Steel Sheets: ASTM A463 with T1-40 coating.
4. Aluminum Sheets: ASTM B209 for Alclad alloy 3003 or 3004, with temper as required to suit forming operations.

B. Bolts for Structural Framing: ASTM A307 or ASTM A325, as necessary for design loads and connection details.

C. Glass and Glazing Materials: Provide glass complying with ASTM C1036, of quality and type indicated.
1. Float Glass: Type I, Class 1, Quality q3, clear float glass.
2. Silicone Sealant: Single-component elastomeric silicone sealant complying with ASTM C920, Type S, Grade NS, Class 25, low modulus nonacid curing-type.
3. Glazing Tape: Preformed butyl-polyisobutylene glazing tape complying with AAMA 807.1 packaged on rolls with release paper on side, with or without continuous spacer rod.
4. Glazing Gasket: Extruded or molded closed cell, integral-skinned preformed neoprene of profile and hardness required to maintain watertight seal, complying with ASTM C509, Type II, black.

5. Setting Blocks: Neoprene, EPDM, or silicone setting blocks compatible with glazing sealants, 80 to 90 Shore A durometer hardness.
6. Spacers: Neoprene, EPDM, or silicone setting blocks compatible with glazing sealants of size, shape, and hardness recommended by glass and sealant manufacturer for application indicated.
7. Edge Blocks: Neoprene, EPDM, or silicone setting blocks compatible with glazing sealants of size, shape, and hardness required to limit lateral movement of glass.
8. Filler Rods: Compressible closed-cell or waterproof-jacketed rod stock of flexible and resilient synthetic rubber or plastic foam with 5 to 10 psi compression strength for 25 percent deflection.

D. Thermal Insulation:
1. Glass fiber blanket insulation complying with ASTM C991, 0.5 pcf density, with 25 or less UL flame spread classification, 2 in. wide continuous vapor tight edge tabs.
2. Vapor Barrier: Vinyl film, white.
3. Retainer Strips: 26 ga. formed galvanized steel retainer clips colored to match insulation facing.

2.02 FABRICATION

A. Structural Framing:
1. Shop-fabricate structural framing components to indicated size and section complete with base plates, bearing plates, and other plates required for erection, welded in place.
2. Provide all required holes for anchoring or for connections either shop-drilled or punched to template dimensions.
3. Shop Connections: Provide riveted, bolted, or welded shop connections.
4. Field Connections: Provide bolted field connections.

PART 3 EXECUTION

3.01 ERECTION

A. General:
1. Comply with manufacturer's detailed instructions for installation.

2. Coordinate work of this Section with other Sections and provide templates and setting diagrams as required.

B. Cutting, Fitting, and Placement:
1. Perform as required for installation of miscellaneous metal fabrications.
2. Set dispenser accurately in location, alignment, and elevation, level, true and free of rack, measured from established lines and levels.
3. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry, or similar construction.
4. Fit exposed connections accurately together to form tight hairline joints.

3.02 ADJUSTING AND CLEANING

A. Cleaning:
1. Clean metal surfaces promptly after installation, exercising care to avoid damage to protective coatings and finishes.
2. Smooth any abraded areas of stainless steel and polish to match undamaged finish.
3. Remove excess glazing and sealant compounds, dirt, and other substances.
4. Clean glazing of window using materials and methods recommended by glazing manufacturer to prevent damage or hazing.
5. Erect and maintain protection of glazing to ensure unit will be without damage or deterioration, other than normal weathering, at time of Acceptance.

END OF SECTION

APPENDIX A

GEOTECHNICAL REPORT

FINAL GEOTECHNICAL ENGINEERING REPORT

FOR

AIR NATIONAL GUARD

AIR CONTROL COMPLEX

ORANGE, CONNECTICUT

MGI NO. 14881

MARCH, 1999

PREPARED BY:

MAGUIRE GROUP INC.
ENGINEERS
FOXBOROUGH, MASSACHUSETTS - NEW BRITAIN, CONNECTICUT

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APPENDIX

Figure 1 - Boring Location Plan

Figure 2 - Section Location Plan

Figures 3 through 11 - General Soil Profiles

Boring Logs B-2 through B-12 and B-14 through B-17

FINAL GEOTECHNICAL ENGINEERING REPORT

FOR

AIR NATIONAL GUARD

AIR CONTROL COMPLEX

ORANGE, CONNECTICUT

MGI NO. 14881

I. PURPOSE AND SCOPE

This report presents the determination and analysis of the subsurface soil and rock conditions which would affect the design and construction of the building foundations, utilities and site grading for the Air National Guard Air Control Complex in Orange, Connecticut. The project will include the following improvements; a two-story building with a one-story maintenance bay, an 85' by 85' Radar pad, a 2,000 s.f. addition to Building 18, a 600 ft. long retaining wall and two 4,000 s.f. covered storage areas. In addition, considerable grading will be required for a detention basin, a new access drive and parking area. The Appendix of this Report contains boring and section location plans, generalized soil profiles and the Engineer's boring logs for this project.

II. FIELD SUBSURFACE INVESTIGATIONS

The completed boring program for the Air National Guard Air Control Complex in Orange, Connecticut consisted of fifteen (15) hollow stem auger borings (B-2 through B-12 and B-14 through B-17). The originally planned boring program consisted of seventeen (17) borings, however, two (2) borings (B-1 and B-15) were deleted due to possible conflicts with existing underground utilities. All of the borings were drilled by General Borings, Inc. of Prospect, Connecticut between February 8 and February 12, 1999. Borings were drilled using a 3-1/2 inch and 4-1/2 inch inside diameter hollow stem augers. The borings varied in depth from 8.0 to 35.42 feet in soil. Auger refusal, where encountered, was considered to be near or

upon bedrock. No rock cores were taken. To classify and determine the density of the various soil strata encountered, disturbed samples were obtained from all of the borings by driving a split spoon sampler with a 140 pound weight falling 30 inches. Ground water levels were recorded upon completion of each boring. Locations of all borings are shown on the Boring Location Plan - Figure 1, in the Appendix of this report. The Consulting Engineer was responsible for the layout, inspection and analysis of the boring program.

III. SUBSURFACE SOIL AND ROCK CONDITIONS

The subsurface soil and rock conditions encountered at the project site will be discussed in detail below. Reference should be made to the series of generalized soil profiles developed from the results of the subsurface investigations which show the basic pattern of soil deposits and bedrock found within the project limits. These profiles are shown as Figures 3 through 11 in the Appendix of this report. The following proportions are used in all soil descriptions: Trace - 1% to 10%, little - 11% to 20%, some -21% to 35%, and -36% to 50%.

A. Two-story Building and Maintenance Bays (Figures 4 through 7)

Two (2) major soil strata are present at the site of the proposed Two-story Building. The following is a generalized description of the soils encountered from the surface downward.

- A 2 to 5 foot thick deposit of brown, fine to coarse sand containing some silt with trace amounts of gravel. The relative density of this stratum ranges from medium dense to dense.
- A deposit of very dense, brown glacial till consisting of fine to coarse sand containing a little to some silt, with trace amounts of gravel. The till extends 10 to 25 feet to bedrock.

In addition, an artificial fill was encountered at the ground surface, in Borings B-5, B-7 and B-8. The artificial fill ranges from 2.5 feet to 6.0 feet in thickness and consists of brown, fine to coarse sand containing some silt and varying amounts of

gravel.

No groundwater was observed in this area.

As presently proposed, the two-story building will bear in the silty sand, till and artificial fill deposits.

B. Radar Pad (Figure 8)

The subsurface soils at the proposed Radar Pad location consist of a 2 foot thick layer of medium dense, brown fine to coarse sand containing some silt with trace amounts of gravel underlain by a glacial till deposit consisting of very dense, brown, fine to coarse sand containing a little silt and gravel. The till extends approximately 30 feet to bedrock. Some boulders were encountered within the soil mass. Groundwater was observed at approximately elevation 211.5

As presently proposed, the Radar Pad will require the construction of a 9 foot thick pad of compacted gravel fill to meet proposed foundation grade. The Radar Pad will bear on the proposed compacted gravel fill.

C. Covered Storage Areas (Figures 9 and 10)

Section F-F'

The subsurface soils at the location of the easterly covered storage area (Section F-F', Figure 9), of an artificial fill consisting of loose to medium dense, brown and dark brown, fine to medium sand containing some silt and a little gravel. Underlying the fill along the northern portion of the storage area is glacial till, consisting of dense to very dense, brown fine to coarse sand containing some silt with a little gravel. The till is three or more feet thick and extends to bedrock. Underlying the fill along the southern edge of the storage area is a 4 foot thick deposit of brown fine to medium sand and silt with trace amounts of gravel extending to bedrock. No groundwater was not encountered in this area.

This covered storage area will bear in the artificial fill.

Section G-G'

The subsurface soils at the location of the westerly covered storage area (Section G-G', Figure 10) consist of brown fine to coarse sand, containing varying amounts of silt and a little gravel. The relative density of this deposit ranges from medium dense to very dense. A few boulders were encountered within the soil mass. Groundwater was observed at about elevation 167.0.

This covered storage area will bear in the silty sand.

D. Building 18 Addition (Figure 11)

The subsurface soil at the Building 18 Addition consists of 4 to 9 feet of dense, brown, fine to coarse sand containing some silt, with a little gravel. This soil deposit extends to bedrock. In addition, an artificial fill 3.5 feet thick was encountered in Boring B-16. The fill consists of gravel and dark brown, fine to coarse sand, containing a little silt. Groundwater was not encountered in this area.

As presently proposed, foundations for the Building 18 Addition will bear in the natural granular soils or the artificial fill.

E. Ten Foot Retaining Wall

It is anticipated that the soils along the Retaining Wall consist of a 2 to 5 foot thick deposit of medium dense, brown fine to coarse sand containing some silt with trace amounts of gravel underlain by dense to very dense glacial till consisting of brown, fine to coarse sand containing varying amounts of silt with trace amounts of gravel. The glacial till extends to bedrock. In addition, a thin artificial fill may be present at the ground surface in some areas. The reported groundwater in this area is at approximately elevation 211.5

It is anticipated that the proposed retaining wall will bear in the silty sand or glacial till.

IV. ANALYSIS AND FOUNDATION RECOMMENDATIONS

An analysis of the foundation conditions and recommendations for the design and construction of the proposed Air National Guard Air Control Complex in Orange, Connecticut are presented below. Reference to the following conclusions and recommendations without referring to the several features previously discussed, may result in interpreting certain statements out of context with the desired meaning. Reference to the preceding discussions, knowledge of the field geological conditions and an interpretative judgement based on the actual appearance and behavior of the subsurface soils and bedrock comprising the foundation materials are all necessary prior to the most beneficial use of these conclusions and recommendations. With respect to the above presumption, the following foundation analyses, conclusions and recommendations are presented for the work within the project limits.

Structure Foundations

As presently proposed, all structures will bear on natural granular soils or existing artificial fill except for the Radar Tower which will bear on about nine feet of new fill. All of the natural soils present at the site will provide suitable foundation material for the proposed structures. The existing artificial fill varies significantly in both composition and density and may contain significant amounts of rubble in some areas. Therefore, all existing artificial fill is judged unsuitable for support of any proposed structures. It is recommended that all existing artificial fill be excavated to its full depth and be replaced with compacted gravel prior to placement of any required structural fill or structure foundations. It is recommended that all structures be founded on spread footings or mat foundations.

The following foundation recommendations are presented for the proposed structures at the Air National Guard Air Control Complex in Orange, Connecticut.

- Provide 12 inches of gravel, compacted in two equal lifts to at least 95 percent of the maximum dry density, as determined by modified proctor tests, beneath all footings. To maintain suitable quality control, it is recommended that density tests be performed on each lift of compacted gravel placed beneath each interior footing. Density tests should also be performed on each lift of compacted gravel placed under exterior strip footings at 50 foot intervals along the footings.

- Provide 6 inches of gravel, compacted to at least 95 percent of the maximum dry density, as determined by modified proctor tests, beneath all floor slabs. Density tests should be performed at a rate of one test for each 2500 square feet of each lift.

- The Radar Pad will require the construction of a 9 foot thick pad of fill to meet the proposed foundation grades. This fill should consist of gravel compacted to at least 95 percent of the maximum dry density in lifts not to exceed 8 inches in compacted depth. It is recommended that compaction tests be performed at a rate of one test for each 2500 square feet of each lift of fill beneath the proposed structure.

- Prior to placing any compacted gravel, all topsoil must be removed and the subgrade soils must be thoroughly compacted. The topsoil may be stockpiled for use on proposed slopes.

- The maximum allowable bearing capacity for the two-story building and maintenance bay is 2.5 tons per square foot.

- The maximum allowable bearing capacity for the Retaining Wall, Covered Storage Areas and the Building 18 Addition is 2.0 tons per square foot.

- Minimum depth of foundation for frost protection - 42 inches.

- Minimum footing width for exterior strip footings - 30 inches.

- Minimum interior footing dimensions - 3 feet.

- Equivalent fluid pressure for design of unbraced walls - 40 pounds per square foot per foot.

- Equivalent fluid pressure for design of braced walls - 60 pounds per square foot per foot.

- Pervious structure backfill must be provided behind the proposed Retaining Wall.

- Weep holes must be provided in the proposed Retaining Wall.

- Friction factor for all structures - 0.40

- Soils are not susceptible for liquefaction.

- "S" Coefficient for seismic design - 1.0.

- Foundation underdrains will not be required.

Earthwork

Significant cuts and fills will be required to accommodate the proposed detention basins, access drive and parking areas at this site. The maximum depths of cut and fill will be approximately 15 feet and 4 feet respectively. The maximum recommended slopes for both cuts and fills (in both soil and bedrock) is two horizontal to one vertical. In the event that bedrock is encountered in any of the excavations, extreme care should be employed during blasting operations to prevent damage or injury to any structures, vehicles or pedestrians in the vicinity of such operations. It is recommended that a preconstruction condition survey be accomplished on all structures within 1000 feet of any anticipated blasting operations.

It would be desirable to use on-site material for the required fills on this project. On site material will not likely meet the specifications for compacted gravel and therefore is unsuitable for use as fill under the proposed building and radar structures. Imported gravel must be utilized for all fills placed beneath structures. The on-site material will be suitable for fill under the access drives, parking areas and landscaped portions of the site.

All site fills supporting pavement for access roadways or parking areas should be placed in lifts not to exceed 8 inches in loose depth and should be compacted to at least 90 percent of the maximum dry density of the material being utilized, as determined by modified proctor tests, except that the top 3 feet of the fill should be compacted to at least 95 percent of the maximum dry density. Compaction tests are recommended at a rate of one test for each 5000 square feet of each lift. All site fills supporting landscaped areas should be compacted to at least 90 percent of maximum dry density. The maximum allowable slope for any fill is 2 horizontal to 1 vertical. Little volume change is anticipated when the natural materials at the site are excavated and recompacted. It is recommended that all existing topsoil be stripped, stockpiled and reused on the new slopes.

Utilities

It is recommended that 6 inches of compacted gravel bedding be provided beneath the proposed storm drainage system and other utilities to be installed on this project. If bedrock is encountered, the rock should be excavated to a depth of at least 6 inches below the bottom of the pipe. The trench should then be backfilled to the invert elevation with compacted gravel prior to placing the pipe. Little, if any dewatering of the excavations will be required during construction.

The Contractor will be responsible for the design of all temporary excavation support systems utilized on this project.

It is recommended that all gravel fill and pavements installed on this project meet the specifications of the State of Connecticut Department of Transportation Standard Specifications for Road, Bridges and Incidental Construction, "Form 815A".

SECTION 15050

BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Piping materials and installation instructions common to most piping systems.
2. Transition fittings.
3. Dielectric fittings.
4. Mechanical sleeve seals.
5. Sleeves.
6. Escutcheons.
7. Grout.
8. Equipment installation requirements common to equipment sections.
9. Concrete bases.
10. Supports and anchorages.

1.03 DEFINITIONS

A. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below roof, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels.

B. Exposed, Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

C. Exposed, Exterior Installations: Exposed to view outdoors or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for plastic materials:

1. ABS: Acrylonitrile-butadiene-styrene plastic.

2. CPVC: Chlorinated polyvinyl chloride plastic.
3. PE: Polyethylene plastic.
4. PVC: Polyvinyl chloride plastic.

G. The following are industry abbreviations for rubber materials:

1. EPDM: Ethylene-propylene-diene terpolymer rubber.
2. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

A. Product Data: For the following:

1. Transition fittings.
2. Dielectric fittings.
3. Mechanical sleeve seals.
4. Escutcheons.

B. Welding certificates.

1.05 QUALITY ASSURANCE

A. Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code--Steel."

B. Steel Pipe Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

C. Electrical Characteristics for Mechanical Equipment: Equipment of higher electrical characteristics may be furnished provided such proposed equipment is approved in writing and connecting electrical services, circuit breakers, and conduit sizes are appropriately modified. If minimum energy ratings or efficiencies are specified, equipment shall comply with requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. 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.

B. Store plastic pipes protected from direct sunlight. Support to prevent sagging and bending.

1.07 COORDINATION

A. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.

B. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

C. Coordinate requirements for access panels and doors for mechanical items requiring access that are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors and Frames."

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.

2.02 PIPE, TUBE, AND FITTINGS

A. Refer to individual Division 15 piping Sections for pipe, tube, and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch (3.2-mm) maximum thickness unless thickness or specific material is indicated.

a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

2. AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick, unless otherwise indicated; and full-face or ring type, unless otherwise indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material recommended by piping system manufacturer, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing, unless otherwise indicated; and AWS A5.8, BAg1, silver alloy for refrigerant piping, unless otherwise indicated.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

H. Solvent Cements for Joining Plastic Piping:

1. ABS Piping: ASTM D 2235.
2. CPVC Piping: ASTM F 493.
3. PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.
4. PVC to ABS Piping Transition: ASTM D 3138.

I. Fiberglass Pipe Adhesive: As furnished or recommended by pipe manufacturer.

2.04 TRANSITION FITTINGS

A. AWWA Transition Couplings: Same size as, and with pressure rating at least equal to and with ends compatible with, piping to be joined.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Dresser Industries, Inc.; DMD Div.
c. Ford Meter Box Company, Incorporated (The); Pipe Products Div.
d. JCM Industries.
e. Smith-Blair, Inc.
f. Viking Johnson.

2. Underground Piping NPS 1-1/2 (DN 40) and Smaller: Manufactured fitting or coupling.
3. Underground Piping NPS 2 (DN 50) and Larger: AWWA C219, metal sleeve-type coupling.
4. Aboveground Pressure Piping: Pipe fitting.

B. Plastic-to-Metal Transition Fittings: CPVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Eslon Thermoplastics.

C. Plastic-to-Metal Transition Adaptors: One-piece fitting with manufacturer's SDR 11 equivalent dimensions; one end with threaded brass insert, and one solvent-cement-joint end.

1. Available Manufacturers:

a. Thompson Plastics, Inc.

D. Plastic-to-Metal Transition Unions: MSS SP-107, CPVC four-part union. Include brass end, solvent-cement-joint end, rubber O-ring, and union nut.

1. Available Manufacturers:

a. NIBCO INC.
b. NIBCO, Inc.; Chemtrol Div.

E. Flexible Transition Couplings for Underground Nonpressure Drainage Piping: ASTM C 1173 with elastomeric sleeve, ends same size as piping to be joined, and corrosion-resistant metal band on each end.

1. Available Manufacturers:

a. Cascade Waterworks Mfg. Co.
b. Fernco, Inc.
c. Mission Rubber Company.
d. Plastic Oddities, Inc.

2.05 DIELECTRIC FITTINGS

A. Description: Combination fitting of copper alloy and ferrous materials with threaded, solder-joint, plain, or weld-neck end connections that match piping system materials.

B. Insulating Material: Suitable for system fluid, pressure, and temperature.

C. Dielectric Unions: Factory-fabricated, union assembly, for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C).

1. Available Manufacturers:

a. Capitol Manufacturing Co.
b. Central Plastics Company.
c. Eclipse, Inc.
d. Epco Sales, Inc.
e. Hart Industries, International, Inc.
f. Watts Industries, Inc.; Water Products Div.
g. Zurn Industries, Inc.; Wilkins Div.

D. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure as required to suit system pressures.

1. Available Manufacturers:

   a. Capitol Manufacturing Co.
   b. Central Plastics Company.
   c. Epco Sales, Inc.
   d. Watts Industries, Inc.; Water Products Div.

E. Dielectric-Flange Kits: Companion-flange assembly for field assembly. Include flanges, full-face- or ring-type neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.

1. Available Manufacturers:

   a. Advance Products & Systems, Inc.
   b. Calpico, Inc.
   c. Central Plastics Company.
   d. Pipeline Seal and Insulator, Inc.

2. Separate companion flanges and steel bolts and nuts shall have 150- or 300-psig (1035- or 2070-kPa) minimum working pressure where required to suit system pressures.

F. Dielectric Couplings: Galvanized-steel coupling with inert and noncorrosive, thermoplastic lining; threaded ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:

   a. Calpico, Inc.
   b. Lochinvar Corp.

G. Dielectric Nipples: Electroplated steel nipple with inert and noncorrosive, thermoplastic lining; plain, threaded, or grooved ends; and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).

1. Available Manufacturers:

   a. Perfection Corp.
   b. Precision Plumbing Products, Inc.
   c. Sioux Chief Manufacturing Co., Inc.
   d. Victaulic Co. of America.
   e. <Insert manufacturer's name.>

2.06 MECHANICAL SLEEVE SEALS

A. Description: Modular sealing element unit, designed for field assembly, to fill annular space between pipe and sleeve.

1. Available Manufacturers:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Metraflex Co.
d. Pipeline Seal and Insulator, Inc.

2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
3. Pressure Plates: Stainless steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.07 SLEEVES

A. Galvanized-Steel Sheet: 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint.

B. Steel Pipe: ASTM A 53, Type E, Grade B, Schedule 40, galvanized, plain ends.

C. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

E. Molded PVC: Permanent, with nailing flange for attaching to wooden forms.

F. PVC Pipe: ASTM D 1785, Schedule 40.

G. Molded PE: Reusable, PE, tapered-cup shaped, and smooth-outer surface with nailing flange for attaching to wooden forms.

2.08 ESCUTCHEONS

A. Description: Manufactured wall and ceiling escutcheons and floor plates, with an ID to closely fit around pipe, tube, and insulation of insulated piping and an OD that completely covers opening.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with polished chrome-plated finish.

C. One-Piece, Cast-Brass Type: With set screw.

1. Finish: Polished chrome-plated.

D. Split-Casting, Cast-Brass Type: With concealed hinge and set screw.

1. Finish: Polished chrome-plated.

E. One-Piece, Stamped-Steel Type: With spring clips and chrome-plated finish.

F. Split-Casting, Floor-Plate Type: Cast brass with concealed hinge and set screw.

2.09 GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

1. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.01 PIPING SYSTEMS - COMMON REQUIREMENTS

A. Install piping according to the following requirements and Division 15 Sections specifying piping systems.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Install piping in concealed locations, unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

E. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

F. Install piping to permit valve servicing.

G. Install piping at indicated slopes.

H. Install piping free of sags and bends.

I. Install fittings for changes in direction and branch connections.

J. Install piping to allow application of insulation.

K. Select system components with pressure rating equal to or greater than system operating pressure.

L. Install escutcheons for penetrations of walls, ceilings, and floors according to the following:

1. New Piping:

   a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
   b. Chrome-Plated Piping: One-piece, cast-brass type with polished chrome-plated finish.
   c. Insulated Piping: One-piece, stamped-steel type with spring clips.
   d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished chrome-plated finish.
   e. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, stamped-steel type.
   f. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece or split-casting, cast-brass type with polished chrome-plated finish.
   g. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished chrome-plated rough-brass finish.
   h. Bare Piping in Equipment Rooms: One-piece, cast-brass type.
   i. Bare Piping at Floor Penetrations in Equipment Rooms: One-piece, floor-plate type.

M. Sleeves are not required for core-drilled holes.

N. Permanent sleeves are not required for holes formed by removable PE sleeves.

O. Install sleeves for pipes passing through concrete and masonry walls and concrete floor and roof slabs.

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 (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Install sleeves in new walls and slabs as new walls and slabs are constructed.
3. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. PVC or Steel Pipe Sleeves: For pipes smaller than NPS 6 (DN 150).
   b. Steel Sheet Sleeves: For pipes NPS 6 (DN 150) and larger, penetrating gypsum-board partitions.
   c. Stack Sleeve Fittings: For pipes penetrating floors with membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches (50 mm) above finished floor level. Refer to Division 7 Section "Sheet Metal Flashing and Trim" for flashing.

      1) Seal space outside of sleeve fittings with grout.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using joint sealants appropriate for size, depth, and location of joint. Refer to Division 7 Section "Joint Sealants" for materials and installation.

P. Aboveground, Exterior-Wall Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) and larger in diameter.
3. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

Q. Underground, Exterior-Wall Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Mechanical Sleeve Seal Installation: Select type and number of sealing elements required for pipe material and size. Position pipe in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pipe and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

R. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Refer to Division 7 Section "Through-Penetration Firestop Systems" for materials.

S. Verify final equipment locations for roughing-in.

T. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

3.02 PIPING JOINT CONSTRUCTION

A. Join pipe and fittings according to the following requirements and Division 15 Sections specifying piping systems.

B. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

C. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook," using lead-free solder alloy complying with ASTM B 32.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter, using copper-phosphorus brazing filler metal complying with AWS A5.8.

F. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

G. Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

H. Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.

I. Plastic Piping Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. CPVC Piping: Join according to ASTM D 2846/D 2846M Appendix.
4. PVC Pressure Piping: Join schedule number ASTM D 1785, PVC pipe and PVC socket fittings according to ASTM D 2672. Join other-than-schedule-number PVC pipe and socket fittings according to ASTM D 2855.
5. PVC Nonpressure Piping: Join according to ASTM D 2855.
6. PVC to ABS Nonpressure Transition Fittings: Join according to ASTM D 3138 Appendix.

J. Plastic Pressure Piping Gasketed Joints: Join according to ASTM D 3139.

K. Plastic Nonpressure Piping Gasketed Joints: Join according to ASTM D 3212.

L. 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.

M. Fiberglass Bonded Joints: Prepare pipe ends and fittings, apply adhesive, and join according to pipe manufacturer's written instructions.

3.03 PIPING CONNECTIONS

A. Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping NPS 2 (DN 50) and smaller, adjacent to each valve and at final connection to each piece of equipment.

2. Install flanges, in piping NPS 2-1/2 (DN 65) and larger, adjacent to flanged valves and at final connection to each piece of equipment.
3. Dry Piping Systems: Install dielectric unions and flanges to connect piping materials of dissimilar metals.
4. Wet Piping Systems: Install dielectric coupling and nipple fittings to connect piping materials of dissimilar metals.

3.04 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to allow maximum possible headroom unless specific mounting heights are not indicated.

B. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

C. Install mechanical equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations. Extend grease fittings to accessible locations. Maintain manufacturer's required service clearances.

D. Install equipment to allow right of way for piping installed at required slope.

3.05 PAINTING

A. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.06 CONCRETE BASES

A. Concrete Bases: Anchor equipment to concrete base according to equipment manufacturer's written instructions and according to seismic codes at Project.

1. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) 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 (450-mm) 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. Install anchor bolts according to anchor-bolt manufacturer's written instructions.
7. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.07 ERECTION OF METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 5 Section "Metal Fabrications" for structural steel.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

C. Field Welding: Comply with AWS D1.1.

3.08 ERECTION OF WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages to support, and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.09 GROUTING

A. Mix and install grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

END OF SECTION 15050

SECTION 15051

BASIC PLUMBING MATERIALS AND METHODS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

B. Related Sections include the following:

1. Section 15060 – Hangers and Supports.
2. Section 15083 – Pipe Insulation.
3. Section 15110 – Valves.
4. Section 15122 – Meters and Gages.
5. Section 15211 – General Service Compressed Air Piping
6. Section 15251 – General Service Compressed`Air Equipment
7. Section 15410 – Plumbing Fixtures.
8. Section 15412 – Emergency Plumbing Fixtures
9. Section 15430 – Plumbing Specialties.
10. Section 15440 – Domestic Water Piping.
11. Section 15441 – Water Distribution Pumps.
12. Section 15450 – Sanitary Waste and Vent Piping.
13. Section 15470 – Fuel Gas Piping.
14. Section 15486 – Fuel Fired Domestic Metal Heaters.

1.02 SUMMARY

A. This Section includes the following basic plumbing materials and methods to complement other Division 15 Sections.

1. Piping materials and installation instructions common to most piping systems.
2. Concrete base construction requirements.
3. Escutcheons.
4. Mechanical sleeve seals.
5. Equipment nameplate data requirements.
6. Labeling and identifying mechanical systems and equipment is specified in Division 15 Section "Mechanical Identification."
7. Nonshrink grout for equipment installations.
8. Field-fabricated metal and wood equipment supports.
9. Installation requirements common to equipment specification sections.
10. Cutting and patching.

B. Pipe and pipe fitting materials are specified in Division 15 piping system Sections.

C. This Contractor shall be responsible for firestopping all penetrations made under Division 15, in accordance with the requirements of Division 7.

1.03 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, crawl spaces, 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 gas piping and drains.

D. Concealed, Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings.

E. Concealed, Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

F. The following are industry abbreviations for rubber materials:

1. CR: Chlorosulfonated polyethylene synthetic rubber.
2. EPDM: Ethylene propylene diene terpolymer rubber.

1.04 SUBMITTALS

A. Product Data: For dielectric fittings, mechanical sleeve seals, and identification materials and devices.

B. Shop Drawings: Detail fabrication and installation for metal and wood supports and anchorage for plumbing materials and equipment.

C. Coordination Drawings: For access panel locations.

D. Coordination Drawings: Detail major elements, components, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Include the following:

1. Planned piping layout, including valve locations.
2. Clearances for servicing and maintaining equipment, accessories, and specialties, including space for disassembly required for periodic maintenance.
3. Equipment and accessory service connections and support details.
4. Exterior wall and foundation penetrations.
5. Fire-rated wall and floor penetrations.
6. Sizes and location of required concrete pads and bases.

7. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

1.05 QUALITY ASSURANCE

A. Comply with ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.

B. Equipment Selection: Equipment of higher electrical characteristics, physical dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. Additional costs shall be approved in advance by appropriate Contract Modification for these increases. If minimum energy ratings or efficiencies of equipment are specified, equipment must meet design and commissioning requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver pipes and tubes with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor, if stored inside.

C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate plumbing equipment installation with other building components.

B. Arrange for pipe spaces, chases, slots, and openings in building structure during progress of construction to allow for piping installations.

C. Coordinate installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.

D. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning before closing in building.

E. Coordinate connection of plumbing systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.

F. Coordinate requirements for access panels and doors if plumbing items requiring access are concealed behind finished surfaces. Access panels and doors are specified in Division 8 Section "Access Doors."

G. Coordinate installation of identifying devices after completing covering and painting, if devices are applied to surfaces. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Mechanical Sleeve Seals:

a. Calpico, Inc.
b. Metraflex Co.
c. Thunderline/Link-Seal.

2.02 PIPE AND PIPE FITTINGS

A. Refer to individual Division 15 piping Sections for pipe and fitting materials and joining methods.

B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.03 JOINING MATERIALS

A. Refer to individual Division 15 piping Sections for special joining materials not listed below.

B. Solder Filler Metals: ASTM B 813, ASTM B 32.

1. Use ASTM B 813 water flushable, lead-free flux; use ASTM B 32, lead-free-alloy solder; and ASTM B 828 procedure, unless otherwise noted.

C. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.04 MECHANICAL SLEEVE SEALS

A. Description: Modular design, with interlocking rubber links shaped to continuously fill annular space between pipe and sleeve. Include connecting bolts and pressure plates.

2.05 PIPING SPECIALTIES

A. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Pipe: ASTM A 53, Type E, Grade A, Schedule 40, galvanized, plain ends.
2. Cast Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

B. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type if required to conceal protruding fittings and sleeves.

1. ID: Closely fit around pipe, tube, and insulation of insulated piping.
2. OD: Completely cover opening.
3. Cast Brass: One piece, with set screw.
   a. Finish: Chrome-plated.
4. Cast Brass: Split casting, with concealed hinge and set screw.
   a. Finish: Chrome plated.
5. Stamped Steel: One piece, with set screw and chrome-plated finish.
6. Cast-Iron Floor Plate: One-piece casting.

2.06 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. If more than one type is specified for application, selection is Installer's option, but provide one selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.

1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
2. Location: Accessible and visible location.

C. Pressure-Sensitive Pipe Markers: Manufacturer's standard preprinted, permanent adhesive, color-coded, pressure-sensitive vinyl, complying with ASME A13.1.

2.07 GROUT

A. Nonshrink, Nonmetallic Grout: ASTM C 1107, Grade B.

1. Characteristics: Post-hardening, volume-adjusting, dry, hydraulic-cement grout, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.
2. Design Mix: 5000-psig (34.5-MPa), 28-day compressive strength.
3. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, unless piping Sections specify otherwise. Individual Division 15 piping Sections specify unique piping installation requirements.

B. General Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size

pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, unless deviations to layout are approved on Coordination Drawings.

C. Install piping at indicated slope.

D. Install components with pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior piping at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch (25-mm) clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's written instructions.

M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings.

N. Sleeves are not required for core drilled holes.

O. Install sleeves for pipes passing through concrete and masonry walls, and concrete floor and roof slabs.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, and concrete floor and roof slabs.

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 (50 mm) above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.

2. Build sleeves into new walls and slabs as work progresses.
3. Install sleeves large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:

   a. Steel Pipe Sleeves: For pipes smaller than 6-inch NPS (DN150).

b. Steel, Sheet-Metal Sleeves: For pipes 6-inch NPS (DN150) and larger, penetrating gypsum-board partitions.

4. Except for underground wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants. Refer to Division 7 Section "Joint Sealants" for materials.
5. Use Type S, Grade NS, Class 25, Use O, neutral-curing silicone sealant, unless otherwise indicated.

Q. Aboveground, Exterior-Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Install steel pipe for sleeves smaller than 6 inches (150 mm) in diameter.
2. Install cast-iron "wall pipes" for sleeves 6 inches (150 mm) in diameter and larger.
3. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

R. Underground, Exterior-Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

1. Assemble and install mechanical sleeve seals according to manufacturer's written instructions. Tighten bolts that cause rubber sealing elements to expand and make watertight seal.

S. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping materials. Refer to Division 7 Section "Firestopping" for materials.

T. Verify final equipment locations for roughing-in.

U. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

V. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping specification Sections:

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
3. Soldered Joints: Construct joints according to AWS's "Soldering Manual," Chapter "The Soldering of Pipe and Tube"; or CDA's "Copper Tube Handbook."
4. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

a. Note internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
b. Apply appropriate tape or thread compound to external pipe threads, unless dry seal threading is specified.
c. Align threads at point of assembly.
d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
e. 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.

W. Piping Connections: Make connections according to the following, unless otherwise indicated:

1. Install unions, in piping 2-inch NPS (DN50) and smaller, adjacent to each valve and at final connection to each piece of equipment with 2-inch NPS (DN50) or smaller threaded pipe connection.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide maximum possible headroom, if mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to Contracting Officer.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, unless otherwise indicated.

D. Install plumbing equipment to facilitate service, maintenance, and repair or replacement of components. Connect equipment for ease of disconnecting, with minimum interference to other installations.

E. Install equipment giving right of way to piping installed at required slope.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow.

1. Stenciled Markers: According to ASME A13.1.
2. Plastic markers, with application systems. Install on insulation.
3. Locate pipe markers as follows if piping is exposed in finished spaces, machine rooms, and accessible maintenance spaces, such as shafts, tunnels, plenums, and exterior nonconcealed locations:

a. Near each valve and control device.
b. Near each branch, excluding short takeoffs for fixtures. Mark each pipe at branch, if flow pattern is not obvious.
c. Near locations if pipes pass through walls, floors, ceilings, or enter nonaccessible enclosures.

d. At access doors, manholes, and similar access points that permit view of concealed piping.
e. Near major equipment items and other points of origination and termination.
f. Spaced at maximum of 50-foot (15-m) intervals along each run. Reduce intervals to 25 feet (7.5 m) in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Adjusting: Relocate identifying devices as necessary for unobstructed view in finished construction.

3.4 PAINTING AND FINISHING

A. Refer to Division 9 Section "Painting" for paint materials, surface preparation, and application of paint.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

2. Interior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.

3. Exterior, Ferrous Piping: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

4. Exterior, Ferrous Supports: Use semigloss, acrylic-enamel finish. Include two finish coats over rust-inhibitive metal primer.

C. Do not paint piping specialties with factory-applied finish.

D. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES

A. Construct concrete bases of dimensions indicated, but not less than 4 inches (100 mm) larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000-psig (20.7-MPa), 28-day compressive-strength concrete and reinforcement as specified in Division 3 Section "Cast-in-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE

A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.

B. Field Welding: Comply with AWS D1.1, "Structural Welding Code--Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.

B. Select fastener sizes that will not penetrate members if opposite side will be exposed to view or will receive finish materials. Tighten connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair cut surfaces to match adjacent surfaces.

3.9 GROUTING

A. Install nonmetallic, nonshrink, grout for mechanical equipment base bearing surfaces, pump and other equipment base plates, and anchors. Mix grout according to manufacturer's written instructions.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placing of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases to provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout according to manufacturer's written instructions.

END OF SECTION 15051

SECTION 15055

MOTORS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes basic requirements for factory-installed and field-installed motors.

B. Related Sections include the following:

1. Division 15 Section "Mechanical Vibration and Seismic Controls" for mounting motors and vibration isolation and seismic-control devices.
2. Division 15 Sections for application of motors and reference to specific motor requirements for motor-driven equipment.

1.03 DEFINITIONS

A. Factory-Installed Motor: A motor installed by motorized-equipment manufacturer as a component of equipment.

B. Field-Installed Motor: A motor installed at Project site and not factory installed as an integral component of motorized equipment.

1.04 SUBMITTALS

A. Product Data for Field-Installed Motors: For each type and size of motor, provide nameplate data and ratings; shipping, installed, and operating weights; mounting arrangements; size, type, and location of winding terminations; conduit entry and ground lug locations; and information on coatings or finishes.

B. Shop Drawings for Field-Installed Motors: Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Include the following:

1. Each installed unit's type and details.
2. Nameplate legends.
3. Diagrams of power and control wiring. Provide schematic wiring diagram for each type of motor and for each control scheme.

C. Coordination Drawings: Floor plans showing dimensioned layout, required working clearances, and required area above and around field-installed motors. Show motor layout, mechanical

power transfer link, driven load, and relationship between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.

D. Manufacturer Seismic Qualification Certification: Submit certification that motors, accessories, and components will withstand seismic forces defined in Division 15 Section "Mechanical Vibration and Seismic Controls." Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."
   b. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

2. Dimensioned Outline Drawings of Motorized Equipment: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Qualification Data: For testing agency.

F. Test Reports: Written reports specified in Parts 2 and 3.

G. Operation and Maintenance Data: For field-installed motors to include in emergency, operation, and maintenance manuals.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

B. Source Limitations: Obtain field-installed motors of a single type through one source from a single manufacturer.

C. Product Options for Field-Installed Motors: Drawings indicate size, profiles, and dimensional requirements of motors and are based on the specific system indicated. Refer to Division 1 Section "Product Requirements."

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

E. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Government or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify Contracting Officer at least two days in advance of proposed utility interruptions. Identify extent and duration of utility interruptions.
2. Indicate method of providing temporary utilities.
3. Do not proceed with utility interruptions without Contracting Officer's written permission.

1.07 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices. Provide motors that are:

1. Compatible with the following:

a. Magnetic controllers.
b. Multispeed controllers.
c. Reduced-voltage controllers.

2. Designed and labeled for use with variable frequency controllers, and suitable for use throughout speed range without overheating.
3. Matched to torque and horsepower requirements of the load.
4. Matched to ratings and characteristics of supply circuit and required control sequence.

B. Coordinate motor support with requirements for driven load; access for maintenance and motor replacement; installation of accessories, belts, belt guards; and adjustment of sliding rails for belt tensioning.

C. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section.

PART 2 - PRODUCTS

2.01 MOTOR REQUIREMENTS

A. Motor requirements apply to factory-installed and field-installed motors except as follows:

1. Different ratings, performance, or characteristics for a motor are specified in another Section.
2. Manufacturer for a factory-installed motor requires ratings, performance, or characteristics, other than those specified in this Section, to meet performance specified.

2.02 MOTOR CHARACTERISTICS

A. Motors 1/2 HP and Larger: Three phase.

B. Motors Smaller Than 1/2 HP: Single phase.

C. Frequency Rating: 60 Hz.

D. Voltage Rating: NEMA standard voltage selected to operate on nominal circuit voltage to which motor is connected.

E. Service Factor: 1.15 for open dripproof motors; 1.0 for totally enclosed motors.

F. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3300 feet (1005 m) above sea level.

G. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

H. Enclosure: Open dripproof.

2.03 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Premium efficiency.

C. Stator: Copper windings, unless otherwise indicated.

1. Multispeed motors shall have separate winding for each speed.

D. Rotor: Squirrel cage, unless otherwise indicated.

E. Bearings: Double-shielded, prelubricated ball bearings suitable for radial and thrust loading.

F. Temperature Rise: Match insulation rating, unless otherwise indicated.

G. Insulation: Class F, unless otherwise indicated.

H. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or G.
2. Motors Smaller Than 15 HP: Manufacturer's standard starting characteristic.

I. Enclosure: Cast iron for motors 7.5 hp and larger; rolled steel for motors smaller than 7.5 hp.

1. Finish: Gray enamel.

2.04 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Inrush Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Designed with critical vibration frequencies outside operating range of controller output.
2. Temperature Rise: Matched to rating for Class B insulation.
3. Insulation: Class H.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

C. Rugged-Duty Motors: Totally enclosed, with 1.25 minimum service factor, greased bearings, integral condensate drains, and capped relief vents. Windings insulated with nonhygroscopic material.

1. Finish: Chemical-resistant paint over corrosion-resistant primer.

D. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

2.05 SINGLE-PHASE MOTORS

A. Type: One of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split-phase start, capacitor run.
3. Capacitor start, capacitor run.

B. Shaded-Pole Motors: For motors 1/20 hp and smaller only.

C. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

D. Bearings: Ball type for belt-connected motors and other motors with high radial forces on motor shaft; sealed, prelubricated-sleeve type for other single-phase motors.

E. Source Quality Control: Perform the following tests on each motor according to NEMA MG 1:

1. Measure winding resistance.
2. Read no-load current and speed at rated voltage and frequency.
3. Measure locked rotor current at rated frequency.
4. Perform high-potential test.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas to receive field-installed motors for compliance with requirements, installation tolerances, and other conditions affecting performance.

B. Examine roughing-in of conduit systems to verify actual locations of conduit connections before motor installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 MOTOR INSTALLATION

A. Anchor each motor assembly to base, adjustable rails, or other support, arranged and sized according to manufacturer's written instructions. Attach by bolting. Level and align with load transfer link.

B. Install motors on concrete bases complying with Division 3.

C. Comply with mounting and anchoring requirements specified in Division 15 Section "Mechanical Vibration and Seismic Controls."

3.03 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Run each motor with its controller. Demonstrate correct rotation, alignment, and speed at motor design load.
2. Test interlocks and control features for proper operation.
3. Verify that current in each phase is within nameplate rating.

B. Testing: Government will engage a qualified testing agency to perform the following field quality-control testing:

C. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

D. Testing: Perform the following field quality-control testing:

1. Perform each electrical test and visual and mechanical inspection stated in NETA ATS, Section 7.15.1. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

E. Manufacturer's Field Service: Engage a factory-authorized service representative to perform the following:

1. Inspect field-assembled components, equipment installation, and piping and electrical connections for compliance with requirements.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Verify bearing lubrication.
4. Verify proper motor rotation.
5. Test Reports: Prepare a written report to record the following:

   a. Test procedures used.
   b. Test results that comply with requirements.
   c. Test results that do not comply with requirements and corrective action taken to achieve compliance.

3.04 ADJUSTING

A. Align motors, bases, shafts, pulleys and belts. Tension belts according to manufacturer's written instructions.

3.05 CLEANING

A. After completing equipment installation, inspect unit components. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean motors, on completion of installation, according to manufacturer's written instructions.

END OF SECTION 15055

SECTION 15060

HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes hangers and supports for mechanical system piping and equipment.

B. Related Sections include the following:

1. Division 5 Section "Metal Fabrications" for materials for attaching hangers and supports to building structure.
2. Division 13 Sections on fire-suppression piping for fire-suppression pipe hangers.
3. Division 15 Section "Mechanical Vibration Controls and Seismic Restraints" for vibration isolation and seismic restraint devices.

1.03 DEFINITIONS

A. MSS: Manufacturers Standardization Society for the Valve and Fittings Industry.

B. Terminology: As defined in MSS SP-90, "Guidelines on Terminology for Pipe Hangers and Supports."

1.04 PERFORMANCE REQUIREMENTS

A. Design channel support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

B. Design heavy-duty steel trapezes for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

C. Design seismic restraint hangers and supports for piping and equipment.

D. Design and obtain approval from authorities having jurisdiction for seismic restraint hangers and supports for piping and equipment.

1.05 SUBMITTALS

A. Product Data: For each type of pipe hanger, channel support system component, and thermal-hanger shield insert indicated.

B. Shop Drawings: Signed and sealed by a qualified professional engineer for multiple piping supports and trapeze hangers. Include design calculations and indicate size and characteristics of components and fabrication details.

C. Welding Certificates: Copies of certificates for welding procedures and operators.

1.06 QUALITY ASSURANCE

A. Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Engineering Responsibility: Design and preparation of Shop Drawings and calculations for each multiple pipe support, trapeze, and seismic restraint by a qualified professional engineer.

1. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of hangers and supports that are similar to those indicated for this Project in material, design, and extent.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Pipe Hangers:

a. Carpenter & Patterson, Inc.
b. Grinnell Corp.
c. National Pipe Hanger Corp.

2. Channel Support Systems:

a. Grinnell Corp.; Power-Strut Unit.
b. National Pipe Hanger Corp.
c. Unistrut Corp.

3. Thermal-Hanger Shield Inserts:

a. Carpenter & Patterson, Inc.
b. Pipe Shields, Inc.
c. Value Engineered Products, Inc.

4. Powder-Actuated Fastener Systems:

a. Gunnebo Fastening Corp.

b. Hilti, Inc.
c. ITW Ramset/Red Head.
d. Masterset Fastening Systems, Inc.

2.02 MANUFACTURED UNITS

A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.

1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

B. Channel Support Systems: MFMA-2, factory-fabricated components for field assembly.

1. Coatings: Manufacturer's standard finish, unless bare metal surfaces are indicated.
2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

C. Thermal-Hanger Shield Inserts: 100-psi (690-kPa) minimum compressive-strength insulation, encased in sheet metal shield.

1. Material for Cold Piping: ASTM C 552, Type I cellular glass with vapor barrier.
2. Material for Hot Piping: ASTM C 552, Type I cellular glass.
3. For Trapeze or Clamped System: Insert and shield cover entire circumference of pipe.
4. For Clevis or Band Hanger: Insert and shield cover lower 180 degrees of pipe.
5. Insert Length: Extend 2 inches (50 mm) beyond sheet metal shield for piping operating below ambient air temperature.

2.03 MISCELLANEOUS MATERIALS

A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.

C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.

D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.

1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
2. Properties: Nonstaining, noncorrosive, and nongaseous.
3. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

PART 3 - EXECUTION

3.01 HANGER AND SUPPORT APPLICATIONS

A. Specific hanger requirements are specified in Sections specifying equipment and systems.

B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.

C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification 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 (DN15 to DN750).
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F (49 to 232 deg C) pipes, NPS 4 to NPS 16 (DN100 to DN400), requiring up to 4 inches (100 mm) of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24 (DN20 to DN600), requiring clamp flexibility and up to 4 inches (100 mm) of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24 (DN15 to DN600), if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4 (DN15 to DN100), to allow off-center closure for hanger installation before pipe erection.
6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8 (DN20 to DN200).
7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8 (DN15 to DN200).
9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2 (DN15 to DN50).
10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8 (DN10 to DN200).
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3 (DN10 to DN80).
12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30 (DN15 to DN750).
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36 (DN100 to DN900), with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.

16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36 (DN65 to DN900), if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30 (DN25 to DN750), from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20 (DN65 to DN500), from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42 (DN50 to DN1050), if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24 (DN50 to DN600), if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30 (DN50 to DN750), if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20 (DN20 to DN500), if longer ends are required for riser clamps.

E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) 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 (49 to 232 deg C) piping installations.

F. Building Attachments: Unless otherwise indicated and except as specified in piping system Specification 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 I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (675 kg).
    c. Heavy (MSS Type 33): 3000 lb (1350 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where head room is limited.

G. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Specification 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 by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe, 360-degree insert of high-density, 100-psi (690-kPa) minimum compressive-strength, water-repellent-treated calcium silicate or cellular-glass pipe insulation, same thickness as adjoining insulation with vapor barrier and encased in 360-degree sheet metal shield.

H. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches (32 mm).
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41 roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from hanger.

6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to absorb expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

3.02 HANGER AND SUPPORT INSTALLATION

A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Channel Support System Installation: Arrange for grouping of parallel runs of piping and support together on field-assembled channel systems.

1. Field assemble and install according to manufacturer's written instructions.

C. Heavy-Duty Steel Trapeze Installation: Arrange for grouping of parallel runs of horizontal piping and support together on field-fabricated, heavy-duty trapezes.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified above for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, steel shapes selected for loads being supported. Weld steel according to AWS D-1.1.

D. Install building attachments within concrete slabs or attach to structural steel. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional attachments at concentrated loads, including valves, flanges, guides, strainers, and expansion joints, 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.

E. Install powder-actuated drive-pin fasteners 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.

F. Install mechanical-anchor fasteners in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

G. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.

H. 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.

I. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and so maximum pipe deflections allowed by ASME B31.9, "Building Services Piping," is not exceeded.

K. Insulated Piping: Comply with the following:

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 according to ASME B31.9.

2. Install MSS SP-58, Type 39 protection saddles, if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) 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 arc of 180 degrees.

   a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 (DN100) 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 (DN8 to DN90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.
   b. NPS 4 (DN100): 12 inches (305 mm) long and 0.06 inch (1.52 mm) thick.
   c. NPS 5 and NPS 6 (DN125 and DN150): 18 inches (457 mm) long and 0.06 inch (1.52 mm) thick.

5. Insert Material: Length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.03 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure above or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make smooth bearing surface.

3.04 METAL FABRICATION

A. Cut, drill, and fit miscellaneous metal fabrications for heavy-duty steel trapezes 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 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 contours of welded surfaces match adjacent contours.

3.05 ADJUSTING

A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.06 PAINTING

A. Touching Up: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal are specified in Division 9 Section "Painting."

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 15060

SECTION 15071

MECHANICAL VIBRATION AND SEISMIC CONTROLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following:

1. Elastomeric isolation pads and mounts.
2. Restrained elastomeric isolation mounts.
3. Freestanding and restrained spring isolators.
4. Housed spring mounts.
5. Elastomeric hangers.
6. Spring hangers.
7. Spring hangers with vertical-limit stops.
8. Thrust limits.
9. Pipe riser resilient supports.
10. Resilient pipe guides.
11. Restrained vibration isolation roof-curb rails.
12. Seismic snubbers.
13. Restraining cables.

1.03 PERFORMANCE REQUIREMENTS

A. Mechanical system supports shall be designed and installed for thee seismic forces in accordance with the Connecticut State Building Code.

1.04 SUBMITTALS

A. Product Data: Include load deflection curves for each vibration isolation device.

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Include the following:

1. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
2. Riser Supports: Include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on building structure, spring deflection changes, and seismic loads. Include certification that riser system has been examined for excessive stress and that none will exist.
3. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include auxiliary motor slides and

rails, base weights, equipment static loads, power transmission, component misalignment, and cantilever loads.

4. Seismic-Restraint Details: Detail fabrication and attachment of seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.
5. Submittals for Interlocking Snubbers: Include load deflection curves up to 1/2-inch (13-mm) deflection in x, y, and z planes.

C. Welding certificates.

D. Manufacturer Seismic Qualification Certification: Submit certification that all specified equipment will withstand seismic forces identified in "Performance Requirements" Article above. Include the following:

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.

   a. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified."

2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.05 QUALITY ASSURANCE

A. Seismic-restraint devices shall have horizontal and vertical load testing and analysis performed according to OSHPD and shall bear anchorage preapproval "R" number, from OSHPD or another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer. Testing and calculations must include both shear and tensile loads and 1 test or analysis at 45 degrees to the weakest mode.

B. Welding: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code--Steel."

1.06 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into base. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 7 Section "Roof Accessories."

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Seismic Snubber Units: Furnish replacement neoprene inserts for all snubbers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by the manufacturers specified.

2.02 VIBRATION ISOLATORS

A. Available Manufacturers:

1. Ace Mounting Co., Inc.
2. Amber/Booth Company, Inc.
3. B-Line Systems, Inc.
4. Mason Industries, Inc.
5. Vibration Eliminator Co., Inc.
6. Vibration Isolation Co., Inc.
7. Vibration Mountings & Controls/Korfund.

B. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

1. Material: Standard neoprene or natural rubber.

C. Elastomeric Mounts: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements with factory-drilled, encapsulated top plate for bolting to equipment and with baseplate for bolting to structure. Color-code or otherwise identify to indicate capacity range.

D. Restrained Elastomeric Mounts <Insert Drawing Designation>: All-directional elastomeric mountings with seismic restraint.

1. Materials: Cast-ductile-iron housing containing two separate and opposing, molded, bridge-bearing neoprene elements that prevent central threaded sleeve and attachment bolt from contacting the casting during normal operation.

E. Spring Isolators: Freestanding, laterally stable, open-spring isolators.

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory drilled for bolting to structure and bonded to 1/4-inch- (6-mm-) thick, rubber isolator pad attached to baseplate underside. Baseplates shall limit floor load to 100 psig (690 kPa).
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

F. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

1. Housing: Steel with resilient vertical-limit stops to prevent spring extension due to wind loads or if weight is removed; factory-drilled baseplate bonded to 1/4-inch- (6-mm-) thick, elastomeric isolator pad attached to baseplate underside; and adjustable equipment mounting and leveling bolt that acts as blocking during installation.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

G. Housed Spring Mounts: Housed spring isolator with integral seismic snubbers.

1. Housing: Ductile-iron or steel housing to provide all-directional seismic restraint.
2. Base: Factory drilled for bolting to structure.
3. Snubbers: Vertically adjustable to allow a maximum of 1/4-inch (6-mm) travel before contacting a resilient collar.

H. Elastomeric Hangers: Double-deflection type, with molded, oil-resistant rubber or neoprene isolator elements bonded to steel housings with threaded connections for hanger rods. Color-code or otherwise identify to indicate capacity range.

I. Spring Hangers: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression.

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 the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

J. Spring Hangers with Vertical-Limit Stop: Combination coil-spring and elastomeric-insert hanger with spring and insert in compression and with a vertical-limit stop.

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 the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.

K. Thrust Limits: Combination coil spring and elastomeric insert with spring and insert in compression and with a load stop. Include rod and angle-iron brackets for attaching to equipment.

1. Frame: Steel, fabricated for connection to threaded rods and to allow for a maximum of 30 degrees of angular rod misalignment without binding or reducing isolation efficiency.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Elastomeric Element: Molded, oil-resistant rubber or neoprene.
7. Coil Spring: Factory set and field adjustable for a maximum of 1/4-inch (6-mm) movement at start and stop.

L. Pipe Riser Resilient Support: All-directional, acoustical pipe anchor consisting of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick, 60-durometer neoprene. Include steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions. Design support for a maximum load on the isolation material of 500 psig (3.45 MPa) and for equal resistance in all directions.

M. Resilient Pipe Guides: Telescopic arrangement of 2 steel tubes separated by a minimum of 1/2-inch- (13-mm-) thick, 60-durometer neoprene. Factory set guide height with a shear pin to

allow vertical motion due to pipe expansion and contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.03 RESTRAINED VIBRATION ISOLATION ROOF-CURB RAILS

A. Available Manufacturers:

1. Amber/Booth Company, Inc.
2. Mason Industries, Inc.
3. Vibration Eliminator Co., Inc.
4. Vibration Isolation Co., Inc.
5. Vibration Mountings & Controls/Korfund.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand 125-mph (56-m/s) wind impinging laterally against side of equipment.

C. Lower Support Assembly: Sheet-metal "Z" section containing adjustable and removable steel springs that support upper floating frame. Upper frame shall provide continuous support for equipment and shall be captive to resiliently resist wind and seismic forces. Lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches (50 mm) of rigid, glass-fiber insulation on inside of assembly.

D. Spring Isolators: Adjustable, restrained spring isolators shall be mounted on 1/4-inch- (6-mm-) thick, elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

1. Restrained Spring Isolators: Freestanding, steel, open-spring isolators with seismic restraint.

a. Housing: Steel with resilient vertical-limit stops and adjustable equipment mounting and leveling bolt.
b. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
c. Minimum Additional Travel: 50 percent of the required deflection at rated load.
d. Lateral Stiffness: More than 80 percent of the rated vertical stiffness.
e. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2. Elastomeric Isolator Pads: Oil- and water-resistant elastomer or natural rubber, arranged in single or multiple layers, molded with a nonslip pattern and galvanized steel baseplates of sufficient stiffness for uniform loading over pad area, and factory cut to sizes that match requirements of supported equipment.

a. Material: Standard neoprene or natural rubber.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch (6 mm) thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counterflashed over roof materials.

2.04 SEISMIC-RESTRAINT DEVICES

A. Available Manufacturers:

1. Amber/Booth Company, Inc.
2. B-Line Systems, Inc.
3. Mason Industries, Inc.
4. Vibration Eliminator Co., Inc.
5. Vibration Isolation Co., Inc.
6. Vibration Mountings & Controls/Korfund.

B. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40 50 60, plus or minus 5, with a flat washer face.

C. Seismic Snubbers: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: 1-piece, molded, bridge-bearing neoprene complying with AASHTO M 251 and having a durometer of 40 50 60, plus or minus 5.

D. Restraining Cables: Galvanized steel aircraft cables with end connections made of steel assemblies that swivel to final installation angle and utilize two clamping bolts for cable engagement.

E. Anchor Bolts: Seismic-rated, drill-in, and stud-wedge or female-wedge type. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488/E 488M.

2.05 VIBRATION ISOLATION EQUIPMENT BASES

A. Available Manufacturers:

B. Manufacturers:

1. Amber/Booth Company, Inc.
2. Mason Industries, Inc.
3. Vibration Eliminator Co., Inc.
4. Vibration Isolation Co., Inc.
5. Vibration Mountings & Controls/Korfund.

C. Steel Base: Factory-fabricated, welded, structural-steel bases and rails.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. 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 angles on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Inertia Base: Factory-fabricated, welded, structural-steel bases and rails ready for field-applied, cast-in-place concrete.

1. Design Requirements: Lowest possible mounting height with not less than 1-inch (25-mm) clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. 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 angles 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.

2.06 FACTORY FINISHES

A. 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 electrogalvanized. Hot-dip galvanize metal components for exterior use.
3. Baked enamel 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

3.01 EXAMINATION

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

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install roof curbs, equipment supports, and roof penetrations as specified in Division 7 Section "Roof Accessories."

B. Install thrust limits at centerline of thrust, symmetrical on either side of equipment.

C. Install seismic snubbers on isolated equipment. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

D. Install restraining cables at each trapeze and individual pipe hanger. At trapeze anchor locations, shackle piping to trapeze. Install cables so they do not bend across sharp edges of adjacent equipment or building structure.

E. Install steel angles or channel, sized to prevent buckling, clamped with ductile-iron clamps to hanger rods for trapeze and individual pipe hangers. At trapeze anchor locations, shackle piping to trapeze. Requirements apply equally to hanging equipment. Do not weld angles to rods.

F. Install resilient bolt isolation washers on equipment anchor bolts.

3.03 FIELD QUALITY CONTROL

A. Testing: Government will engage a qualified testing agency to perform the following field quality-control testing:

B. Testing: Engage a qualified testing agency to perform the following field quality-control testing:

C. Testing: Perform the following field quality-control testing:

1. Isolator seismic-restraint clearance.
2. Isolator deflection.
3. Snubber minimum clearances.
4. Air-Mounting System Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
5. Air-Mounting System Operational Test: Test the compressed-air leveling system. Remove malfunctioning units, replace with new units, and retest.
6. Test and adjust air-mounting system controls and safeties. Replace damaged and malfunctioning controls and equipment.

3.04 ADJUSTING

A. Adjust isolators after piping systems have been filled and equipment is at operating weight.

B. Adjust limit stops on restrained spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

C. Attach thrust limits at centerline of thrust and adjust to a maximum of 1/4-inch (6-mm) movement during start and stop.

D. Adjust air spring leveling mechanism.

E. Adjust active height of spring isolators.

F. Adjust snubbers according to manufacturer's written recommendations.

G. Adjust seismic restraints to permit free movement of equipment within normal mode of operation.

H. Torque anchor bolts according to equipment manufacturer's written recommendations to resist seismic forces.

3.05 CLEANING

A. After completing equipment installation, inspect vibration isolation and seismic-control devices. Remove paint splatters and other spots, dirt, and debris.

END OF SECTION 15071

SECTION 15075

MECHANICAL IDENTIFICATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes the following mechanical identification materials and their installation:

1. Equipment nameplates.
2. Access panel and door markers.
3. Pipe markers.
4. Duct markers.
5. Valve tags.
6. Valve schedules.
7. Warning tags.

1.03 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. Valve numbering scheme.

D. Valve Schedules: For each piping system. Furnish extra copies (in addition to mounted copies) to include in maintenance manuals.

1.04 QUALITY ASSURANCE

A. ASME Compliance: Comply with ASME A13.1, "Scheme for the Identification of Piping Systems," for letter size, length of color field, colors, and viewing angles of identification devices for piping.

1.05 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 location of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 EQUIPMENT IDENTIFICATION DEVICES

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.

1. Data:

a. Manufacturer, product name, model number, and serial number.
b. Capacity, operating and power characteristics, and essential data.
c. Labels of tested compliances.

2. Location: Accessible and visible.
3. Fasteners: As required to mount on equipment.

B. Access Panel and Door Markers: 1/16-inch- (1.6-mm-) thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch (3.2-mm) center hole for attachment.

1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.02 PIPING IDENTIFICATION DEVICES

A. Manufactured Pipe Markers, General: Preprinted, color-coded, with lettering indicating service, and showing direction of flow.

1. Colors: Comply with ASME A13.1, unless otherwise indicated.
2. Lettering: Use piping system terms indicated and abbreviate only as necessary for each application length.
3. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Full-band pipe markers extending 360 degrees around pipe at each location.
4. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Either full-band or strip-type pipe markers at least three times letter height and of length required for label.
5. Arrows: Integral with piping system service lettering to accommodate both directions; or as separate unit on each pipe marker to indicate direction of flow.

B. Pretensioned Pipe Markers: Precoiled semirigid plastic formed to cover full circumference of pipe and to attach to pipe without adhesive.

C. Shaped Pipe Markers: Preformed semirigid plastic formed to partially cover circumference of pipe and to attach to pipe with mechanical fasteners that do not penetrate insulation vapor barrier.

2.03 DUCT IDENTIFICATION DEVICES

A. Duct Markers: Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

2.04 VALVE TAGS

A. Valve Tags: Stamped or engraved with 1/4-inch (6.4-mm) letters for piping system abbreviation and 1/2-inch (13-mm) numbers, with numbering scheme approved by Contracting Officer. Provide 5/32-inch (4-mm) hole for fastener.

1. Material: 0.032-inch- (0.8-mm-) thick brass.
2. Valve-Tag Fasteners: Brass wire-link or beaded chain; or S-hook.

2.05 VALVE SCHEDULES

A. Valve Schedules: For each piping system, on standard-size 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-Schedule Frames: Glazed display frame for removable mounting on masonry walls for each page of valve schedule. Include mounting screws.
2. Frame: Extruded aluminum.
3. Glazing: ASTM C 1036, Type I, Class 1, Glazing Quality B, 2.5-mm, single-thickness glass.

2.06 WARNING TAGS

A. Warning Tags: Preprinted or partially preprinted, accident-prevention tags; of plasticized card stock with matte finish suitable for writing.

1. Size: Approximately 4 by 7 inches (100 by 178 mm).
2. Fasteners: Brass grommet and wire.
3. Nomenclature: Large-size primary caption such as DANGER, CAUTION, or DO NOT OPERATE.
4. Color: Yellow background with black lettering.

PART 3 - EXECUTION

3.01 APPLICATIONS, GENERAL

A. Products specified are for applications referenced in other Division 15 Sections. If more than single-type material, device, or label is specified for listed applications, selection is Installer's option.

3.02 EQUIPMENT IDENTIFICATION

A. Install and permanently fasten equipment nameplates on each major item of mechanical equipment that does not have nameplate or has nameplate that is damaged or located where not easily visible. Locate nameplates where accessible and visible. Include nameplates for the following general categories of equipment:

1. Fuel-burning units, including boilers and heaters.
2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
3. Coils, evaporators and similar equipment.
4. Fans, blowers, primary balancing dampers, and mixing boxes.
5. Packaged HVAC central-station and zone-type units.

B. Install access panel markers with screws on equipment access panels.

3.03 PIPING IDENTIFICATION

A. Install manufactured pipe markers indicating service on each piping system. Install with flow indication arrows showing direction of flow.

1. Pipes with OD, Including Insulation, Less Than 6 Inches (150 mm): Pretensioned pipe markers. Use size to ensure a tight fit.
2. Pipes with OD, Including Insulation, 6 Inches (150 mm) and Larger: Shaped pipe markers. Use size to match pipe and secure with fasteners.

B. Locate pipe markers where piping is exposed in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior nonconcealed 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 nonaccessible 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 (15 m) along each run. Reduce intervals to 25 feet (7.6 m) in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced markers.

3.04 DUCT IDENTIFICATION

A. Install duct markers with permanent adhesive on air ducts in the following color codes:

1. Green: For supply ducts.
2. Blue: For exhaust-, outside-, relief-, return-, and mixed-air ducts.
3. ASME A13.1 Colors and Designs: For hazardous material exhaust.
4. Letter Size: Minimum 1/4 inch (6.4 mm) for name of units if viewing distance is less than 24 inches (600 mm), 1/2 inch (13 mm) for viewing distances up to 72 inches (1830

mm), and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

B. Locate markers near points where ducts enter into concealed spaces and at maximum intervals of 50 feet (15 m) in each space where ducts are exposed or concealed by removable ceiling system.

3.05 VALVE-TAG INSTALLATION

A. Install tags on valves and control devices in piping systems, except check valves; valves within factory-fabricated equipment units; plumbing fixture supply stops; shutoff valves; faucets; convenience and lawn-watering hose connections; and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in the following:

1. Valve-Tag Size and Shape:

a. Cold Water: 1-1/2 inches (38 mm), round.
b. Hot Water: 1-1/2 inches (38 mm) round.
c. Fire Protection: 1-1/2 inches (38 mm), round.
d. Gas: 1-1/2 inches (38 mm round.

2. Valve-Tag Color:

a. Cold Water: Natural.
b. Hot Water: Natural.
c. Fire Protection: Natural.
d. Gas: Natural.

3. Letter Color:

a. Cold Water: Black.
b. Hot Water: Black.
c. Fire Protection: Black.
d. Gas: Black.

3.06 VALVE-SCHEDULE INSTALLATION

A. Mount valve schedule on wall in accessible location in each major equipment room.

3.07 WARNING-TAG INSTALLATION

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

3.08 ADJUSTING

A. Relocate mechanical identification materials and devices that have become visually blocked by other work.

3.09 CLEANING

A. Clean faces of mechanical identification devices and glass frames of valve schedules.

END OF SECTION 15075

SECTION 15081

DUCT INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes semirigid and flexible duct, plenum, and breeching insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7 Section "Firestopping" for firestopping materials and requirements for penetrations through fire and smoke barriers.
2. Division 15 Section "Pipe Insulation" for insulation for piping systems.
3. Division 15 Section "Metal Ducts" for duct liner.

1.03 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Removable insulation sections at access panels.
2. Application of field-applied jackets.
3. Applications at linkages for control devices.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

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

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate clearance requirements with duct Installer for insulation application.

1.07 SCHEDULING

A. Schedule insulation application after testing duct systems. Insulation application may begin on segments of ducts that have satisfactory test results.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Mineral-Fiber Insulation:

a. CertainTeed Manson.
b. Knauf FiberGlass GmbH.
c. Owens-Corning Fiberglas Corp.
d. Schuller International, Inc.

2. Flexible Elastomeric Thermal Insulation:

a. Armstrong World Industries, Inc.
b. Rubatex Corp.

3. Closed-Cell Phenolic-Foam Insulation:

a. Kooltherm Insulation Products, Ltd.

2.02 INSULATION MATERIALS

A. Mineral-Fiber Board Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IB, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

B. Mineral-Fiber Blanket Thermal Insulation: Glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II, without facing and with all-service jacket manufactured from kraft paper, reinforcing scrim, aluminum foil, and vinyl film.

C. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Adhesive: As recommended by insulation material manufacturer.
2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

D. Closed-Cell Phenolic-Foam Insulation: Block insulation of rigid, expanded, closed-cell structure. Comply with ASTM C 1126, Type II, Grade 1.

2.03 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. Foil and Paper Jacket: Laminated, glass-fiber-reinforced, flame-retardant kraft paper and aluminum foil.

C. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

1. Adhesive: As recommended by insulation material manufacturer.
2. PVC Jacket Color: White or gray.

2.04 ACCESSORIES AND ATTACHMENTS

A. Glass Cloth and Tape: Comply with MIL-C-20079H, Type I for cloth and Type II for tape. Woven glass-fiber fabrics, plain weave, presized a minimum of 8 oz./sq. yd. (270 g/sq. m).

1. Tape Width: 4 inches (100 mm).

B. Bands: 3/4 inch (19 mm) wide, in one of the following materials compatible with jacket:

1. Stainless Steel: ASTM A 666, Type 304; 0.020 inch (0.5 mm) thick.
2. Galvanized Steel: 0.005 inch (0.13 mm) thick.
3. Aluminum: 0.007 inch (0.18 mm) thick.

C. Wire: 0.080-inch (2.0-mm), nickel-copper alloy; 0.062-inch (1.6-mm), soft-annealed, stainless steel; or 0.062-inch (1.6-mm), soft-annealed, galvanized steel.

D. Weld-Attached Anchor Pins and Washers: Copper-coated steel pin for capacitor-discharge welding and galvanized speed washer. Pin length sufficient for insulation thickness indicated.

1. Welded Pin Holding Capacity: 100 lb (45 kg) for direct pull perpendicular to the attached surface.

E. Adhesive-Attached Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

1. Adhesive: Recommended by the anchor pin manufacturer as appropriate for surface temperatures of ducts, plenums, and breechings; and to achieve a holding capacity of 100 lb (45 kg) for direct pull perpendicular to the adhered surface.

F. Self-Adhesive Anchor Pins and Speed Washers: Galvanized steel plate, pin, and washer manufactured for attachment to duct and plenum with adhesive. Pin length sufficient for insulation thickness indicated.

2.05 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.03 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; and free of voids throughout the length of ducts and fittings.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each duct system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply multiple layers of insulation with longitudinal and end seams staggered.

E. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

F. Keep insulation materials dry during application and finishing.

G. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

H. Apply insulation with the least number of joints practical.

I. Apply insulation over fittings and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated.

J. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic. Apply insulation continuously through hangers and around anchor attachments.

K. Insulation Terminations: For insulation application where vapor retarders are indicated, seal ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

L. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Joints and Seams: Cover with tape and vapor retarder as recommended by insulation material manufacturer to maintain vapor seal.
3. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation according to manufacturer's written instructions to prevent compressing insulation to less than 75 percent of its nominal thickness.

N. Install vapor-retarder mastic on ducts and plenums scheduled to receive vapor retarders.

1. Ducts with Vapor Retarders: Overlap insulation facing at seams and seal with vapor-retarder mastic and pressure-sensitive tape having same facing as insulation. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-retarder seal.
2. Ducts without Vapor Retarders: Overlap insulation facing at seams and secure with outward clinching staples and pressure-sensitive tape having same facing as insulation.

O. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Seal insulation to roof flashing with vapor-retarder mastic.

P. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and partitions, except fire-rated walls and partitions.

Q. Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire/smoke damper sleeves for fire-rated wall and partition penetrations.

R. Floor Penetrations: Terminate insulation at underside of floor assembly and at floor support at top of floor.

1. For insulation indicated to have vapor retarders, taper termination and seal insulation ends with vapor-retarder mastic.

3.04 MINERAL-FIBER INSULATION APPLICATION

A. Blanket Applications for Ducts and Plenums: Secure blanket insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, 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 anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.

4. Impale insulation over anchors and attach speed washers.
5. 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.
6. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
7. Overlap unfaced blankets a minimum of 2 inches (50 mm) on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches (450 mm) o.c.

8. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
9. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
10. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

B. Board Applications for Ducts and Plenums: Secure board insulation with adhesive and anchor pins and speed washers.

1. Apply adhesives according to manufacturer's recommended coverage rates per square foot, 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. Space anchor pins as follows:

   a. On duct sides with dimensions 18 inches (450 mm) and smaller, along longitudinal centerline of duct. Space 3 inches (75 mm) maximum from insulation end joints, and 16 inches (400 mm) o.c.
   b. On duct sides with dimensions larger than 18 inches (450 mm). Space 16 inches (400 mm) o.c. each way, and 3 inches (75 mm) maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
   c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.

4. 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.
5. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches (50 mm) from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch (13-mm) staples, 1 inch (25 mm) o.c., and cover with pressure-sensitive tape having same facing as insulation.
6. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply 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 the insulation surface with 6-inch- (150-mm-) wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches (150 mm) o.c.
8. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

3.05 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to ducts and plenums as follows:

1. Follow the manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the duct and plenum surface.

3.06 CLOSED-CELL PHENOLIC-FOAM INSULATION APPLICATION

A. Apply insulation as follows:

1. Secure each layer of insulation to duct with stainless-steel bands at 12-inch (300-mm) intervals and tighten without deforming the insulation materials.
2. Apply two-layer insulation with joints tightly butted and staggered at least 3 inches (75 mm). Secure inner layer with 0.062-inch (1.6-mm), soft-annealed, stainless-steel wire spaced at 12-inch (300-mm) intervals. Secure outer layer with stainless-steel bands at 12-inch (300-mm) intervals.
3. On exposed applications, finish insulation with a skim coat of mineral-fiber, hydraulic-setting cement to surface of installed insulation. When dry, apply flood coat of lagging adhesive and press on one layer of glass cloth or tape. Overlap edges at least 1 inch (25 mm). Apply finish coat of lagging adhesive over glass cloth or tape. Thin the finish coat to achieve smooth finish.

3.07 FIELD-APPLIED JACKET APPLICATION

A. Apply glass-cloth jacket, where indicated, directly over bare insulation or insulation with factory-applied jackets.

1. Apply jacket smooth and tight to surface with 2-inch (50-mm) overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- (1.6-mm-) thick coats of jacket manufacturer's recommended adhesive.
3. Completely encapsulate insulation with jacket, leaving no exposed raw insulation.

3.08 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

3.09 DUCT SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Materials and thicknesses for systems listed below are specified in schedules at the end of this Section.

C. Insulate the following plenums and duct systems:

1. Indoor concealed supply-, return-, and outside-air ductwork.
2. Indoor exposed supply-, return-, and outside-air ductwork.
3. Outdoor exposed supply and return ductwork.
4. Indoor exposed range-hood exhaust ductwork.
5. Indoor concealed range-hood exhaust ductwork.
6. Indoor exposed dishwasher exhaust ductwork.
7. Indoor concealed dishwasher ductwork.

D. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Metal ducts with duct liner.
2. Factory-insulated flexible ducts.
3. Factory-insulated plenums, casings, terminal boxes, and filter boxes and sections.
4. Flexible connectors.
5. Vibration-control devices.
6. Testing agency labels and stamps.
7. Nameplates and data plates.
8. Access panels and doors in air-distribution systems.

3.10 INDOOR DUCT AND PLENUM APPLICATION SCHEDULE

A. Service: Round, supply-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

B. Service: Round, return-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

C. Service: Rectangular, supply-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm.
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

D. Service: Rectangular, return-air ducts, concealed.

1. Material: Mineral-fiber blank.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: Foil and paper.
5. Vapor Retarder Required: Yes.

E. Service: Rectangular, outside-air ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

F. Service: Round, supply-air ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

G. Service: Round, return-air ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

H. Service: Round, outside-air ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

I. Service: Rectangular, supply-air ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

J. Service: Rectangular, return-air ducts, exposed.

1. Material: Mineral-fiber board.

2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

K. Service: Rectangular, outside-air ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

L. Service: Rectangular, range-hood exhaust ducts, concealed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

M. Service: Rectangular, range-hood exhaust ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

N. Service: Rectangular, dishwasher exhaust ducts, concealed.

1. Material: Mineral-fiber blanket.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

O. Service: Rectangular, dishwasher exhaust ducts, exposed.

1. Material: Mineral-fiber board.
2. Thickness: 1-1/2 inches (38 mm).
3. Number of Layers: One.
4. Field-Applied Jacket: PVC.
5. Vapor Retarder Required: Yes.

END OF SECTION 15081

SECTION 15083

PIPE INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes preformed, rigid and flexible pipe insulation; insulating cements; field-applied jackets; accessories and attachments; and sealing compounds.

B. Related Sections include the following:

1. Division 7 Section "Through-Penetration Firestop Systems" for firestopping materials and requirements for penetrations through fire and smoke barriers.
2. Division 15 Section "Hangers and Supports" for pipe insulation shields and protection saddles.

1.03 SUBMITTALS

A. Product Data: Identify thermal conductivity, thickness, and jackets (both factory and field applied, if any), for each type of product indicated.

B. Shop Drawings: Show fabrication and installation details for the following:

1. Application of protective shields, saddles, and inserts at pipe hangers for each type of insulation and hanger.
2. Insulation application at pipe expansion joints for each type of insulation.
3. Insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
4. Removable insulation at piping specialties and equipment connections.

C. Material Test Reports: From a qualified testing agency acceptable to authorities having jurisdiction indicating, interpreting, and certifying test results for compliance of insulation materials, sealers, attachments, cements, and jackets with requirements indicated. Include dates of tests.

D. Installer Certificates: Signed by the Contractor certifying that installers comply with requirements.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics who have successfully completed an apprenticeship program or another craft training program certified by the U.S. Department of Labor, Bureau of Apprenticeship and Training.

B. Fire-Test-Response Characteristics: As determined by testing materials identical to those specified in this Section according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and sealer and cement material containers with appropriate markings of applicable testing and inspecting agency.

1. Insulation Installed Indoors: Flame-spread rating of 25 or less, and smoke-developed rating of 50 or less.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Ship insulation materials in containers marked by manufacturer with appropriate ASTM specification designation, type and grade, and maximum use temperature.

1.06 COORDINATION

A. Coordinate size and location of supports, hangers, and insulation shields specified in Division 15 Section "Hangers and Supports."

B. Coordinate clearance requirements with piping Installer for insulation application.

1.07 SCHEDULING

A. Schedule insulation application after testing piping systems. Insulation application may begin on segments of piping that have satisfactory test results.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Cellular-Glass Insulation:

a. Pittsburgh-Corning Corp.

2. Flexible Elastomeric Thermal Insulation:

a. Armstrong World Industries, Inc.
b. Rubatex Corp.

2.02 INSULATION MATERIALS

A. Cellular-Glass Insulation: Inorganic, foamed or cellulated glass, annealed, rigid, hermetically sealed cells, incombustible.
   1. Preformed Pipe Insulation, with Jacket: Comply with ASTM C 552, Type II, Class 2.

B. Flexible Elastomeric Thermal Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials and Type II for sheet materials.

   1. Adhesive: As recommended by insulation material manufacturer.
   2. Ultraviolet-Protective Coating: As recommended by insulation manufacturer.

2.03 FIELD-APPLIED JACKETS

A. General: ASTM C 921, Type 1, unless otherwise indicated.

B. PVC Jacket: High-impact, ultraviolet-resistant PVC; 20 mils (0.5 mm) thick; roll stock ready for shop or field cutting and forming.

   1. Adhesive: As recommended by insulation material manufacturer.
   2. PVC Jacket Color: White or gray.

C. Standard PVC Fitting Covers: Factory-fabricated fitting covers manufactured from 20-mil-(0.5-mm-) thick, high-impact, ultraviolet-resistant PVC.

   1. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories for the disabled.
   2. Adhesive: As recommended by insulation material manufacturer.

2.04 VAPOR RETARDERS

A. Mastics: Materials recommended by insulation material manufacturer that are compatible with insulation materials, jackets, and substrates.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation: Clean and dry pipe and fitting surfaces. Remove materials that will adversely affect insulation application.

3.03 GENERAL APPLICATION REQUIREMENTS

A. Apply insulation materials, accessories, and finishes according to the manufacturer's written instructions; with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Refer to schedules at the end of this Section for materials, forms, jackets, and thicknesses required for each piping system.

C. Use accessories compatible with insulation materials and suitable for the service. Use accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Apply insulation with longitudinal seams at top and bottom of horizontal pipe runs.

E. Apply multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Seal joints and seams with vapor-retarder mastic on insulation indicated to receive a vapor retarder.

H. Keep insulation materials dry during application and finishing.

I. Apply insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by the insulation material manufacturer.

J. Apply insulation with the least number of joints practical.

K. Apply insulation over fittings, valves, and specialties, with continuous thermal and vapor-retarder integrity, unless otherwise indicated. Refer to special instructions for applying insulation over fittings, valves, and specialties.

L. Hangers and Anchors: Where vapor retarder is indicated, seal penetrations in insulation at hangers, supports, anchors, and other projections with vapor-retarder mastic.

1. Apply insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor retarders are indicated, extend insulation on anchor legs at least 12 inches (300 mm) from point of attachment to pipe and taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.
3. Install insert materials and apply insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by the insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect the jacket from tear or puncture by the hanger, support, and shield.

M. Insulation Terminations: For insulation application where vapor retarders are indicated, taper insulation ends. Seal tapered ends with a compound recommended by the insulation material manufacturer to maintain vapor retarder.

N. Apply adhesives and mastics at the manufacturer's recommended coverage rate.

O. Apply insulation with integral jackets as follows:

1. Pull jacket tight and smooth.
2. Circumferential Joints: Cover with 3-inch- (75-mm-) wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip and spaced 4 inches (100 mm) o.c.
3. Longitudinal Seams: Overlap jacket seams at least 1-1/2 inches (40 mm). Apply insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches (100 mm) o.c.

   a. Exception: Do not staple longitudinal laps on insulation having a vapor retarder.

4. Vapor-Retarder Mastics: Where vapor retarders are indicated, apply mastic on seams and joints and at ends adjacent to flanges, unions, valves, and fittings.
5. At penetrations in jackets for thermometers and pressure gages, fill and seal voids with vapor-retarder mastic.

P. Roof Penetrations: Apply insulation for interior applications to a point even with top of roof flashing.

1. Seal penetrations with vapor-retarder mastic.
2. Apply insulation for exterior applications tightly joined to interior insulation ends.
3. Extend metal jacket of exterior insulation outside roof flashing at least 2 inches (50 mm) below top of roof flashing.
4. Seal metal jacket to roof flashing with vapor-retarder mastic.

Q. Interior Wall and Partition Penetrations: Apply insulation continuously through walls and floors.

R. Fire-Rated Wall and Partition Penetrations: Apply insulation continuously through penetrations of fire-rated walls and partitions.

1. Firestopping and fire-resistive joint sealers are specified in Division 7 Section "Firestopping."

S. Floor Penetrations: Apply insulation continuously through floor assembly.

1. For insulation with vapor retarders, seal insulation with vapor-retarder mastic where floor supports penetrate vapor retarder.

3.04 CELLULAR-GLASS INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Secure each layer of insulation to pipe with wire, tape, or bands without deforming insulation materials.
2. Where vapor retarders are indicated, seal longitudinal seams and end joints with vapor-retarder mastic.
3. For insulation with factory-applied jackets, secure laps with outward clinched staples at 6 inches (150 mm) o.c.
4. For insulation with factory-applied jackets with vapor retarders, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by the insulation material manufacturer and seal with vapor-retarder mastic.

B. Apply insulation to flanges as follows:

1. Apply preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of the same thickness as pipe insulation.
4. Apply canvas jacket material with manufacturer's recommended adhesive, overlapping seams at least 1 inch (25 mm), and seal joints with vapor-retarder mastic.

C. Apply insulation to fittings and elbows as follows:

1. Apply premolded insulation sections of the same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When premolded sections of insulation are not available, apply mitered sections of cellular-glass insulation. Secure insulation materials with wire, tape, or bands.
3. Cover fittings with standard PVC fitting covers.

D. Apply insulation to valves and specialties as follows:

1. Apply premolded segments of cellular-glass insulation or glass-fiber blanket insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, arrange insulation for access to stainer basket without disturbing insulation.
2. Apply insulation to flanges as specified for flange insulation application.
3. Use preformed standard PVC fitting covers for valve sizes where available. Secure fitting covers with manufacturer's attachments and accessories. Seal seams with tape and vapor-retarder mastic.

3.05 FLEXIBLE ELASTOMERIC THERMAL INSULATION APPLICATION

A. Apply insulation to straight pipes and tubes as follows:

1. Follow manufacturer's written instructions for applying insulation.
2. Seal longitudinal seams and end joints with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

B. Apply insulation to flanges as follows:

1. Apply pipe insulation to outer diameter of pipe flange.
2. Make width of insulation segment the same as overall width of the flange and bolts, plus twice the thickness of the pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of the same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

C. Apply insulation to fittings and elbows as follows:

1. Apply mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

D. Apply insulation to valves and specialties as follows:

1. Apply preformed valve covers manufactured of the same material as pipe insulation and attached according to the manufacturer's written instructions.
2. Apply cut segments of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation. For check valves, fabricate removable sections of insulation arranged to allow access to stainer basket.
3. Apply insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive. Cement to avoid openings in insulation that will allow passage of air to the pipe surface.

3.06 FIELD-APPLIED JACKET APPLICATION

A. Apply PVC jacket where indicated, with 1-inch (25-mm) overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

3.07 PIPING SYSTEM APPLICATIONS

A. Insulation materials and thicknesses are specified in schedules at the end of this Section.

B. Items Not Insulated: Unless otherwise indicated, do not apply insulation to the following systems, materials, and equipment:

1. Flexible connectors.
2. Vibration-control devices.
3. Fire-suppression piping.

4. Drainage piping located in crawl spaces, unless otherwise indicated.
5. Below-grade piping, unless otherwise indicated.
6. Chrome-plated pipes and fittings, unless potential for personnel injury.
7. Air chambers, unions, strainers, check valves, plug valves, and flow regulators.

3.08 FIELD QUALITY CONTROL

A. Inspection: Government will engage a qualified inspection agency to perform the following field quality-control inspections, after installing insulation materials, jackets, and finishes, to determine compliance with requirements:

B. Insulation applications will be considered defective if sample inspection reveals noncompliance with requirements. Remove defective Work and replace with new materials according to these Specifications.

C. Reinstall insulation and covers on fittings and valves uncovered for inspection according to these Specifications.

3.09 INSULATION APPLICATION SCHEDULE, GENERAL

A. Refer to insulation application schedules for required insulation materials, vapor retarders, and field-applied jackets.

B. Application schedules identify piping system and indicate pipe size ranges and material, thickness, and jacket requirements.

3.10 INTERIOR INSULATION APPLICATION SCHEDULE

A. Service: Domestic hot and recirculated hot water.

1. Operating Temperature: 60 to 140 deg F (15 to 60 deg C).
2. Insulation Material: Mineral fiber Cellular glass.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. Copper PVC Pipe, All Pipe Sizes: 1 inch thick.

4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: None.

B. Service: Rainwater conductors.

1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: Apply the following insulation thicknesses:

   a. Cast Iron, All Pipe Sizes: 1 inch thick.

4. Field-Applied Jacket: None.

5. Vapor Retarder Required: No.
6. Finish: None.

C. Service: Roof drain bodies.

1. Operating Temperature: 32 to 100 deg F (0 to 38 deg C).
2. Insulation Material: Mineral fiber.
3. Insulation Thickness: 1 inch thick.
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: No.
6. Finish: None.

D. Service: Condensate drain piping.

1. Operating Temperature: 35 to 75 deg F (2 to 24 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: 1"
4. Field-Applied Jacket: None.
5. Vapor Retarder Required: Yes.
6. Finish: None.

E. Service: Exposed sanitary drains and domestic water supplies and stops for fixtures for the disabled.

1. Operating Temperature: 35 to 120 deg F (2 to 49 deg C).
2. Insulation Material: Flexible elastomeric.
3. Insulation Thickness: ½-inch.
4. Field-Applied Jacket: PVC P-trap and supply covers.
5. Vapor Retarder Required: No.
6. Finish: Painted None.

END OF SECTION 15083