

SECTION 15440 – PLUMBING SPECIALTIES

PART 1 – GENERAL

1.1 WORK INCLUDED

- A. The work shall include labor, materials, tools, equipment, transportation, insurance, temporary protection, supervision and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings but which are usually provided or are essential for proper installation of systems related to this Section, as indicated on the drawings and specified herein.
- B. The specifications and drawings describe the minimum requirements that must be met for the installation of work as shown on the drawings and as specified hereinunder.
- C. Shop drawings.
- D. Field acceptance testing.

1.2 RELATED SECTIONS

- A. Examine drawings and criteria sheets and other Sections of the Specifications for requirements which affect work under this Section whether or not such work is specifically mentioned in this Section.
 - 1. Section 15050 – Basic Mechanical Materials and Methods
 - 2. Section 15055 – Through-Penetration Firestop Systems
 - 3. Section 15060 – Hangers and Supports
 - 4. Section 15075 – Mechanical Identification
 - 5. Section 15410 – Plumbing Valves
 - 6. Section 15420 – Plumbing Distribution Piping
 - 7. Section 15430 – Drainage and Vent Piping
 - 8. Section 15450 – Plumbing Fixtures
 - 9. Section 15460 – Plumbing Equipment
 - 10. Section 15480 – Medical Plumbing Systems

1.3 REFERENCES

- A. Applicable provisions of the following Codes and Trade Standard Publications shall apply to the work of this Section, and are hereby incorporated into, and made a part of the Contract Documents.

B. Material standards shall be as specified or detailed hereinafter and as follows:

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- a. ANSI American National Standards Institute
- b. ASME American Society of Mechanical Engineers
- c. ASTM American Society of Testing Materials
- d. ASTM B88-78: Wrought Copper Fittings
- e. AWS American Welding Society
- f. CS Commercial Standards, U.S. Dept. of Commerce
- g. FM Factory Mutual
- h. FS Federal Specification, U.S. Government
- i. MSS Manufacturers Standardization Society of the Valve and Fittings Industry
- j. UL Underwriters Laboratories, Inc.
- k. OSHA Occupational Safety and Health Act
- l. ASPE American Society of Plumbing Engineers

1.4 SUBMITTALS

A. Refer to Section 01330 – SUBMITTAL PROCEDURES.

B. Prepare and submit shop drawings in accordance with the requirements of the General Conditions and Supplementary Conditions and in the manner described therein, modified as noted hereinafter.

C. Submittals: The following documents shall be provided:

- 1. Hangers and supports
- 2. Insulation
- 3. Access panels
- 4. Water meter
- 5. Shock absorbers and trap primers
- 6. Pressure gauges
- 7. Thermometers
- 8. Hose bibbs
- 9. Wall hydrants
- 10. Backflow preventers and vacuum breakers
- 11. Floor drains and roof drains
- 12. Cleanouts
- 13. Flanges and unions
- 14. Sleeves and firestopping
- 15. Water filters
- 16. Heating cable
- 17. Grease traps and interceptors
- 18. Vibration isolation and seismic restraints

1.5 QUALITY ASSURANCE

- A. Refer to Section 01400 – QUALITY REQUIREMENTS.

PART 2 – PRODUCTS

2.1 FLANGES AND UNIONS

A. Flanges

- 1. Flanges shall be companion type, faced and drilled for not less than 125# steam working pressure complete with necessary adapter, and shall be of size and material of adjacent piping.

B. Unions

- 1. Provide union connections to fixtures and equipment. Union connections include compression fittings, grooved couplings, and flared fittings.
 - a. Unions on copper piping shall be bronze minimum working pressure of 200 psi.
 - b. Unions on steel and iron shall be ferrous ground joint brass to iron, rated for the working pressure of the system.

C. Dielectric Fittings

- 1. Provide separation between copper and ferrous piping systems such as nipples, unions or flanges. Components shall be equal to Watts or Clearflow.

D. Solder

- 1. Domestic water, waste and vent: 95-5 lead free, ASTM B32.

2.2 HANGERS AND SUPPORTS

- A. All piping shall be supported from the building structure by means of approved hangers and supports. Piping shall be supported to maintain required grading and sloping of lines, to prevent vibration and to secure piping in place, and shall be so arranged as to provide for expansion and contraction. Hangers shall be provided at all change of direction. All piping in the following schedule shall be supported in accordance with seismic restraints as detailed in SMACNA Guidelines.

- B. Maximum spacing of hangers on runs of pipe no concentrations of weight shall be as follows:

Schedule (Hanger Spacing in Feet/Pipe Material)				
Pipe Size (Inches)	Steel	Copper or Brass	Polypropylene	PVDF
½-1	7	5	5	5
1 ¼	10	6	5	5
1 ½-2	10	8	5	5
2 ½-6	12	10	5	5

- C. Maximum spacing on cast iron soil pipe shall be 5'-0" and hangers shall be provided at all changes in direction. Hanger rods to support piping from the structure or supplementary steel shall not exceed 4'-0" in total length. Where pipe support assemblies exceed 4'-0" in total length, this Contractor shall furnish and install factory fabricated channels and associated accessories.
- D. Where codes having jurisdiction require closer spacing, the hanger spacing shall be as required by code in lieu of the distances specified herein.
- E. Friction clamps shall be installed at the base of all plumbing risers and at each floor. Friction clamps shall not be supported from or rest on floor sleeves. Clamps on concealed piping shall not be exposed in occupied space.
- F. Hangers in general for all horizontal cast iron piping shall be clevis type hangers. These hangers shall be sized to provide for insulation protectors as hereinbefore specified.
- G. Hangers for polypropylene and polyvinylidene fluoride piping systems shall be a trough clevis hanger with continuous angle iron pipe supports.
- H. Hangers for uncovered (uninsulated) copper and brass piping shall be factory applied plastic coated steel band or copper plated.
- I. Where (3) or more pipes are running parallel to each other, factory fabricated gang type hangers with the pipe saddle clips shall be used in lieu of the hereinbefore specified clevis hangers. These hangers shall be sized to provide for insulation protectors as hereinafter specified. Pipe saddle clips shall be not less than 16 gauge metal and shall be plastic coated when installed with uninsulated copper piping.
- J. All vertical drops and runouts, including insulated pipes, shall be supported by extension type split ring type hangers. These hangers shall be plastic coated when used on uncovered copper tubing. Supports on insulated piping shall be sized to fit the outside diameter of the pipe insulation.
- K. Field painting or spraying of hangers in lieu of plastic coating will not be accepted.

- L. All horizontal piping shall be suspended from the building by mild steel rod connecting the pipe hanger to inserts, beam clamps, angle brackets, and lag screws as required by the Building Construction in accordance with the following:

Pipe Size (Inches)	Rod Diameter (Inches)
1/2 to 2	3/8
2 1/2 to 3	1/2
4 to 5	5/8
6	3/4
8 to 12	7/8

- M. Provide sway bracing as outlined in SMACNA Guidelines on hangers 12" or further from the structure.
- N. All hangers on insulated lines shall be sized to fit the outside diameter of the pipe insulation. Provide pipe covering protection saddles at all hangers on the insulated lines.
- O. Piping at all equipment and control valves shall be supported to prevent strains or distortions or transmission of vibration in the connected equipment and control valves. Piping at equipment shall be supported to allow for removal of equipment, valves, and accessories with a minimum of dismantling and without requiring additional support after these items are removed.
- P. All piping installed under this Section shall be independently supported from the building structure and not from the piping, ductwork, or conduit of other trades. All supplementary steel, including factory fabricated channels, required to meet the requirements specified herein, shall be furnished and installed by this Contractor.
- Q. All supplementary steel, including factory fabricated channels and associated accessories throughout the project for this Section, both suspended and floor mounted, shall be furnished and installed by this Contractor and shall be subject to the approval of the Architect/Engineer.
- R. Hanger assemblies (hanger, plates, rods, and screws) installed for chrome plated piping shall also be chrome plated.
- S. All hangers shall be secured to approved inserts or expansion shields wherever possible and practicable. Drilling where required shall be done by the Plumbing Contractor under this Section. The use of explosives for driving shields and inserts is prohibited. All hangers and support systems shall be UL listed and/or FM approved.

2.3 SLEEVES AND PLATES, ESCUTCHEONS, FIRESTOPPING AND SMOKESTOPPING

- A. Where pipes pass through concrete walls or floors, this Contractor shall provide and set individual sleeves for each pipe, and all other work under his charge. Sleeves shall be of sufficient size to provide 1/2" minimum air space around the pipe, or insulation on covered lines passing through it. All openings shall be sealed, smokeproofed and made tight as outlined in

items below. This Contractor shall be responsible for the exact location of sleeves provided under this Contract and shall coordinate all requirements for sleeves. In the event that failure to do so requires cutting and patching, it shall be done at this Contractor's expense.

- B. This Contractor, for work under his charge, shall determine the diameter of each individual wall opening or sleeve before ordering, fabricating or installing.
- C. Sleeves passing through lightproof or soundproof walls and floors and through firewalls shall be sealed and made tight using only approved materials and methods.
- D. Sleeves and wall openings shall not be used in any portions of the building where their use would impair the strength or construction features of the building. This Contractor shall immediately bring to the Architect's attention any situation which may promote this condition.
- E. Provide chrome plated brass escutcheons with set screw for exposed piping in all areas. In mechanical rooms use plain brass or cast iron escutcheons suitable for painting. All escutcheons shall be sized to fit the bare pipe or insulation in a snug and neat manner. They shall be of sufficient size to cover sleeves openings for the pipes and of sufficient depth to cover sleeves projecting above floors. Escutcheons shall be as manufactured by Beaton & Caldwell, Dearborn Brass or Grinnell. All escutcheons shall be of one-piece construction.
- F. Pipe sleeves shall be made of galvanized Schedule 40 pipe, 20 gauge galvanized steel or 16 gauge steel as follows:
 - 1. Sleeves passing through fire or smoke rated drywall construction shall be 16 gauge galvanized steel.
 - 2. Sleeves passing through masonry or concrete construction shall be Schedule 40 pipe or in the case of a cast-in-place firestop device, plastic and steel assembly with integral water and cold smoke seal.
 - 3. Sleeves passing through non-fire or smoke rated drywall construction shall be 20 gauge galvanized steel.
- G. Sleeves shall be set as follows:
 - 1. Set sleeves 1" above finished floor (6" at mechanical rooms and wet areas).
 - 2. Set sleeves to be flush with each side of finished wall.
 - 3. Sleeves shall be set securely in place before concrete is poured.
- H. This Contractor shall fire stop and/or smokestop the space between the sleeves and piping systems provided under his Contract as follows:
 - 1. Through Penetration Firestopping in Fire Rated Construction.
 - a. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and HXEL may be used, providing that they conform to the construction type, penetrant type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall applications. Systems or devices must be asbestos free.

- 1) Additional requirements: Systems must withstand the passage of cold smoke either as an inherent property of the system or by the use of a separate product included as part of the UL System or device.
 - 2) Acceptable manufacturers and products
 - a) Those listed in the UL Fire Resistance directory for the UL System involved, including Hilti, 3M, BioFire Shield or approved equal.
 - 3) All products must be from a single manufacturer.
2. Smokestopping at Smoke Partitions
- a. Any system complying with the requirements for through penetration firestopping in fire rated construction, as specified in Item H1 is acceptable, provided that the system provides the required smoke seal.
3. Accessories
- a. Fire, void or cavity materials: As classified under category XHHW in the UL Fire Resistance Directory.
 - b. Forming materials: As classified under category XHKU in the UL Fire Resistance Directory.
4. Cast-in-place firestop devices, such as Hilti CP 680, shall be set in place prior to concrete placement. The cast-in-place device shall provide a water tight and cold smoke seal after the through penetrant is installed.
5. The materials, installation procedures, clean-up, safety precautions and requirements shall be in accordance with manufacturers published information.
- I. Piping which passes through exterior walls or foundation slabs on grade shall have penetration closures similar to Link Seal of the modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall opening. Links shall be loosely assembled with bolts to form a continuous belt around the pipe and with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely watertight seal between the pipe and wall, reducing chances of cathodic reaction between these members. The Plumbing Contractor for work under his charge shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabrication or installation. The inside diameter of the wall opening shall be sized to fit the pipe and ensure a watertight joint. Where applicable, when installing seals, take into account the pipe O.D. if non-standard due to coating or jacketing.

2.4 ACCESS PANELS

- A. Group together valves, traps, cleanouts, etc., concealed in suspended ceilings, walls and furred spaces to reduce the number of access panels, but all valves must be freely accessible for maintenance.
- B. Furnish access panels of proper size to service all concealed traps, valves and cleanouts, but in no case less than 18" by 12" for valves, traps or cleanout, and 24" by 12" for (2) valves, traps or cleanouts, or more. Panels shall be of the proper type for material in which they occur to be furnished by this Contractor and turned over to the trade in which they occur for installation by the particular trade Contractor. The exact number of panels shall be determined by the number, location and grouping of traps, valves and cleanouts which must be accessible for servicing and maintaining the plumbing systems. Panels below ceilings shall be key operated.
- C. Panels shall have flush doors with #14 USCG steel door and trim #16 USCG steel frame, metal wings for fitting into construction, concealed hinges, and screwdriver operated stainless steel cam lock. Panels shall be shop coated with (1) coat of zinc chromate primer. Valves above removable ceilings shall have tiles marked with tile clips by this Contractor for identification, properly labeled. Panels in toilet rooms adjacent to urinals shall be Type 302, 18 gauge, stainless steel. All locks shall be universal with all building access panels locks.

2.5 INSULATION

- A. Scope: The following piping, fittings, and valves shall be insulated:
 - 1. All interior water piping.
 - 2. Equipment, including heat exchangers and cold water chiller.
 - 3. Aboveground horizontal rain water piping past the elbow, down the vertical, including drain bodies.
 - 4. Water, rainwater waste piping in exterior furred ceiling spaces and overhangs.
 - 5. All piping insulation disturbed or removed as a result or renovation work.
 - 6. All horizontal waste piping receiving cold water condensate.
- B. Materials: The following materials are specified:
 - 1. Pipe Insulation: Fiberglass similar to Owens Corning, Manville, Certain-Teed.
 - 2. Fittings and Valves Insulation
 - a. Moulded or fabricated fitting covers of equal thickness and identical in composition to adjacent pipe insulation, equal to Zeston pre-molded covers. At fittings and valves, the insulation vapor barrier shall be continuous and unbroken.
 - 3. Heat Exchangers / Chillers
 - a. Fiberglass pipe insulation, blanket insulation on ends.
 - 4. All materials, including vapor barrier jackets, adhesives, etc., shall be fire retardant.

C. Insulation Thickness

1. The piping, fittings, and valves shall be insulated with the following minimum thicknesses:
 - a. Hot water and circulation piping: 1" thick
 - b. Cold water piping: 1/2" thick
 - c. Rainwater Piping: 1/2" thick
 - d. Water heaters, storage tanks, heat exchangers/chiller: 2" thick

D. Finish

1. Concealed or Exposed: All service vapor barrier jacket (ASJ Fiberglass 24) on all conductor and water piping, except where flexible tubing insulation is used which requires no vapor barrier. Fittings shall be finished with pre-molded fitting covers.

E. Handicapped Lavatories

1. Truebro Handi Lav-Guard or Brocar Products Trapwrap #C-500R insulation kit, 3-piece interlocking for "P" trap assembly and 2-piece kit for water supplies shall be white flexible vinyl insulation secured with nylon fasteners supplied.

2.6 HOSE BIBBS AND WALL HYDRANTS

- A. Hose Bibb for Toilet Rooms: Chicago 952, chrome plated brass, 3/4" with vacuum breaker and loose tee handle.
- B. Hose Bibb in Mechanical Areas: Chicago 7T, 3/4" inlet and threaded outlet, rough brass, loose tee handle.
- C. Wall Hydrant: Zurn Z-1310, 3/4", anti-siphon, non-freeze, loose key operation with bronze casing and "water" cast on cover.

2.7 BACKFLOW PREVENTERS

A. Acceptable Manufacturers and requirements

1. Provide units approved by the authorities having jurisdiction, the following specified type is utilized to establish quality.
2. This Subcontractor shall make application in the name of the Owner for the installation of the backflow preventers and pay any resultant fees.

B. Reduced Pressure Backflow Preventers

1. 2" and Smaller: Watts #009S-U-QT, Conbraco #40-201-A4 or approved equal bronze body, stainless steel check seats, unions, strainer and shutoff valves.
2. 2 1/2" and Larger: Watts #909W-S-OS&Y, Conbraco #40-201-03 or approved equal bronze seats and stainless steel trim, flanged, strainer and shutoff valves.
3. Provide an air gap fitting and full size indirect waste to floor drain.

C. Provide test kit and spare parts for each type of installed unit. Provide inlet and outlet pressure gauges on units. Test kits shall be by the supplied manufacturer of units.

D. Pressure Vacuum Breaker

1. Finished areas and locations unless otherwise noted: Watts #800MCQT, Conbraco #4V-500 or approved equal compact, chrome plated with integral shutoff valves.
2. Mechanical areas and concealed locations: Watts #800M4QT, Conbraco #4V-500 or approved equal rough brass, replaceable seats with shutoff valves.

E. Vacuum Breaker

1. For Hot or Cold Water: Watts #288A, Conbraco #38-100 or approved equal bronze, atmospheric vent, clean plated in exposed, finished areas. **Note:** Unit must be installed a minimum of 6" above the highest downstream point of use, the unit will discharge water.

2.8 TRAP PRIMERS AND WATER HAMMER ARRESTORS

A. Zurn Z-1700 Series or approved equal - stainless steel "shoktrols" shall be installed on water supply lines to flush valves and to plumbing connected equipment equipped with fast acting valves to control water hammer. They shall be sized and selected in accordance with PDI Standard WH201 with access through approved access panels. Examples of such locations are as follows:

1. Flushometer valves
2. Self-closing and metering faucets
3. Prior to all pressure reducing valves
4. Prior to all in-line solenoid valves
5. Emergency showers
6. Sterilizer water supplies
7. Autoclaves
8. Hose spray pre-rinse
9. Top of all risers

B. Trap Primers

1. Individual fixtures shall be primed by Precision Plumbing products, Inc., model Prime Rite, or approved equal. Device shall be machined brass with no springs or diaphragms. Mount 12" above trap to be primed.

2. Multiple fixtures shall be primed by Precision Plumbing Products, Model PT-4 through 30 and rated for quantity of traps to be served. The priming manifold shall be capable of supplying 2 oz. of water per trap supply at 20 psig every 24 hours. The device shall be factory assembled and prepiped complete with ball valve, water hammer arrestor, copper barrel hammer arrestor, copper barrel with piston, solenoid valve and 1/2" trap primer connections. Electronic connections include single point 120V, manual override switch breaker, timer with relay. Unit shall be factory tested and supplied in a wall mounted 16 gauge steel cabinet.

2.9 DRAINAGE SPECIALTIES

- A. Before setting any drains, cleanouts or wall plates, obtain from the General Contractor the exact information relative to the finished grades of the top of the drains, equipment locations and partition locations. All drainage specialties shall be of the size noted on the drawings and shall be equal to the figure numbers scheduled below. Drainage specialties may be Zurn, Wade, JR Smith Company, Josam, Watts or approved equal.
- B. Cleanouts
 1. Cleanouts shall be furnished and installed at all locations required by applicable Codes, in accessible locations, at bottoms of soil and waste stacks, and other locations shown on the drawings and at each change of direction. All cleanouts shall be brought up to finished floor. Outlets shall be caulked or no hub type.
 2. Cleanouts occurring in floors finished with quarry, ceramic tile, brick or granite shall be equipped with flush scoriated round bronze as selected by Architect to coordinate with color of flooring covers with round frames, equal to J.R. Smith #4046. Covers shall be adjustable in height.
 3. Cleanouts occurring in resilient tile floors or carpeted areas shall be equipped with flush round metal covers with frames, equal to J.R. Smith #4146 for tile and #4026 for carpet, with covers recessed to receive tile or carpet. Covers shall have adjustable height.
 4. Cleanouts occurring in floors finished with plain concrete shall be equipped with heavy duty flush scoriated round cast iron covers with round frame equal to J.R. Smith #4226. Covers shall be adjustable in height.
 5. Where cleanouts occur under the floors in unexcavated areas, they shall be brought up flush with the finish floor and fitted with a cover equal to J.R. Smith #4226 series, cast iron top.
 6. Cleanouts occurring in floors protected with membrane waterproofing shall be same as above, except with integral clamping collar.
 7. Cleanouts occurring in walls shall be equipped with flush smooth white metal covers, with 10 inch by 10 inch openings in square frames having anchoring lugs, equal to J.R. Smith #4735.
 8. All otherwise exposed or accessible cleanouts shall be equal to J.R. Smith #4420 or #4531 as required to suit the conditions at each point of application.
 9. Extension pieces and bodies of cleanouts shall be of cast iron and arranged to suit each condition of application.

10. All metal specified above shall be solid "nickel-bronze" having high nickel content, appearance of satin chrome, and corrosion and wear resistance qualities greater than bronze.
11. Cleanouts shall be the full size of the pipelines to which they are directly connected, but need not be larger than 4 inches for pipe lines up to 10 inches, and shall be at least 6 inches for pipe lines 10 inches and up.
12. Cleanouts occurring in floors finished with plain concrete shall be equipped with heavy duty flush scoriated round cast iron covers with round frame equal to J.R. Smith #4340. Covers shall be adjustable in height.
13. Grade cleanouts shall be Zurn #1456 with inside caulk mounted in cast iron 12" square frame and cover LeBaron #S512.

C. Floor Drains (FD)

1. All floor drains shall be the product of one manufacturer such as Zurn Industries, J.R. Smith, Wade, Josam, Watts or approved equal.
2. Provide "deep seal" traps for all floor drains, of same material as piping systems connected thereto.
3. Drains located in waterproofed floors of composition materials or of other kinds, shall be fitted with all required flanges, clamping devices and trim required to assure watertight conditions, and they shall be made watertight. Provide all other miscellaneous devices, as required, for a complete installation as approved by Architect.
 - a. Type A: Toilet Rooms, Shower Rooms and Plenums
 - 1) Zurn Z-415 floor and shower drain, dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with Type H polished, nickel bronze strainer with flashing clamp device.
 - b. Type B: Mechanical Rooms
 - 1) Zurn Z-541, 12" diameter top drain, dura-coated cast iron body with bottom outlet, seepage pan and combination membrane flushing clamp and frame for anti-tilt heavy duty slotted grate with suspended sediment bucket.
 - c. Type: Sterilizers
 - 1) Zurn Z1750-4, 12" x 12" sani-floor receptor 6" sump depth, 14 gauge, all Type 304 (CF8) stainless steel light duty sani-floor receptor with non-tile, loose set full grate with 3" square center opening and anti-splash interior dome strainer.
 - d. Type: Ice Machines
 - 1) Zurn Z-415 floor drain, dura-coated cast iron body with bottom outlet, combination invertible membrane clamp and adjustable collar with Type E polished, nickel bronze strainer with 4" diameter funnel.

D. Trench Drains (TD)

1. The trench drains shall be Polydrain or approved equal as manufactured by ABT, Inc. (Troutman, NC - 1-800-438-6057), J.R. Smith or Zurn. Channels shall have interlocking joints and horizontal ribs to ensure a positive anchor in the encasement concrete. Properly fitting outlets, end caps and necessary catch basins shall be included. Quantity and required length of trench drains are to be based on the architectural dimensioned drawings.
 - a. Type A: The grate shall be Polydrain #Stainless Steel #442/#443 or pre-approved equal and be capable of being locked to the channel with removable lock downs.
 - b. Type B: The grate shall be Polydrain #444 or pre-approved equal and be capable of being locked to the channel with removable lock downs.
2. The trench drains shall be installed in accordance with manufacturer's instructions and details. Polyseat installation chairs shall be used where sub-base allows, to hold the channels to line and grade, prevent flotation and ensure proper concrete encasement.

E. Roof Drains (RD)

1. All roof drains shall be the product of one manufacturer such as Zurn Industries, J.R. Smith, Wade, Josam, Watts or approved equal.
 - a. Type A: Zurn ZA-100-C-VP, 15" diameter roof drain, dura-coated cast iron body with combination membrane flashing clamp/gravel guard and low silhouette aluminum dome, supplied with underdeck clamp and vandalproof secured top.
2. Provide Zurn ARB-190 vertical expansion joint at every drain location where the drain outlet piping connects directly to a vertical leader or when the horizontal offset is less than 10'.

F. Area Drains (AD)

1. All area drains shall be the product of one manufacturer such as Zurn Industries, J.R. Smith, Wade, Josam, Watts or approved equal.

G. Backwater valves to be installed on gravity waste lines shall be as follows:

1. Storm and Sanitary piping system valves shall be Zurn Model No. Z-1095 line-size, coated cast iron body, hub inlet, spigot outlet, bronze threaded cover with automatic valve seat and flapper or approved equal.
2. Laboratory waste shall be Zurn Model No Z-1095, line size similar to that specified for storm and sanitary systems, except enamel coated interior with ABS removable cover or approved equal.

2.10 HEATING CABLE

- A. Provide a complete UL listed system of heaters and components approved specifically for pipe heat tracing, as manufactured by Thermon Manufacturing Co., Item No. 5-FLX-1.
- B. The self-regulating system shall consist of (2) nickel-plated copper bus wires embedded in a radiation cross-linked semi-conductive polymer core. The system shall be capable of varying its heat output all along its length, allowing the system to be crossed over itself without overheating. The system shall be covered by a polyolefin dielectric jacket rated 300 VAC at 105°C and a tinned copper braid, (12 AWG equivalent wire size). Buried piping to ground hydrant shall have an additional covering of a flouropolymer outer jacket for protection from organic chemicals or corrosives. For piping above grade, heating cable shall have an additional polyolefin outer jacket for protection from aqueous inorganics.
- C. The system shall operate on live voltage of 110-120 VAC without the use of transformers. The system shall have additional thermostat control.
- D. Refer to the manufacturer's freeze protection "Design Guide" for design details, maximum lengths and accessory information.

2.11 THERMOMETERS

- A. Thermometers shall be adjustable angle design of the separable well type and shall have a 9" cast aluminum case. The scale shall be white with black figures and graduations embossed on the scale. The column shall be filled with red reading mercury. Thermometers shall be manufactured by Terice Co. or Taylor Instrument.
- B. Thermometers shall be furnished complete with all necessary sockets, wells, connectors and accessories required for installation suitable for the service in which installed. Extension necks shall be furnished for insulated piping.
- C. Thermometers shall be furnished with the temperature ranges of 30° to 100°F for cold water, and of 30° to 240°F for hot water systems.

2.12 PRESSURE GAUGES

- A. Pressure gauges shall have brass movement, aluminum case, double strength clear glass window with black embossed figures and graduations on a white dial face, with 1% accuracy of scale range. Gauges shall be manufactured by Terice Co., Taylor Instrument, or Marshaltown Mfg.
- B. Gauges shall be furnished with snubbers and needle valve shutoff valves.
- C. Gauges shall be 4 1/2" diameter furnished with ranges that will locate the intended pressure at the point of application approximately midpoint on the range scale. Gauges for natural gas, vacuum and similar low pressure systems shall be gauges specifically designed for low pressure applications.

2.13 WATER METERS

- A. Meter shall be displacement type with cast iron casing and bronze trim. Meter shall consist of standard trimmings including an all bronze bypass meter with isolation valves, bronze and stainless steel gears and spindles, strainer and flanged ends. Meter shall be fitted with OS&Y gate valves, cast iron body and bronze trim. Meter shall meet all requirements of the local Water Department and shall be equipped with dry contacts for remote reading on the Building Automation System.

2.14 GREASE TRAPS, PLASTER TRAPS AND SEDIMENT INTERCEPTORS

- A. Grease Traps
 - 1. Furnish and install prefabricated steel PDI rated and approved grease trap with acid resistant enamel interior and exterior, low inlet, high outlet, bronze cleanout plug, visible double wall trap seal, gas and watertight gasketed cover, recessed and covered center securing handle and flow control fitting.
 - 2. Trap shall be ejecto-matic greaseceptor type, ___ GPM, ___ lbs grease capacity.

2.15 BUILDING AUTOMATION SYSTEM

Coordinate Points with HVAC Engineer

- A. The building automation system shall be furnished and installed under another Section of these specifications. This Subcontractor shall provide the tees, pipe wells, valves, and caps to allow the connection from the BAS system to the plumbing points required. The pH probes, moisture content meter and resistivity probe shall be provided for BAS tie-in. The following table itemizes the equipment and location of the type of device necessary to connect to the BAS system.

Service or Equipment	Pressure	Temperature	Flow	Trouble	Location
Water meter			X		Basement
Water heaters		X			Basement
Water booster pumps	X			X	Basement
Vacuum pumps	X			X	Basement
Air compressor	X			X	Basement
Ejectors				X	Basement

2.16 VIBRATION ISOLATION AND SEISMIC RESTRAINTS

A. General Requirements

1. This Section 15400 Contractor shall provide noise and vibration isolation systems to prevent the transmission of excessive structural borne noise or vibration to critical and non-critical areas of the building as characterized by NC35 to NC40 noise criteria levels.
2. The work under this Section shall include the furnishing and installation of all equipment, appliances, materials, tools, labor and the performing of all operations necessary for the complete execution of the installation of noise and vibration isolation devices and/or systems as may be specified under the equipment specifications elsewhere contained in this Section, as may be scheduled on the drawings and as specified herein, including but not necessarily limited to the following:
 - a. All equipment such as pumps, air compressors, etc., shall be isolated from the building structure by means of noise and vibration isolators.
 - b. All piping and in mechanical equipment rooms and penthouses over 1" diameter shall be isolated from the building structure by means of noise and vibration isolation hangers.
 - c. Piping penetrations through floors and walls shall not be rigidly connected to the building structure. Provide sleeves with clearances around the outside, as recommended by the vibration materials manufacturer. All such penetrations shall be smoke and firestopped in an approved manner as hereinbefore specified.
 - d. Generally, isolation facilities shall be designed to limit equipment room floor or roof loading to a maximum of 50 lbs./sq.ft. and vibration isolators shall be carefully and specifically selected for each piece of equipment.
 - e. Piping found to have water hammer or other objectionable vibration or noise which cannot be eliminated by proper grading or other natural means shall be braced, trapped, hung with vibration isolating hangers, equipped with air chambers or mechanical shock absorbers, flexible pipe connectors or otherwise silenced using means as approved by the Architect.
 - f. Motor driven equipment which is to be isolated, shall have motor mounted on the isolated equipment or shall have motor, equipment and drive mounted on a common base.
3. The vibration materials manufacturer shall be responsible for the proper selection of all isolation materials, including selection of spring rates to accomplish the specified minimum static deflections for spring and pad type isolators, based on weight distribution and location of equipment.
4. This Section 15400 Contractor shall furnish to the vibration materials manufacturer the following:
 - a. A complete approved set of shop drawings of all isolated equipment showing operating weight and weight distribution at support points.
5. Prior to ordering any products, submit shop drawings of the vibration isolation equipment. The shop drawings must be complete when submitted and must be

represented in a clear, easily understood form. Incomplete or unclear presentation of shop drawings may be reason for rejection of the submittal.

- a. A complete description of products to be supplied, including product data, dimension, specifications, and installation instructions.
- b. Detailed selection data for each vibration isolator supporting equipment, including:
 - 1) The equipment identification mark
 - 2) The isolator type
 - 3) The actual load
 - 4) The static deflection expected under the actual load
 - 5) Specified minimum static deflection
 - 6) The additional deflection to solid under actual load
 - 7) The ratio of spring height under actual load to spring diameter
- c. Steel rails, steel base frames and concrete inertia base showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
- d. Special details necessary to convey complete understanding of the work to be performed.
- e. Submission of samples may be requested for each type of vibration isolation device. After approval, samples will be returned for installation at the job. All costs associated with submission of samples shall be borne by this Section 15400 Contractor.

6. Materials and Equipment

- a. All vibration and isolation mounts shall be supplied by one of the following approved manufacturers:
 - 1) Amber/Booth Co. - A.B.
Houston, Texas
 - 2) Korfund Dynamics Corp. - K.D.
Westburn, New York
 - 3) Mason Industries Inc. - M.I.
Hollis, New York
 - 4) Peabody Noise Control Inc. - P.N.C.
Dublin, Ohio
 - 5) Vibration Mountings and Controls Inc. - V.M.&C.
Butler, New Jersey
- b. Unless otherwise specified, supply only new equipment, parts and materials.
- c. Substitutions of equal equipment beyond the alternatives listed will be permitted only with the written permission of the Architect. Accompany each request for acceptance of substitute equipment with manufacturer's certified data proving the equivalence of the proposed substitute in quality and performance. The Architect shall be the final judge of the validity of the data submitted.

7. Quality Assurance

- a. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other Trades. Coordinate plan dimensions with size of housekeeping pads.
- b. Provide vibration isolators of the appropriate sizes and proper loading to meet the specified deflection requirements.
- c. Supply and install any incidental material needed to meet the requirements stated herein, even if not expressly specified or shown on the drawings, without claim for additional payment.
- d. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- e. Should any rotating equipment cause excessive noise or vibration, this Section 15400 Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration level. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.
- f. Upon completion of the work, the Architect or Architect's representative shall inspect the installation and shall inform the installing contractor of any further work that must be completed. Make all adjustments as directed by the Architect that result from the final inspection. This work shall be done before vibration isolation systems are accepted.

8. Speed and Balance Requirements for Rotating Equipment

- a. Rotating mechanical equipment shall not operate at speeds in excess of 80% of their future critical speed.
- b. Vertical vibration of rotating equipment shall not be greater than the levels indicated. The vibration shall be measured on the equipment or steel frame equipment base when the equipment is mounted on its vibration isolation mounts. If the equipment has an inertia base, the allowable vibration level is reduced by the ratio of the equipment weight alone to the equipment weight plus the inertia base weight.

Equipment Speed	Vibration Displacement Mils Peak to Peak
Under 600 rpm	4
600 to 1000 rpm	3
1000 to 2000 rpm	2
Over 2000 rpm	1

B. Materials

1. General

- a. Isolator types are scheduled to establish minimum standards. At this Section 15400 Contractor's option, labor-saving accessories can be an integral part of isolators supplied to provide initial lift of equipment to operating height, hold piping at fixed elevations during installation and initial system filling operations, and similar

installation advantages. Accessories must not degrade the vibration isolation system.

- b. Static deflection of isolators shall be as provided in the vibration isolation schedule and as shown on the drawings. All static deflections stated are the minimum acceptable deflection for the mounts under actual load. Isolators selected on the basis of rated deflection are not acceptable and will be disapproved.

2. Unit FSN (Floor Spring and Neoprene)

- a. Spring isolators shall be freestanding and laterally stable without any housing. Spring minimum diameter shall be 0.8 of the compressed height of the spring at the design load. Springs shall have a minimum additional travel to solid equal to 50% of the actual deflection. Springs shall be so designed that the approximate ratio of horizontal stiffness to vertical stiffness is 1 (one). All mounts shall have leveling bolts.
- b. The spring element in the isolator shall either be set in a neoprene cup and have a steel washer to distribute the load evenly over the neoprene, or each isolator shall be mounted on a unit DNP isolator. If the DNP isolator is used, a rectangular bearing plate of appropriate size to load the pad uniformly in the range of 40 to 50 psi shall be provided. If the spring isolator is supplied with a neoprene friction pad, a stainless steel or aluminum plate shall be used between the friction pad and the DNP isolator. The DNP isolator, separator plate and friction pad shall be permanently adhered to one another and to the bottom of the bearing plate.
- c. If the isolator is to be fastened to the building structure and a unit DNP isolator is used under the bearing plate, neoprene grommets shall be provided for each bolt hole in the base plate. Bolt holes shall be properly sized to allow for grommets. The hold down bolt assembly shall include washers to distribute load evenly to the grommet. Bolts and washers are to be galvanized.

3. Unit HN (Hanger Neoprene or Glass Fiber)

- a. Vibration isolation hanger shall consist of a neoprene-in-shear or pre-compressed glass fiber element contained within a steel housing. A neoprene neck bushing (or other element) shall be provided where the hanger rod passes through the hanger housing to prevent the rod from contacting the hanger housing. The diameter of the hole in the housing shall be sufficient to permit the hanger rod to swing through a 30° arc before contacting the hanger housing.
- b. Unit HN isolators shall be one of the following products or approved equal:

- Type BRD-A: A.B.
- Type H: K.D.
- Type HD: M.I.
- Type RH or FH: P.N.C.
- Type RHD or RFD: V.M.&C.

4. Unit FN (Floor Neoprene)

- a. Neoprene isolators shall be neoprene-in-shear type with steel reinforced top and base. All metal surfaces shall be covered with neoprene. The top and bottom surfaces shall be ribbed. Bolt holes shall be provided in the base and the top shall have a threaded fastener. The mounts shall include leveling bolts that may be rigidly connected to the equipment.
- b. Type FN isolators shall be one of the following products or approved equal:
 - Type RVD: A.B.
 - Type F: K.D.
 - Type ND: M.I.
 - Type RD: K.N.C.
 - Series RD: V.M.&C.

5. Equipment Bases

- a. Type BSF (Base - Steel Frame)
 - 1) Steel base frames shall consist of structural steel sections sized, spaced, and connected to form a rigid base which will not twist, rack, deform, or deflect in any manner which will negatively affect the operation of the supported equipment or the vibration isolation mounts. Frames shall be adequately sized to support basic equipment units and motors plus any associated pipe elbow supports, duct elbow supports, electrical control elements, or other components closely related and requiring resilient support in order to prevent vibration transfer to the building structure. The depth of steel frame bases shall be at least 1/10 the longest dimension of the base, but not less than 6" nor more than 12". The base footprint shall be large enough to provide stability for supported equipment.
 - 2) Frame bases shall include side mounting brackets for attachment to vibration isolators. Mounting brackets shall be located on the sides of the base that are parallel to the axis of rotation of the supported equipment.
 - 3) Type BSF bases shall be supplied by the isolator manufacturer and shall be one of the following products or approved equal:
 - Type WX: A.B.
 - Type Steel Base: K.D.
 - Type WFSL: M.I.
 - Type SFB or SRB: K.N.C.
 - Series WFB: V.M.&C.

6. Resilient Penetration Sleeve/Seal

- a. Resilient penetration sleeve/seals shall be field fabricated from a pipe or sheet metal section that is 1" larger in each dimension than the penetrating element and is used to provide a sleeve through the construction penetrated. The sleeve shall extend 1" beyond the penetrated construction on each side. The annular space

between the sleeve and the penetrating element shall be packed tightly with glass fiber or mineral wool to within ¼" of the end of the sleeve. The remaining ¼" space on each side shall be filled with acoustical sealant to form an air-tight seal. The penetrating element shall be able to pass through the sleeve without contacting the sleeve. Alternatively, prefabricated sleeves or other assembled as specified elsewhere in this section and accomplishing the same result are acceptable.

7. Resilient Lateral Guides

- a. These units shall be the standard product of the vibration isolation mounting manufacturer, incorporating neoprene isolation elements which are specifically designed for providing resilient lateral bracing of vertically rising ducts or pipes.
- b. Resilient lateral guides shall be one of the following products or approved equal:
 - Type Custom: A.D.
 - Type Custom: K.D.
 - Type ADA: M.I.
 - Type RGN: P.N.C.
 - Type MDPA: V.M.&C.

8. Flexible Pipe Connections

- a. Flexible pipe connections shall be fabricated of multiple plies of nylon cord, fabric, and neoprene, vulcanized so as to become inseparable and homogeneous. Straight connections shall be formed in a double sphere shape. Elbow connections shall have a single sphere shape at the curve of the unit. Flexible connections shall be able to accept compressive, elongative, transverse, and angular movements.
- b. The flexible connections shall be selected and specially fitted, if necessary, to suit the system temperature, pressure, and fluid type. No rods or cables shall be used to control extension of the connector.
- c. Connectors for pipe sizes 2" or smaller shall have threaded female union couplings on each end. Larger sizes shall be fitted with metallic flange couplings.
- d. Flexible pipe connections shall be Mason Industries Type MFTNC, MFTFV, or MFNEC, or Metraflex Twin Sphere or ED1 Sphere.

9. Thrust Restraints

- a. Thrust restraints shall consist of a spring element in series with a neoprene pad. The unit shall be designed to have the same deflection as specified for the isolator supporting the equipment. The spring element shall be contained within a steel frame and be designed so it can be reset at the factory for thrust and be adjusted in the field to allow for a maximum ¼" movement during starting or stopping of the equipment.
- b. The assembly shall be furnished complete with rods and angle brackets for attachment to both the equipment and the adjacent fixed structural anchor.
- c. Thrust restraints shall be Mason Industries Type WB, Peabody Noise Control Type HSR, or an equal product of the manufacturer supplying the isolators.

10. Grommets

- a. Grommets shall either be custom made by combining a neoprene washer and sleeve, be Isogrommets as manufactured by MBIS, Inc. (Bedford Heights, Ohio), or be Series W by Barry Controls (Watertown, Mass.). Neoprene durometer is to be between 30 and 50. Grommets shall be special formed to prevent bolts from directly containing the isolator base plate.

11. Acoustical Sealant

- a. Sealants for acoustical purposes as described in this specification shall be one of the non-setting sealants indicated below or an approved equivalent:

- Acoustical sealant: D.A.P.
- BR-96: Pecora
- Acoustical sealant: Tremco
- Acoustical sealant: U.S.G.

C. Execution

1. Major Equipment

- a. Unless otherwise shown or specified, all floor mounted major equipment shall be set on 4" high concrete housekeeping pads. See architectural or structural drawings for details.
- b. Types and minimum static deflections of vibration isolation devices for major equipment devices shall be a scheduled on the drawings or specified hereunder.
- c. Flexible pipe connections shall be installed at all pipe connections to vibration isolated equipment in the positions shown on the drawings.
- d. Electrical connections to vibration isolation equipment shall be flexible, as called for in the electrical portion of the specification.
- e. Thrust restraints shall be installed on equipment as called for in the schedule on the drawings of specified hereunder.

2. Miscellaneous Mechanical Equipment

- a. Miscellaneous pieces of mechanical equipment such as hot water converters, pressure reducing stations, heating converters, storage tanks, condensate receiver tanks, and expansion tanks shall be vibration isolated from the building structure by Unit NP or Unit HN isolators unless their position in the piping system requires higher degrees of isolation as called for under Pipe Isolation.

3. Pipes

- a. All water, compressed air and vacuum piping within mechanical rooms or within 50'-0" total pipe length (whichever is longer) of connected vibration isolated equipment and all of the above piping that is 6" or larger shall be isolated from the

building structure by means of vibration isolation mounts, resilient pipe guides, and resilient penetration sleeve/seals.

- b. Isolators for the first three (3) support points adjacent to connected equipment shall achieve $\frac{1}{2}$ the specified static deflection of the isolator supporting the connected equipment. When the required static deflection of these isolators is greater than $\frac{1}{2}$ ", Unit FSN or HSN isolators (whichever is applicable to the mounting condition) shall be used. When the required static deflection is less than or equal to $\frac{1}{2}$ ", Unit FN or HN isolator (whichever is applicable to the mounting condition) shall be used.
- c. All other pipe support isolator within the specified limits shall be either Unit FN or HN (whichever is applicable to the mounting condition) achieving 0.25" static deflection.
- d. Where lateral support of pipe risers is required within the specified limits, this shall be accomplished by use of resilient later supports.
- e. Pipes within the specified limits that penetrate the building constructions shall be isolated from the building structure by use of resilient penetrating sleeve/seals.
- f. Drain piping connected to vibration isolated equipment shall not contact the building structure or other non-isolated system unless it is resiliently mounted as described above.
- g. Provide flexible pipe connections in piping system as called for under Major Equipment above and wherever shown on the drawings.

4. Isolation Mounts

- a. All vibration isolator shall be aligned squarely above or below mounting points of the supported equipment.
- b. Isolators for equipment with bases shall be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
- c. Locate isolators to provide stable support for equipment, without excess rocking. Consideration shall be given to the location of the center of gravity of the system and the location and spacing of the isolators.
- d. If a housekeeping pad is provided, the isolator shall bear on the housekeeping pad and the isolator base plate shall rest entirely on the pad.
- e. Hanger rods for vibration isolator support shall be connected to structural beams or joists, not from the floor slab between beams and joists. Provide intermediate support members as necessary.
- f. Vibration isolation hanger element shall be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360° about the rod axis without contacting any object.
- g. Parallel running pipes may be hung together on a trapeze which is isolated from the building. Isolator deflections must be the largest determined by the provisions for pipe isolation. Do not mix isolated and non-isolated pipes on the same trapeze.
- h. No pipes or equipment shall be supported from other pipes or equipment.
- i. Resiliently isolated pipes shall not contact the building construction or other equipment.

- j. The installed and operating heights of vibration isolated equipment mounted on Unit FSNTL isolators shall be identical. Limit stops shall be out of contact during normal operation. Adjust isolators to provide ¼" clearance between the limit stop brackets and the isolator top plate, and between the travel limit nuts and travel limit brackets.
 - k. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.
5. Bases
- a. No equipment unit shall bear directly on vibration isolator unless its own frame is suitably rigid to span between isolators and such direct support is approved by the equipment manufacturer. This provision shall apply whether or not a base frame is called for on the schedule. In the case that a base frame is required for the unit because of the equipment manufacturer's requirements and is not specifically called for on the equipment schedule, a base frame recommended by the equipment manufacturer shall be provided at no additional expense.
 - 1) Unless otherwise indicated, there is to be a minimum operating clearance of 1½" between inertia bases or steel frame bases and the floor beneath the equipment. Position isolator mounting brackets and adjust isolators so that the required clearance is maintained. The clearance space shall be checked by this Section 15400 Contractor to ensure that no construction debris has been left to short circuit or restrict the proper operation of the vibration isolation system.
6. Flexible Pipe Connections
- a. Install flexible pipe connections in accordance with the manufacturer's instructions.
7. Thrust restraints shall be attached at the centerline of thrust and symmetrically one (1) each side of the unit. Adjust the restraints to limit equipment movement to the specified limit.
8. Penetration seals shall maintain an airtight seal around the penetrating element and shall prevent rigid contact between the penetrating element and the building structure. Fit the sleeve tightly to the building construction and seal airtight on both sides of the construction penetrated with acoustical sealant.
9. All vibration isolation springs exposed to weather shall have the springs installed in a suitable housing for stiffness and moisture protection.
10. Equipment provided with internal vibration isolating springs will not be required to be provided with external vibration isolators.

11. Vibration Isolation Schedule

Equipment Type	Isolator Type	Min. Static Defl. (In.)	Base Type	Remarks
Vacuum Pumps	FSN	1.5	BSF	
PRV Stations	HN	0.2	---	
Air Compressor	FSN	1.5	BSF	
In-Line Pumps	HN	0.35	---	
Domestic Water Pumps	FN	1.5	BSF	
RODI Pump Skids	FN	1.5	BSF	

PART 3 – EXECUTION

3.1 BACKFLOW PREVENTERS AND APPROVALS

- A. Potable water piping outlets and connections to equipment shall be protected with an airgap or backflow preventer approved by the Department of Environmental Protection Agency or Board of Health. All installations, clearances and equipment shall be in strict accordance with State regulations.
- B. Submit plans and obtain approval for each reduced pressure backflow preventer installation. Copies of approvals shall form a portion of the record drawings.
- C. All reduced pressure backflow preventers shall be installed with inlet and outlet gauges, strainer and indirect waste through an airgap to a floor drain or receiver.

3.2 INSULATION INSTALLATION

- A. Insulation shall be installed in accordance/compliance with the manufacturer's application recommendations by person(s) specializing in this work. Insulation not installed in an acceptable manner will be replaced by this Contractor at no additional cost.
- B. All piping systems shall be cleaned, tested and approved prior to installing insulation. Provide continuous vapor barrier on cold water, rainwater, indirect waste and all insulated systems where condensation could occur.
- C. Piping: Pipe insulation where vapor barrier jacket is required, shall be installed with vapor barrier jackets drawn tight and firmly sealed to assure a positive vaporseal. End joints shall be covered with 4" wide butt strips of material identical to vapor barrier jackets, and they shall be drawn tight and securely sealed. The use of staples, bands, etc., to secure insulation where vapor barrier jacket is required will not be acceptable. Pipe insulation where no vapor barrier is required shall be secured with flare type staples.

- D. Fitting and Valves: Molded insulation on fittings and valves bodies shall be same thickness as adjacent covering and finished neatly to match the adjacent pipe insulation.
- E. Hangers and Saddles
 - 1. Insulation inserts shall be installed at points of hanger support. Insulation inserts shall be either 180° or 260° and not less than 18" in length. The entire insert shall be covered with a vapor barrier facing of the same appearance and quality as the facing on the adjacent covering.
 - 2. Insulation at hangers, anchors and supports shall be neatly cut and fitted.

3.3 IDENTIFICATION OF SYSTEMS

- A. Provide clip-on color coded piping identification markers on piping systems installed under this Section. Provide matching flow arrows to indicate direction of flow. Markers shall be Seton Nameplate Co., W.H. Brady, Westline Products or approved equal.
- B. Color coding shall comply with the American Hospital Association or ANSI A13.1 Standards as directed by the Owner.
- C. Install markers on each side of wall penetrations, at each valve, at tee fittings and base of risers. Spacing of markers shall not exceed 20'-0" and shall include at least one marker in each room. Letters shall not be less than 1 1/2" in height. Arrows shall not be less than 9' long.
- D. Install markers on cleaned or painted piping only after piping is complete and has been accepted by the Architect. Install marker adjacent to access panels where piping is concealed.
- E. Stencil equipment, such as pumps, compressors, water heaters, and tanks with the name of the equipment and equipment number. Stencils shall be at least 6" high and of a color to provide a contrast with the equipment finish.

END OF SECTION