SUPERSEDED

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STANDARD SPECIFICATION

SECTION 15250

INSULATION - MECHANICAL SYSTEMS

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STANDARD SPECIFICATION

SECTION 15250

INSULATION - MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 WORK REQUIREMENTS

A. Insulation shall be applied in a neat and workmanlike manner. Contractor shall be required to remove and replace all insulation not applied in strict accordance with manufacturer's specifications or not presenting a neat appearance.

B. Insulation shall be applied to clean dry surfaces. Piping and ductwork shall be tested before insulation is applied or joints shall be left uncovered until tests have been performed.

C. All insulation on indoor work shall have composite (insulation, jacket or facing and adhesive used to adhere jacket or facing to the insulation) fire and smoke Hazard Ratings, as tested by procedure ASTM E-84, NFPA 255 and UL 73 not exceeding Flame Spread of 25, Fuel Contributed of 50 and Smoke Development of 50 Accessories, such as adhesives, mastics, cements tapes and cloths for fittings shall have component rating as listed above.

D. Insulation shall be continuous through wall and ceiling openings and sleeves.

E. Specified mastics, adhesives and coatings shall be applied in strict accordance with manufacturer's instructions, including recommended coverages.

F. All domestic cold water and non-potable water concealed above ceilings or within 24 inches of an outside wall or concealed in partitions, in basement areas, or penthouses shall be insulated.

1.02 WORK INCLUDED

Materials and operations required for the installation of insulation for domestic cold, non-potable cold water, and hot water, hot water circulating, hot water heating, low and high pressure steam (interior only), hot condensate, chilled water, cold condensate, roof drain, dual temperature, and refrigerant piping; converters and hot water storage tanks, air conditioning ducts, duct lining for ductwork and plenums, underground chilled water and hot water.

1.03 QUALITY ASSURANCE

All insulating materials required for piping, mechanical equipment and ductwork, etc., shall be furnished and installed under this contract. The execution of the work shall be by the insulation manufacturers or their approved contractors in strict accordance with the best practice of the trade and the intent of this Specification.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

The firms mentioned in the following materials sections are of acceptable type, quality and performance.

2.02 PIPING

A. Piping: (10" IPS - 36" IPS) -60 to 650°F.

1. List of Materials:

   All hot and cold pipe shall be covered with "Pipe Wrap" or Bend-a-Board. The insulation shall be a roll of semi-rigid fiberglas board insulation. The fibrous insulation is adhered to the ASJ jacket with the end grain of the insulation perpendicular to the jacket surface. Each 36" section of the "Pipe Wrap" may be secured on the longitudinal seam by using staples and mastic or vapor barrier ASJ pressure sensitive tape. Adjacent sections shall be butted together and then sealed with vapor barrier ASJ tape. Thickness - 1/2" greater than the below specified pipe insulation.

2. Fiberglas Density: 5 lb./Cu. Ft.

3. Compressive Strength: 125 lb./Sq. Ft.

4. Thermal Conductivity (K) at 75F Mean Temp.: 0.22.

5. Insulation Jacket: All Service Jacket (ASJ).

6. Weather Protection: Same as Section B-7.

B. Piping: (9" IPS and Below)

1. Economic thickness - Fiberglas pipe covering.

PIPING SYSTEM	TEMPERATURE, F	ASHRAE 90-80 RECOMMENDED ECONOMIC THICKNESS PIPE SIZE 1" & Below	PIPE SIZE 1-1/2" to 2"	PIPE SIZE 2-1/2" to 4"	PIPE SIZE Above 4"
Heating					
Hi Pressure Steam	306 to 400	2.5	2.5	3.0	3.5
Med. Pressure Steam	251 to 305	2.0	2.5	2.5	3.0
Low Pressure Steam	200 to 250	1.5	1.5	2.0	2.0
Condensate	190 to 220	1.0	1.5	2.0	2.0
Hot Water-Dual Temp.	120 to 200	1.0	1.0	1.5	1.5
Air Conditioning					
Chilled Water	40 to 55	.5	.75	1.0	1.0
Drain	35 to 50	.5	.5	1.0	1.0
Brine	Below 40	1.0	1.5	1.5	1.5
Make-Up Water	40 to 55	.5	.5	1.0	1.0
Plumbing					
Cold Water	55 to 65	1.0	1.0	1.0	1.0
Hot Water	100 to 150	1.0	1.0	1.5	1.5

2. Fiberglas Density:

   All fiberglas pipe insulation shall be nominal 5 pcf density.

3. Insulation Jackets:

   a. Hot Pipes Concealed and Exposed.

      Factory applied white all All Service Jacket (ASJ), with factory applied self-sealing laps (SSL-11) or outward clinching staples on the longitudinal seams.

   b. Cold Pipes Concealed and Exposed (Chilled Water):

      White ASJ Jacket with factory applied self-sealing, pressure sensitive adhesive to adhesive longitudinal lap seal (SSL-11). Ends of pipe insulation shall be sealed off at valves, fittings and flanges, and at 21 feet intervals on continuous runs, with Benjamin Foster 30-35 adhesive. No staples.

4. Fittings, Valves and Flanges:

   a. Where manufactured, by Speedline or Hamfab, factory molded fittings (of the same material and thickness as the pipe insulation) shall be used for all fittings, flanges and valves.

   b. Where pre-molded insulation fittings are not manufactured, all fittings, flanges and valves (for service below 603°F) shall be insulated with mitered segments of nominal 6 lb. density fiberglas pipe covering. Hot service finish - concealed and exposed - embed a 20 x 20 weave white glass reinforcing cloth between two 1/16 inch coats of Benjamin Foster 30-36. The glass cloth and second coat shall overlap adjacent covering by at least two inches. Cold Service Finish - concealed and exposed same as above except use Benjamin Foster 30-35.

   c. Insulation for removable flanges of pipe strainers on cold services shall be fabricated with built-up sections of fiberglas pipe covering, so arranged as to facilitate servicing of the strainer. Applications shall be complete with vaporseals. It is the intent of these Specifications that all vapor barriers be sealed and continue to hangers, walls, sleeves, etc. All adhesives and coatings shall be as noted herein.

   d. Fittings, flanges, valves, etc., for services where Kaylo insulation is specified as a pipe insulation, shall be insulated with insulating cement of equal thickness to the pipe insulation and finished with open weave glass mesh sealed with BF 30-36 on pipes below 4" IPS. Pipes 4" IPS and above, use Kaylo mitered segments wired in place with copper clad wire. Finish with 1/8" coat of insulating cements, 10 x 10 glass weave reinforcing fabric embedded between two 1/4" coats of BF 30-36.

5. Protection of Insulation:

   a. Insulation on cold and hot pipes shall be protected by saddles from hangers, guides and rollers.

      Installing 360° rigid insulation inserts and 360° sheet metal sleeve as manufactured by Pipe Shields, model CSCW for cold pipes and model CSHW for hot pipes.

      Alternate installing 16 gauge galvanized metal shields (at least 3 times the insulation diameter in length and 1/3 the insulation circumference in width), on the outside of the insulation. Where fiberglas insulation is used on piping 360° section of Kaylo pipe insulation of equal thickness shall be used.

   b. Exposed piping at an elevation 8 feet or less above the floor, shall be protected with corrugated aluminum jacket 0.016 inch thick applied with aluminum lock-type bands, 12 inches apart.

6. Piping Subject to Freezing:

   Any piping subject to freezing shall be covered with another additional layer of 2-inch fiberglas insulation of the same finish as specified for the particular service when not subject to freezing.

7. Piping Exposed to Weather:

   Piping which is exposed to weather or called to be electric heated/weatherproofed shall be covered - in addition to insulation and finishes specified for freezing - with corrugated aluminum jacket 0.016 inch thick applied with aluminum lock-type bands, 12-inches apart. Fittings, flanges, strainers and valves shall be coated with BF 65-07.

8. Handicapped Lavatories:

   Insulate all water piping and the p-trap and drain line below each handicapped lavatory with 3/4" thick Armaflex or equivalent material.

9. Refrigerant Suction Piping:

   a. Shall be insulated using 3/4" thick Owens-Corning O-C flexible tubing insulation.

   b. All butt ends and longitudinal joints shall be sealed with O-C 500 adhesive as manufactured by Owens-Corning Co.

   c. Flexible tubing insulation, when exposed to the weather, shall be protected by apply two (2) coats of exterior weatherproof coating as recommended by the manufacturer.

2.03 PREINSULATED PIPE

A. Underground Chilled Water and Hot Water:

1. The insulation shall be rigid closed cell urethane foam with a "K" factor of less than 0.15 at 75°F mean pipe temperature and shall be self extinguishing as manufactured by Insta-Foam Products, Inc., or by the Triangle Conduit and Cable Company.

   a. The urethane foam shall be foamed in place in the factory between the pipe and outer jacket causing the foam to bond securely to both surfaces.

2. There shall be no seams or voids throughout.

3. Thickness shall be 1" and shall be uniform within $\pm$ 1/8" throughout.

4. The waterproof jacket shall be extruded from Hi-impact rigid vinyl (PVC) type II.

5. All joining of fittings to pipe shall be accordance with the manufacturer's standard underground installation instructions and as indicated on drawings.

2.04 EQUIPMENT

List of Materials

A. Expansion Tanks (Chilled Water and Hot Water)

Shall be 1-1/2" thick fiberglas industrial board. Type 705 6 lb. density and finished with 0.016 aluminum or Alpha TGH 1000 jacketing.

B. Hot Water Converters, Condensate Receivers, Flash Tanks, Separators and Blow-Off Tanks:

Shall be 1-1/2" thick fiberglas, 705 6 lb. density. Finish with .016 aluminum or Alpha TGU 1000 jacketing.

C. Chilled Water Cooler:

Shall be 2" thick fiberglas industrial board, Type 705, faced with foil reinforced kraft (FRK), 6 ib. density finished with 0.016 aluminum or Alpha TGH 1000 jacketing.

D. Pumps (Chilled Water and Hot Water):

Shall be 2" thick, 6 lb. density fiberglas rigid board, Type 705, applied to sheet metal boxes as described herein below.

E. Boiler Flue:

Metal flue both horizontal and vertical from boilers shall be insulated with 3" thick hydros calcium silicate block securely wired on 9" centers with #16 gauge copper clad wire. Where exposed insulation shall be finished with two 1/2" coats of cement applied over hex mesh and corner beads. Final coat shall be mixed with Portland cement and troweled to a smooth hard finish. Provide removable insulation at access doors.

F. Emergency Electric Generator:

Emergency Electric Generator Engine Exhaust. Engine exhaust piping, fittings, and silencer shall be insulated with 4" thick hydrous calcium silicate pipe insulation and block finish same as for Boiler Flue.

G. Ducts in Trenches:

Rectangular ducts shall be insulated with 1" thick fiberglas industrial board, Type 705, 6 lb. density, finished with 0.016 aluminum or Alpha TGH 1000 jacketing.

"Pipe Wrap" with ASJ jacketing shall be acceptable for the above A through D sections. The 705 board shall be applied by mechanical fasteners such as stick clips. Joints shall be sealed with an adhesive, as approved and reinforced with a glass of cloth membrane. All pinheads shall be buttered with an adhesive, as approved.

Removable heads for all equipment (such as coolers and interchangers) and the horizontally split pumps, shall be enclosed in aluminum sheet metal boxes for easy removal with 6 lb. density fiberglas rigid board applied to inside of sheet metal boxes of thickness as described above.

2.05 DUCTWORK

List of Materials and Finishes

A. Air Conditioning, Supply Return, Exhaust, Air Intake, Plenums, Rectangular Ducts Within Mechanical Equipment Room:

Shall be 1" thick 705 rigid board applied with mechanical fasteners. Seal all joints and breaks with 3" wide ASJ tape. All punctures shall be sealed with ASJ patches. Where stiffening angles are 1-1/2", insulation shall be 1-1/2" thick.

B. All Rectangular Supply and Return Ducts for Heating, Cooling, Dual Temperature and Ventilating:

A 2" thick 3/4 lb./cu. ft. density with a facing of reinforced foil draft laminate. Use OCF All Service Wrap or approved equal. The vapor barrier shall be legibly printed by the manufacturer to show flame spread smoke developed, nominal thickness and and type of insulation. The duct wrap shall be applied over clear dry sheet metal duct work that has been sealed air-tight at all seams and joints. Duct Wrap shall be installed to allow maximum fullness at corners (avoid excessive compression).

Use manufacturer's suggested "stretchout" information. Insulation shall be butted tightly at joints and vapor barrier facing shall be overlapped a minimum of 2". All seams shall be stapled approximately 6" on center with outward clinching staples, then sealed with a foil vapor barrier tape. Where ducts are over 24" in width, the duct wrap shall be additionally secured to the bottom of the rectangular ducts with mechanical fasteners spaced on 18" centers (maximum), to prevent sagging of insulation. Seal penetrations so as to provide a vapor-tight system.

C. All connections to Fiberglas Flexible Duct shall be installed in sizes and locations where indicated on drawings. The flexible duct shall have: maximum interior air temperature of 200°F, maximum static pressure 10", maximum negative air pressure 1/2" a C value of .23 BTU/hr./ft.2/F. or approved equal.

D. Outdoor Duct Insulation:

Insulate all heating, ventilating and air conditioning sheet metal ductwork, outdoors, exposed to the weather, with 2" thick 6 lb. density 705 ASJ Board or approved equal.

Application:

Insulation shall be cut and fit tightly between standing seams. Insulation boards shall be applied using mechanical fasteners, such as weld pins or stick clips. Fasteners shall be located not less than 3" from each edge or corner of the board. Pin or clip spacing along the duct should be no greater than 12" on centers. Additional pins or clips may be required to hold the insulation tightly against the surface where cross breaking is used for stiffening. Weld pin lengths must be selected to insure tight fit but avoid "oil canning" effect.

Finish:

Air Conditioning, heating and ventilating ducts. Cover all joints and fastener penetration with 3" wide pressure sensitive All Service Jacket (ASJ) tape. Rub tape hard with a nylon sealing tool. Over the entire surface apply a 20 x 20 weave

glass reinforcing cloth embedded between two 1/8" thick wet coats of Breather mastic, i.e., B. Foster Seal Fast 6 PM 35-00-4500.

E. Duct Lining for Rectangular heating and Cooling Ducts:

Shall be 1" thick 3 lb./cu./ft. density with a black fire resistant coating. Use Aeroflex or Engineers approved equal.

Application:

All portions of duct designated to receive duct liner shall be completely covered with Duct Liner. Transverse joints shall be neatly butted and there shall be no interruptions or gaps.

The black coated surface of the Duct Liner shall face the air stream.

The Duct Liner shall be adhered to the sheet metal with 100% coverage of adhesive and all exposed leading edges and all transverse joints coated with adhesive. Adhesive shall conform to Adhesive and Sealant Council Standards for Adhesive for Duct Liner, ASC-A-7001C-1972.

The Duct Liner shall be additionally secured with mechanical fasteners (Mechanical fasteners hall conform to Mechanical Fastener Standard MF-1-1971, available from Sheet Metal and Air Conditioning Contractors National Association, which shall compress the duct liner sufficiently to hold it firmly in place.

Duct Liner shall be cut to a assure overlapped and compressed longitudinal corner joints.

For velocities to 2,000 feet per minute, fasteners shall start within 3" of the upstream transverse edges of the Aeroflex Duct Liner and 3" from the longitudinal joints and shall be spaced at a maximum of 12" o.c. around the perimeter of the duct, except that they may be maximum of 12" from corner break. Elsewhere they shall be a maximum of 18" o.c. except that they shall be placed not more than 6" from a longitudinal joint of the liner nor 12" from a corner break.

For velocities from 2,001 to 4000 feet per minute, fasteners shall start within 3" of the upstream transverse edges of the liner and 3" from the longitudinal joints and shall be spaced at a maximum of 6" o.c. around the perimeter of the duct, except that they may be a maximum of 6" from a corner break. Elsewhere they shall be a maximum of 16" o.c. , except that they shall be placed not more than 6" from a longitudinal joint of the liner nor 12" from a corner break. In addition to the adhesive edge coating of transverse joints, any longitudinal joints shall be similarly coated with adhesive.

For velocities from 4,000 to 6,000 feet per minute. Same as 2,001 to 4,000 a FPM except that metal nosing shall be installed to secure the Aeroflex Duct Liner at all upstream transverse edges.

END OF SECTION