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BuildingName
The Description of the Project
P00000000 0000

SPECIFICATION DIVISION 22

NUMBER SECTION DESCRIPTION

END OF CONTENTS TABLE

DIVISION 22 PLUMBING
SECTION 220719 - MECHANICAL SYSTEMS INSULATION

REVISIONS:
8-1-99: CONTENT APPROVED AS NEW MASTER
8-11-99: REVISED TO VBS.DOT TEMPLATE

1-7-2011: REVISED TO COMPLY WITH ASHRAE 90.1-2007.

SPEC EDITOR: MANUFACTURERS WERE UPDATED 6/97 W/ ASSSISTANCE FROM ARMSTRONG. HOWEVER, MODEL NUMBERS SEEM TO CHANGE FREQUENTLY IN THE INSULATION INDUSTRY, REVIEW CAREFULLY AGAINST CURRENT CATALOG AND NOTIFY THE SPEC TEAM OF DISCREPANCIES.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

INCLUDE PARAGRAPH 1.1.A AND B IN EVERY SPECIFICATION SECTION. EDIT RELATED SECTIONS 1.1.B TO MAKE IT PROJECT SPECIFIC.

A. Drawings and general provisions of the Contract, Standard General and Supplementary General Conditions, Division 1 Specification Sections, and other applicable Specification Sections including the Related Sections listed below, apply to this Section.

SPEC EDITOR: EDIT THE FOLLOWING AS REQUIRED

1.2 SCOPE OF WORK:

A. Insulate piping, ductwork and equipment unless indicated as not to be insulated in paragraph 1.2.

B. Reinsulate items from which asbestos insulation was removed.

C. Insulate connection points between new and existing items.

D. Repair or replace insulation damaged during construction.

1.3 ITEMS NOT TO BE INSULATED:

SPEC EDITOR: EDIT LIST BELOW TO SUIT PROJECT

A. Equipment: hot water pumps, steam condensate pumps, feed water pump, water softener shell, vacuum pumps, hot water shot feeders, hot water expansion tanks, factory insulated equipment.

B. In hot piping: Unions, flexible connectors, control valves 2" and smaller, safety valves, discharge vent piping, vacuum breakers, thermostatic vent valves, and steam traps 3/4 inch and smaller.

C. Other piping: waste and vent, compressed air, natural gas, lab vacuum, refrigerant liquid lines, vertical portion of rain water conductors.

D. Ductwork: indoor return air ductwork in conditioned areas, exhaust air ductwork.

SPEC EDITOR: REVISE 1.3 AS REQUIRED; INCLUDE ITEMS CONTAINING ASBESTOS IN DIVISION 02 OR ON PLANS.

1.4 ASBESTOS ABATEMENT:

A. All asbestos within the contract bounds shall be removed per the requirements described in Division 02. Refer to drawings for items containing asbestos insulation. Reinsulate all piping, ductwork and equipment to remain from which asbestos has been removed.

PART 2 - PRODUCTS

2.1 GENERAL INSULATION DEFINITIONS:

A. Insulation thermal conductivity: No greater than value listed, in Btu-inch/hour-square foot-degrees F at 75 degrees F mean temperature.

B. Water Vapor Permeance (ASTM E97 or E96, Procedure A): No more than value listed, in perms. Water vapor permeability (ASTM C355): No greater than value listed, in perm-inch.

C. Puncture resistance (ASTM D781): No less than value listed.

D. Flame spread classification (ASTM E84, NFPA 255): No greater than value listed. Smoke density classification (ASTM E84, NFPA 255): No greater than value listed. Composite listing includes insulation, jacket, and adhesive.

E. Density no less than value listed, in pounds per cubic foot.

2.2 PIPING INSULATION THICKNESS TABLE:

A. Minimum insulation thickness in inches, shall comply with the table below for the associated piping system and pipe sizes. Values are based on an R value of 4 per inch thickness. Overall conductance shall comply with ASHRAE 90.

SPEC EDITOR: INSULATION THICKNESSES GENERALLY CORRESPONDS TO ASHRAE TABLE.

Piping System Fluid	Temp. Range Deg. F	Thickness in Inches For Pipe Sizes Through Size Listed 1"	2"	4"	6"	8"	10" & above
MPS (60#) (above to include MPS condensate)	251-305	2.0	3.0	3.0	3.0	3.0	3.0
LPS (15#) (above to include LPS condensate)	201-250	1.5	2.0	2.0	2.0	2.0	2.0
Hot Water (above includes domestic and heating)	110-200	1.0	1.0	1.5	1.5	1.5	1.5
Cold Water	Any	0.5	0.5	0.5	0.5	0.5	0.5
Storm	Any	0.5	0.5	0.5	0.5	0.5	0.5
Chilled W.	Any	0.5	1.0	1.0	1.0	1.0	1.5
Ref. Suct.	Any	1.0	1.5	1.5	N/A	N/A	N/A
Energy Recovery	Any	1.0	1.0	1.0	1.0	1.0	1.0

Free Cooling Cond. Water	Any	1.0	1.0	1.0	1.0	1.0	1.0

B. For heat traced piping use insulation ¼" diameter larger to allow room for installation of cable.

2.3 PIPING INSULATION - INDOOR (FIBERGLASS):

A. Insulate with fiberglass insulation with factory-applied vapor barrier jacket with self-sealing laps. ASTM C547 Class 1 insulation, conductivity of 0.26. Vapor barrier jacket: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.2 perms, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50. Apply insulation in thickness listed in Insulation Thickness Table listed in paragraph 2.2.

Manufacturers: Johns-Manville (Micro-Lok 650 AP-T), Knauf (ASJ-SS1 Pipe Insulation), Owens/Corning (Fiberglass ASJ/SSL-II)

B. At fittings and flanges, insulate with wrapped fiberglass insulation of same thickness as adjacent pipe, and cover with pre-molded PVC jackets. Seal edge of jacket with self-sealing vapor barrier tape.

Jacket Manufacturer: Zeston, Ceeco, Proto

C. For valves, strainers, suction diffusers and other accessories that require maintenance: In hot piping, insulate similar to fittings and flanges. In cold piping, insulate with closed cell elastomeric insulation, installed to be removable for maintenance access.

D. Wherever necessary to seal insulation and provide a complete and continuous vapor barrier, apply two coats of insulating mastic Manufacturers: Celotex - MW-1 Insulating and Finishing Cement; Pabco - Pabcote One Coat Insulating Cement.

2.4 PIPING INSULATION - OUTDOOR (FIBERGLASS):

SPEC EDITOR: THIS SECTION SHOULD BE USED FOR VERY HOT PIPING ONLY (SURFACE TEMPERATURE ABOVE 200F)

A. Insulate steam and condensate piping systems outside buildings with the materials and methods listed for "Piping Insulation - Indoor (Fiberglass)." Apply insulation 1/2" thicker than listed in table, and weatherproof the insulation with PVC insulation jacketing: Manufacturers: Zeston, Ceeco, Proto

2.5 PIPING INSULATION (CLOSED CELL ELASTOMERIC):

SPEC EDITOR: INDOOR PIPE INSULATION MAY BE SPECIFIED IN ONE OF THE FOLLOWING WAYS:
A. FIBERGLASS ONLY (USE PARAGRAPH 2.3)
B. FIBERGLASS OR ELASTOMERIC (USE PARAGRAPH 2.3 AND 2.5, WITH CONTRACTOR'S OPTION PARAGRAPH)
C. ELASTOMERIC ONLY (USE 2.5 WITHOUT CONTRACTOR OPTION)

THESE PRODUCTS ARE SUITABLE FOR TEMPERATURES OF APPROXIMATELY 0 TO 180F.

SPEC EDITOR: CHOOSE ONE OF THE FOLLOWING "A." PARAGRAPHS:

A. As a Contractor's Option to paragraph 2.3, insulate hot water, cold water, chilled water, refrigerant, piping systems with flexible closed cell elastomeric or Polyolefin pipe insulation, ASTM C534, conductivity of 0.30, water vapor permeability of 0.20. In thickness 1" and less, composite flame spread/ smoke density of 25/50.. Manufacturers: Armstrong - AP Armaflex; Rubatex - R-180-FS, IMCOA.

B. Insulate hot water, cold water, chilled water, and refrigerant piping systems with flexible closed cell elastomeric or Polyolefin pipe insulation, ASTM C534, conductivity of 0.30, water vapor permeability of 0.20. In thickness 1" and less, composite flame spread/ smoke density of 25/50. Manufacturers: Armstrong - AP Armaflex; Rubatex - R-180-FS, IMCOA.

1. Apply insulation in thickness listed in table in paragraph 2.2. Seal all butt joints and seams by joining cut edges with adhesive as supplied by the insulation manufacturer.
2. For exterior piping, coat insulation with glass mesh and two finish coats compatible with insulation. Manufacturer: Armstrong WB.

2.6 PIPING INSULATION SPECIALTIES:

SPEC EDITOR: ALUMINUM JACKETS ARE NOT GENERALLY RECOMMENDED, BECAUSE OF DAMAGE AND FAILURES WE'VE EXPERIENCED LATELY.

A. Expansion Joints Insulation: Expansion joints shall be insulated with prefabricated insulation blankets, installed in a manner to allow for the repacking of the joints without removing blanket. Hold blankets in place with permanently attached Velcro fasteners.

B. Aluminum Jackets: Where indicated on drawings, provide 0.016” thick alloy 3003 aluminum jacketing with longitudinal lock seam and butt strap circumferential joints. Manufacturers: Childers-Lock-on and Pabco-Surfeit.

C. Removable Insulation Jackets: Where indicated on drawings, provide removable insulation jackets with fiberglass insulation, flexible fabric jacket and velcro fasteners. Manufacturer: ESI - Q Master; Insulation Technologies Inc.

2.7 DUCTWORK INSULATION - INDOOR, EXPOSED:

SPEC EDITOR: RIGID INSULATION IS AVAILABLE IN DENSITIES OF 1.6, 2.25, 3.0, 4.25 AND 6.0. R VALUE AND COST INCREASE WITH DENSITY. INSULATION THICKNESS WAS INCREASED TO IMPROVE FIT OVER FLANGED CONNECTIONS, MAY BE REDUCED TO 1" FOR SLIP AND DRIVE DUCT.

A. In mechanical equipment rooms and all other areas where visible without removing ceilings or opening access panels, insulate ductwork with 1-1/2" thick rigid, fiberglass insulation board with factory-applied vapor barrier. Insulation: ASTM C612 Class 2, conductivity of 0.26, density of 3.0. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

B. Manufacturers: CertainTeed - IB600 ASJ Industrial Insulation Board; Schuller - Type 817 Ap Spin-Glas; Knauf - PCF-ASJ Insulation Board; Owens/Corning - Type 705 ASJ-25 Fiberglas Insulation

2.8 DUCTWORK INSULATION - INDOOR, CONCEALED:

SPEC EDITOR: BLANKET INSULATION IS AVAILABLE IN DENSITIES 0.75, 1.0 AND 1.5. R VALUE AND COST INCREASE WITH DENSITY.

A. In ceiling spaces, building shafts, and other locations where not visible, insulate ductwork with 1-1/2" thick, blanket-type, fiberglass insulation with factory-applied vapor barrier, and 2" stapling and taping flange along one edge. Insulation: ASTM C553, density of 0.75, conductivity of 0.32. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.02, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

B. Manufacturers: CertainTeed - Type 75 FSK Standard Duct Wrap; Schuller - R Series Microlite with FSKL; Knauf - Duct Wrap with Multi-Purpose FSK; Owens/Corning - All Service Faced Duct Wrap

SPEC EDITOR: SCHULLER IS IN QUESTION AS A MANUAFCTURER, AS IS JOHNS MANVILLE

2.9 DUCTWORK INSULATION - OUTDOOR:

SPEC EDITOR: PLANT HAS BEEN EXPERIMENTING WITH USING EPDM ROOFING AS A WRAPPING MATERIAL FOR EXTERIOR DUCTWORK. PRELIMINARY RESULTS LOOK PROMISING. CONSIDER ADDING PLANT WORK ORDER TO BUDGET TO COVER THIS.

A. Insulate exterior ductwork with 2.0" thick flexible closed cell elastomeric insulation, ASTM C534, conductivity of 0.30, water vapor permeability of 0.20. Composite flame spread/ smoke density of 25/50..

1. Seal all butt joints and seams by joining cut edges with adhesive as supplied by the insulation manufacturer.
2. Wrap insulation with glass mesh and coat with two finish coats. Manufacturer: Armstrong WB.
3. Taper insulation to prevent ponding.
4. Manufacturers: Armstrong - AP Armaflex; Rubatex - R-180-FS.

2.10 HOT EQUIPMENT INSULATION:

A. Insulate all equipment with surface temperature over 100F, using rigid fiberglass insulation board. Insulation: ASTM C612 Class 2, conductivity of 0.26, density of 6.0. Vapor barrier: laminated white kraft paper, aluminum foil, glass fiber reinforcement, permeance of 0.2, and puncture resistance of 50 units. Composite flame spread/ smoke density of 25/50.

B. Manufacturers: CertainTeed - IB600 ASJ Industrial Insulation Board; Schuller - Type 817 Ap Spin-Glas; Knauf - 6PCF-ASJ Insulation Board; Owens/Corning - Type 705 ASJ-25 Fiberglas Insulation

C. Apply insulation in thickness as follows: 1-1/2" for operating temperature up to 150F, 2" for operating temperature of 150F to 200F, 3" for operating temperature over 200F.

D. Cut, score, or miter insulation to fit contour of equipment and secure with galvanized steel bands or wire, or weld pins. Stagger joints where possible and fill voids with insulating cement. Apply 1" galvanized wire mesh over entire exterior surface and finish with two coats of insulating cement toweled to a hard finish.

2.11 COLD EQUIPMENT INSULATION:

A. Insulate all equipment with surface temperature below 60F with 1" thick, flexible, closed cell, elastomeric foam insulation sheet. Manufacturers: Armstrong - AP Armaflex Sheet Insulation; Rubatex - R-1800-FS Insul-Sheet.

B. Insulation: ASTM C534, conductivity of 0.30, permeance of 0.20, composite flame spread/ smoke density of 25/50..

C. Apply elastomeric foam insulation sheet with contact adhesive. Manufacturers: Armstrong - 520 Adhesive; Rubatex - 373 Adhesive. Seal all butt joints with adhesive.

PART 3 - EXECUTION

3.1 INSULATION INSTALLATION

A. All systems shall be tested and approved before being insulated.

B. The insulation shall be applied over clean, dry surface.

C. Insulate all valves, flanges, couplings and fittings. Valve and flange insulation shall be removable and reinstallable.

D. Full lengths of insulation shall be used except at end of straight sections and as required to accommodate fittings. Insulation shall be applied with the joints tightly fitted together. Cracks or voids shall be filled with insulation. Manufacturer's recommended installation procedures shall be strictly adhered to.

E. The edges and seams at all visible locations shall be finished in a neat and workmanlike manner.

F. All exposed ductwork insulation shall be applied with edges butted. Insulation shall be impaled over stick clips or pins welded to the duct, and secured with speed clips. Spacing of pins shall be as required to hold insulation firmly in place but not less than one pin per square foot. All joints and penetrations of the vapor barrier shall be sealed with a 3" wide strip of the same material, supplied with vapor barrier adhesive to both surfaces as recommended by adhesive manufacturers.

G. Blanket insulation shall be tightly sealed at all joints and seams. Insulation shall be cut longer than ductwork perimeter to allow maximum thickness on all areas and avoid excessive compression. All joints shall be over lapped at least 2" and stapled in place. The stapled seams shall be sealed with a minimum 3" wide pressure sensitive tape designed for use with the duct insulation. All breaks in the vapor barrier facing shall also be sealed with the tape. The underside of ductwork 18" or greater in width, and vertical surfaces 48" or greater shall have the insulation additionally secured with mechanical fasteners and speed clips spaced approximately 12" on center. The protruding ends of the fasteners shall be cut off flush after the speed clips are installed, and then sealed with the same tape as specified above.

H. Finished installation shall provide a continuous and effective vapor barrier.

I. Refer to details on drawings.

SPEC EDITOR: INSULATION SHIELDS AND INSULATION INSERTS (PIPE SHIELDS INC. ETC.) ARE COVERED BY UM STANDARD DETAIL.

END OF SECTION 220719