SECTION 15250

INSULATION

1. PART 1 GENERAL

1.1. SUMMARY

1.1.1. Provide labor, equipment and materials, and perform all operations necessary for the installation of insulation as indicated. This section includes thermal insulation for piping and equipment, and thermal and acoustic insulation applied to ductwork and air handling devices.

1.1.2. Provide complete Insulation Submittals and Shop drawings. Refer to Section 15010 paragraph 1.4 Submittals - Shop Drawings/Product Data/Material Certifications.

1.2. RELATED SECTIONS

1.2.1. Section 15010 General Provisions

1.2.2. Section 15400 Plumbing

1.2.3. Section 15800 Heating, Ventilating and Air Conditioning

1.2.4. Section 15900 Controls

1.3. FIRE HAZARD CLASSIFICATION

1.3.1. Insulation shall have a composite (insulation, jacket or facing, and adhesive to secure jacket or facing) fire hazard rating as tested by ASTM E-84, NFPA 255, or UL 723 not to exceed 25 flame spread and 50 smoke developed. Materials labeled accordingly.

1.3.2. Insulation shall conform to current California Mechanical Code.

1.4. QUALITY ASSURANCE

1.4.1. Furnish insulation systems to the project site bearing the manufacturer's label.

1.4.2. Appearance shall be of equal importance with its mechanical correctness and efficiency.

1.5. PROTECTION

1.5.1. Protect insulation against dirt, water, chemical, or mechanical damage before, during and after installation. Any such insulation or covering damaged prior to final acceptance of the work shall be satisfactorily repaired or replaced.

1.6. ENVIRONMENTAL REQUIREMENTS

1.6.1. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

1.7. SUBMITTALS

1.7.1. Comply with specification Section 15010 General Provisions.

1.7.2. Required Submittals

1.7.2.1. Piping insulation, jackets and accessories.

1.7.2.2. Ductwork insulation, jackets, and lining.

1.7.2.3. Equipment insulation and covering.

1.7.2.4. For each product being submitted, provide product description, list of materials, thickness, location of use and manufacturer's installation instructions.

2. PART 2 PRODUCTS

2.1. MANUFACTURER

2.1.1. Acceptable manufacturers for insulation are Manville Corporation, Ownes-Corning and Knauf.

2.1.2. Acceptable manufacturers in addition to insulation manufacturers for adhesives, sealants and coatings are Foster and Childers Product Co.

2.1.3. Duct tape is not an approved sealer tape and shall not be used on this project.

2.2. PIPING SYSTEM INSULATION

2.2.1. Insulation Type

2.2.2. Glass Fiber: Manville Micro-Lok meeting ASTM C547 or equal; rigid molded, noncombustible, Class 1 not to exceed 25 flame spread and 50 smoke developed.

2.2.2.1. 'K' ('KSI') Value: 0.23 at 75 degrees F (0.033 at 24 degrees C).

2.2.2.2. Maximum Service Temperature: 850 degrees F (454 degrees C).

2.2.2.3. Vapor Retarder Jacket: AP-T PLUS White kraft paper reinforced with glass fiber yarn and bonded to aluminum foil, secure with self sealing longitudinal laps and butt strips or AP Jacket with outward clinch expanding staples or vapor barrier mastic as needed. All insulation and jacket material shall be plenum rated.

2.2.2.4. Provide 18 gauge galvanized metal insulation shields at pipe hangers. Insulation shields shall provide an expanded surface area to carrier the weight of the piping without distorting or damage to insulation.

2.2.3. Elastomeric Foam: Rubatex R-180-FS/R-1800-FS meeting ASTM C534 or equal; flexible, cellular elastomeric, molded or sheet, Class 1 not to exceed 25 flame spread and 50 smoke developed:

2.2.3.1. 'K' ('KSI') Value: 0.28 at 75 degrees F (0.04 at 24 degrees C).

2.2.3.2. Maximum Service Temperature of 220 degrees F (104 degrees C).

2.2.3.3. Maximum Flame Spread: 25.

2.2.3.4. Maximum Smoke Developed: 50.

2.2.3.5. Connection: Waterproof vapor retarder adhesive, as needed; RUBATEX R-373 Adhesive.

2.2.3.6. UV-Protection: Outdoor protective coating; Rubatex 374 Coating.

2.2.3.7. Provide 18 gauge galvanized metal insulation shields at pipe hangers. Insulation shields shall provide an expanded surface area to carrier the weight of the piping without distorting or damage to insulation.

2.2.4. Field Applied Jackets

2.2.4.1. Aluminum Jacket: 0.016 inch (0.045 mm) thick sheet, (smooth / embossed) finish, with longitudinal slip joints and 2 inch (50 mm) laps, die shaped fitting covers with factory attached protective liner.

2.3. DUCT WORK INSULATION

2.3.1. Flexible Fiberglass Insulation Wrap Blanket: Manville Microlite Type 100 meeting ASTM C 1290-95 or equal, Type II, Class B-2; flexible blanket, Class 1 not to exceed 25 flame spread and 50 smoke developed. All flexible fiberglass insulation wrap blanket insulation shall have foil back jacket.

2.3.1.1. 'K' ('KSI') Value: 0.25 at 75 degrees F (0.040 at 24 degrees C) installed.

2.3.1.2. Vapor Barrier Jacket: FSK, Aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinched expanded staples and vapor barrier mastic as needed. All insulation and jacket material shall be plenum rated.

2.3.2. Rectangular Duct Liner: Manville Linacoustic Mat Faced or Permacote meeting ASTM C1071 or equal; flexible blanket.

2.3.2.1. 'K' ('KSI') Value: ASTM C518, 0.25 at 75 degrees F (0.036 at 24 degrees C).

2.3.2.2. Noise Reduction Coefficient: .65 or higher based on "Type A mounting". Comply with ASTM C423A Absorption Coefficients, ASTM 84, UL 723 and NFPA 228.

2.3.2.3. Maximum Velocity on Mat or Coated Air Side: 4,000 ft/min.

2.3.2.4. Adhesive: UL listed waterproof type.

2.3.2.5. Fasteners: Duct liner galvanized steel pins, welded or mechanically fastened.

2.3.2.6. Absolute roughness of exposed surface not to exceed 0.0013 coated.

2.3.3. Round Duct Liner: Manville Spiracoustic, meeting ASTM C427 or equal; rigid.

2.3.3.1. 'K' ('KSI') Value: ASTM C518, 0.23 at 75 degrees F (.033 at 24 degrees C).

2.3.3.2. Noise Reduction Coefficient of .70 as per ASTM C427. (Type A mounting)

2.3.3.3. Maximum Velocity: 4000 ft/min (20.3 mm/sec)

2.3.4. Rectangular and round duct liner shall comply with the requirements of NFPA 90A and the "duct liner materials standard" of the Thermal Insulation Manufacturers Association. Duct liner shall be glass fiber insulation with exposed surface coated to prevent fiber erosion at ai velocities up to 4000 fpm. Duct sizes for lined duct show the clear dimension inside the lining.

2.4. EQUIPMENT INSULATION

2.4.1. Manufacturers: Manville Corporation or approved equal.

2.4.2. Flexible Fiber Glass Blanket: Manville 812 Spin-Glas meeting ASTM C612 or equal; flexible, Class 1 not to exceed 25 flame spread and 50 smoke developed: .

2.4.2.1. 'K' ('KSI') Value: 0.24 at 75 degrees F (0.035 at 24 degrees C).

2.4.2.2. Maximum Service Temperature: 450 degrees F (232 degrees C).

2.4.2.3. Density: 1.5 LB/CU FT (24 kg/CU M) density.

2.4.2.4. Vapor Retarder Jacket: Aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinch expanding staples and vapor barrier mastic as needed.

2.4.3. Rigid Fiber Glass Board: Manville 814 Spin-Glas meeting ASTM C612; rigid, Class 1 not to exceed 25 flame spread and 50 smoke developed.

2.4.3.1. 'K' ('KSI') Value: 0.23 at 75 degrees F (0.033 at 24 degrees C).

2.4.3.2. Maximum Service Temperature: 450 degrees F (232 degrees C).

2.4.3.3. Density: 3.0 LB/CU FT (48 kg/CU M) density.

2.4.3.4. Vapor Retarder Jacket: Aluminum foil reinforced with fiber glass yarn and laminated to fire-resistant kraft, secured with UL listed pressure sensitive tape and/or outward clinch expanding staples and vapor barrier mastic as needed.

2.4.3.5. Facing: 1 inch (25 mm) galvanized hexagonal wire mesh stitched on one face of insulation. (optional)

2.4.4. Rigid FiberGlass Board: Manville 1000 Spin-Glas meeting ASTM C612; rigid, noncombustible, Class 1 not to exceed 25 flame spread and 50 smoke developed.

2.4.4.1. 'K' ('KSI') Value: 0.23 at 75 degrees F (0.033 at 24 degrees C)

2.4.4.2. Maximum Service Temperature: 850 degrees F (454 degrees C)

2.4.4.3. Density: 3.0 LB/CU FT (48 kg/CU M)

2.4.4.4. Facing: 1 inch (25mm) galvanized hexagonal wire mesh stiched on one face of insulation. (optional)

2.5. FIRE STOPPING INSULATION

2.5.1. Fire stop insulation shall be ceramic fiber blanket equal to Schuller "Cerablanket" or USG Therma-fiber 6 lb. density, Class 1 not to exceed 25 flame spread and 50 smoke developed.

3. PART 3 EXECUTION

3.1. EXAMINATION AND PREPARATION

3.1.1. Verify that ductwork has been pressure tested for leakage in accordance with SMACNA standards before applying insulation materials.

3.1.2. Verify that all surfaces are clean, dry and free of foreign material. Apply insulation on clean, dry surfaces free of any foreign matter and only after tests and approvals required by the specifications have been completed.

3.2. GENERAL INSTALLATION

3.2.1. Install materials in accordance with manufacturer's recommendations, building codes and industry standards.

3.2.2. Continue insulation vapor barrier through penetrations except where prohibited by code.

3.2.3. Insulation shall be installed by workmen regularly engaged in this kind of work in accordance with the manufacturer's recommendations.

3.2.4. All exposed raw edges shall be finished with finishing cement.

3.2.5. If staples are used, all must be coated with adhesive to maintain vapor barrier integrity. Thickness per ASHRAE Standards Table.

3.3. PIPING SYSTEM INSULATION INSTALLATION AND SCHEDULE

3.3.1. Pipe insulation shall be continuous through walls and floor openings except where walls and floors are required to be fire stopped or required to have a fire resistance rating. Where this occurs, the open space remaining between the sleeve and pipe shall be filled with fire stop insulation.

3.3.2. Insulation on piping indicated must be applied with a continuous, unbroken vapor seal. Supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

3.3.3. Insulated pipes shall be insulated continuously through hangers. Rigid insulation inserts and metal shields are to be provided at all pipe hangers and supports. Pipe insulation shall abut the rigid insulation insert. Apply a wet coat of vapor barrier lap cement on all butt joints and seal the joints with 3" wide vapor barrier tape or band.

3.3.4. Butt all joints firmly together and smoothly, secure all jacket laps and joint strips with lap adhesive.

3.3.5. Factory premolded one-piece insulated fitting covers are to be used, the proper factory precut insulation shall be applied to the fitting. The ends of the insulation shall be tucked snugly into the throat of the fitting and the edges adjacent to the pipe covering, tufted and tucked in, fully insulating the pipefitting. Covers shall overlap the adjoining pipe insulation and jackets and on cold pipes shall be sealed at all seam edges with vapor barrier adhesive. The circumferential edges of all covers shall be sealed with pressure sensitive vinyl tape. The tape shall overlap the jacket and the cover at least one inch.

3.3.6. Valves may be insulated with sections of Fiberglass pipe insulation complete with service jacket. Raw ends shall be coated with vinyl acrylic mastic CP-11 for hot piping.

3.3.7. Locate insulation and cover seams in least visible locations.

3.3.8. Neatly finish insulation at supports, protrusions, and interruptions.

3.3.9. Provide insulated pipes conveying fluids below ambient temperature with vapor retardant jackets with self sealing laps. Insulate complete system.

3.3.10. For insulated pipes conveying fluids above ambient temperature, secure jackets with self sealing lap or outward clinched, expanded staples. Bevel and seal ends of insulation at equipment, flanges, and unions.

3.3.11. Provide shield between isolation inserts and hanger supports. Shields shall be minimum of 20 gauge galvanized metal. Fabricate of Manville Thermo-12 or other heavy density insulating material suitable for temperature. Insulation inserts shall not be less than the following lengths;

1 1/2" to 2 1/2" pipe size	10" long
3" to 6" pipe size	12" long
8" to 10" pipe size	16" long
12" and over	22" long

3.3.12. For pipe on roof, exposed in equipment rooms or unfinished spaces provide field applied aluminum jacket.

3.3.13. For exterior piping applications such heating water and refrigeration suction, provide field applied protection jacket or coating. Insulated pipe, fittings, joints, and valves shall be covered with field applied aluminum jacket. Jacket seams shall located on bottom side of horizontal piping.

3.3.14. For return air plenum areas provide non-combustible jacket .

3.3.15. Fittings and valves shall be covered with premolded one-piece insulated covers.

3.3.16. Piping Insulation Schedule

3.3.16.1. Fiber Glass Insulation

3.3.16.1.1. Domestic Hot Water (supply and return piping):
pipe: up to 2" 1 inch thick
pipe: 2 1/2" to 4" 1 1/2 inch thick

3.3.16.1.2. Condensate piping system
pipe: up to 2" 3/4 inch thick

3.3.16.1.3. Heating Water Supply and Return Piping
all sizes 2 inch thick
roof, exposed in equipment rooms or unfinished spaces provide field aluminum jacket

3.3.16.2. Elastomeric Foam

3.3.16.2.1. Refrigerant Suction
all sizes 1 inch thick
roof, exposed in equipment rooms or unfinished spaces provide field aluminum jacket

3.3.17. The above listed insulation thickness and finish are required. If however, the thickness, density and finish are more restrictive in the current edition of the California Mechanical Code Section 1005 Table No. 10-D and Table 2-53D of the Building Energy Efficiency Standards these values shall be used.

3.4. FLEXIBLE FIBERGLASS INSULATION WRAP BLANKET INSTALLATION AND SCHEDULE

3.4.1. All insulation shall be applied with edges tightly butted with facing overlapping all joints at least 2". All external insulation shall have foil backed vapor seal. Joints shall be sealed with fire retardant adhesive. The insulation shall be secure to the duct with approximately 4" wide strips at 8" O.C. of fire retardant adhesive. Where the duct width exceeds 30", the underside insulation shall be additionally held in place with mechanical fasteners on about 18" maximum centers.

3.4.2. All breaks and punctures shall be sealed with vapor barrier tape and fire retardant adhesive.

3.4.3. Provide all insulated ductwork conveying air with foil backed jacket. Seal all jacket seams and penetrations with UL listed tapes or vapor retardant adhesive. Where service access is required, bevel and seal ends of insulation.

3.4.4. Continue insulation through walls, sleeves, hangers, and other duct penetrations except where prohibited by code.

3.4.5. The underside of duct work 24" or greater shall be secured with mechanical fasteners and speed clips spaced approximately 18" on center. The protruding ends of the fasteners should be cut off flush after the speed clips are installed, and then, when required, sealed with the same tape as specified above.

3.4.6. For ductwork exposed to physical abuse in mechanical equipment rooms or in finished spaces, finish with Manville Zeston 2000 PVC jacket or aluminum jacket.

3.4.7. Flexible Fiberglass Insulation Wrap Blanket Schedule

3.4.7.1. Flexible Fiber Glass

3.4.7.1.1. Supply and Return Ducts @ HVAC units:
1 1/2 inch thick Foil Back Min R-8

3.4.7.1.2. Supply and Return Plenums @ HVAC units:
1 1/2 inch thick Foil Back Min R-8

3.4.8. The above listed insulation thickness and finish are required. If however, the thickness, density and finish are more restrictive in the current edition of the California Mechanical Code Section 1005 Table No. 10-D and Table 2-53D of the Building Energy Efficiency Standards these values shall be used.

3.5. DUCT LINER INSULATION INSTALLATION AND SCHEDULE

3.5.1. Duct liner shall be used in all weather-exposed locations or outside of building. Duct liner shall be installed in all supply and return plenums for sound reduction and thermal insulation. Supply and return plenums occur at each air-moving piece of equipment. Duct liner shall also be installed where indicated on the drawings.

3.5.2. Duct linings shall be interrupted at fire dampers and fire doors so as not to interfere with their operation. Duct coverings and linings shall also be interrupted at the immediate area of operation of heat sources in a duct system involving electric resistance or fuel burning heaters.

3.5.3. All portions of duct designed to receive duct liner shall be completely lined on the interior with acoustical lining as specified herein. Transverse joints shall be neatly butted and there shall be no interruptions or gaps.

3.5.4. The coated surface of the lining shall face the airstream.

3.5.5. The lining shall be adhered to the sheet metal with 100% coverage of adhesive, and all exposed leading edges and all transverse joints coated with adhesive.

3.5.6. The lining shall be additionally secured with mechanical fasteners that shall compress the duct liner sufficiently to hold it firmly in place.

3.5.7. The lining shall be cut to assure overlapped and compressed longitudinal corner joints.

3.5.8. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

3.5.9. Sizes noted on drawings are clear cross-section area (inside the lining).

3.5.10. For velocities up to 2,000 fpm, duct liner shall be applied with 100% coverage of fire retardant adhesive. Duct liner shall be cut to assure snug corner joints. The coated or most dense surface of the liner shall face the air stream. The liner shall be additionally secured with mechanical fasteners that shall compress the duct liner sufficiently to hold it firmly in place They shall start within 3" of the leading edge of each duct section (and any line transverse joints within the duct section) and shall be spaced no more than 12" O.C. around the perimeter of the duct, except that they need to be no closer than 9" to a corner break. Elsewhere, they shall be a maximum of 18" O.C., except that they shall be placed not more than 6" from a cut edge nor 12" from a corner break. All exposed edges and the leading edge of all cross-joints of the liner shall be coated with the same adhesive used to secure the duct liner to the metal surface.

3.5.11. Adhesive shall conform to Adhesive and Sealant Council Standards for Adhesives for Duct Liner; ASC-A700K-1972.

3.5.12. Mechanical fasteners shall conform to Mechanical Fastener Standard MF-1-1971, available from SMACNA.

3.5.13. Adhere insulation to sheet metal with full coverage of a UL listed adhesive.

3.5.14. Secure insulation with mechanical liner fasteners as indicated by SMACNA or manufacturer. Pin length should be as recommended by the liner manufacturer.

3.5.15. All exposed edges of the liner must be factory or field coated. For systems operating at 4000 fpm or higher a metal nosing must be installed in all liner leading edges.

3.5.16. Repair liner surface penetrations with UL listed adhesive.

3.5.17. Duct Liner Insulation Schedule - Rigid Fiber Glass

3.5.17.1. Supply and Return Ducts and Plenums for down discharge HVAC units:

1 1/2 inch thick (min. R-8) LINACOUSTIC PERMACOTE or equal

3.5.17.2. Roof Mounted or Exterior Supply and Return Duct Work from HVAC units:

2 inch thick (min. R-12) LINACOUSTIC PERMACOTE or equal

3.5.18. The above listed insulation thickness and finish are required. If however, the thickness, density and finish are more restrictive in the current edition of the California Mechanical Code Section 1005 Table No. 10-D and Table 2-53D of the Building Energy Efficiency Standards these values shall be used.

3.6. EQUIPMENT INSULATION INSTALLATION AND SCHEDULE

3.6.1. Insulation on equipment indicated must be applied with a continuous, unbroken vapor seal. Supports, anchors, etc., that are secured directly to cold surfaces must be adequately insulated and vapor sealed to prevent condensation.

3.6.2. Insulation board shall be cut and mitered to fit the contour of the vessel and shall be applied with edges tightly butted, joints staggered where two or more of insulation and secured with layers are necessary (due to available thickness of insulation) and secured with galvanized steel bands on 12" centers or with weld pins or stick clips with washers on 18" centers.

3.6.3. Seal all joints, breaks, and punctures in facing with fire retardant vapor barrier adhesive over which 4" wide tape similar to that of the facing material shall be placed.

3.6.4. Heating water air separators, pump bodies and other accessories shall be insulated with fiberglass board foil faced. Seal all joints with vapor barrier mastic. Finish with six oz. canvas fire retardant vapor barrier mastic.

3.6.5. Apply insulation as close as possible to equipment by grooving, scoring, and beveling insulation, if necessary. As required, secure insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

3.6.6. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor retardant cement.

3.6.7. Provide insulated dual temperature equipment or cold equipment containing fluids below ambient temperature with vapor retardant jackets.

3.6.8. For insulated equipment containing fluids above ambient temperature, provide jacket with or without vapor barrier.

3.6.9. Cover insulation with aluminum jacket.

3.6.10. For equipment on roof, in mechanical equipment rooms or in finished spaces, finish with aluminum jacketing.

3.6.11. Do not insulate over nameplate or ASME stamps. Bevel and seal insulation around such.

3.6.12. When equipment with insulation requires periodic opening for maintenance, repair, or cleaning, install insulation in such a manner that it can be easily removed and replaced without damage.

3.6.13. Equipment Insulation Schedule

3.6.13.1. Flexible Fiber Glass Blanket

3.6.13.1.1. Air Separators 1 inch thick
roof, exposed in equipment rooms or unfinished spaces provide field aluminum jacket

3.6.13.1.2. Heating Water Pump Bodies 1 1/2 inch thick
roof, exposed in equipment rooms or unfinished spaces provide field aluminum jacket

3.6.14. The above listed insulation thickness and finish are required. If however, the thickness, density and finish are more restrictive in the current edition of the California Mechanical Code Section 1005 Table No. 10-D and Table 2-53D of the Building Energy Efficiency Standards these values shall be used.

END OF SECTION