

SECTION 23 07 00 - SYSTEM INSULATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

- A. The Conditions of the Contract and applicable requirements of Division 1, "General Requirements", and Section 23 01 00, "Mechanical General Provisions", govern this Section.
- B. Refer to Section 23 31 13, "Ductwork", for duct lining requirements and Section 23 37 13, "Air Distribution Devices", for additional insulation requirements.

1.2 DESCRIPTION OF WORK:

- A. Work Included: Provide piping, ductwork, and equipment system insulation as specified.

1.3 QUALITY ASSURANCE:

- A. Manufacturers: Provide products complying with these specifications and produced by one of the following:
 - 1. Armstrong World Industries.
 - 2. Certain-teed Corporation.
 - 3. Rubatex LLC
 - 4. Resolco Insul-phen
 - 5. Schuller.
 - 6. Owens/Corning Fiberglass.
 - 7. Pittsburgh Corning.

1.4 SUBMITTALS:

- A. Shop Drawings submittals shall include, but not be limited to, the following:
 - 1. Cut sheets on all insulation products to be used.
 - 2. Cut sheets on all mastics and other products to be used with insulation products.
 - 3. Cut sheets on PVC and aluminum jacketing materials.
 - 4. Manufacturer's printed installation instructions for all of the above products.
 - 5. Additional information as required in Section 23 01 00.

1.5 DELIVERY, STORAGE AND HANDLING:

- A. Store insulation products in their factory-furnished coverings, and in a clean, dry indoor space which provides protection against the weather.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. Quality: The type of insulation and its installation in accordance with this Section of the Specifications for each service and the application technique shall be as recommended by the manufacturer.

- B. Fire Rating: All insulation shall have a composite (insulation, jacket or facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard, as tested by ASTM E84, NFPA 255, and UL 723, not to exceed:
 - 1. Flame Spread 25.
 - 2. Smoke Developed 50.
- C. Accessories: Accessories such as adhesives, mastics, tapes, and cements shall have the same component ratings as listed.
- D. Labels: Label products and their shipping cartons indicating that flame spread and smoke developed ratings do not exceed the above requirements.

2.2 INSULATION THICKNESS:

- A. Minimum: Insulation thickness shall not be less than the following:

Equipment Surface (Non-factory Insulated Equipment [**Cold**] [**or**] [**Hot**] Surfaces)

Chilled water pumps	1"
Chillers	1"
Water-to-water heat exchangers	1-1/2"
Steam-to-water heat exchangers	1-1/2"
Cooling tower basins & sumps	1"
Steam and steam condensate vessels	2"
Diesel engine silencers and exhaust piping	3"
Heating water [and auxiliary condenser water] pumps	1-1/2"
Coils	1-1/2"
Compression/expansion tanks	1"
[House, surge and water storage tanks	1"]
Boiler stack and breeching	2"
Outside air fans	1"
Condensate drain pans	1"

Piping Surface

Chilled water 1" and smaller[, domestic refrigerated water] [, condenser water] [and] [heating hot water] [runouts]	[1"] [____"]
Chilled water piping, 1-1/4" to 2" and heating hot water [mains]	[1-1/2"] [____"]
Chilled water piping 2-1/2" and larger	[2"] [____"]
Steam piping 6" and larger	3-1/2"
Steam piping 4" and smaller [and all steam relief vent piping]	2-1/2"
Steam condensate piping, 2" and smaller	1-1/2"
Steam condensate piping, 2-1/2" and larger	2"
Steam condensate vent piping	1"

Refrigerant piping	1"
Condensate drain piping (except above drain pans and less than one foot (1') at floor drains)	1/2"
Roof and overflows drains (underside), horizontal downspouts, underside of drains (including traps) and horizontal drain lines from chilled water drinking fountains and drains receiving cooling coil condensate.	1/2"
Plastic acid waste and vent lines	1"
Domestic hot water lines 2" and smaller	1"
Domestic hot water lines 2-1/2" and larger	1-1/2"
Domestic cold water [mains, risers and horizontal runouts] [all lines below third floor]	1/2"
[Handicapped] [All exposed] lavatory traps, tailpieces hot and cold water supplies	1"
Deionized (treated) water lines	1/2"
Cooling tower make-up water lines	1/2"
Garage fire and domestic water lines exposed to outdoor temperatures [, 2-1/2" and smaller]	1-1/2" [____"]
All otherwise uninsulated pipe exposed to outdoor temperatures	[1-1/2"] [____"]

Ductwork Surface

Conditioned air [and return air***] ductwork, external wrap (where not lined)	1-1/2"
Air devices***	1-1/2"
Kitchen exhaust ductwork	2"
Wet exhaust ductwork	1-1/2"
Ductwork, acoustical lining (see Section 233113).	
Return air ductwork, exterior wrap ***	1-1/2"

* Where exposed to outdoor ambient temperature, increase insulation thickness by 1/2".

** Unless noted otherwise.

*** Where located in non-return air plenums (e.g. ducted return areas).

2.3 EQUIPMENT:

- A. Hot (110° F to 200° F) and Cold (Below 60° F) Surfaces: Provide Armstrong Type II "Armaflex", "Robotex", or an approved equal flexible closed cell elastomeric sheet insulation. Insulation shall have a K factor of not more than 0.28 Btu/inch-per degree F-per hour at 75° F mean temperature and a water vapor permeability of 0.15 perm-inch or less. Insulation shall have a flame spread rating of 25 and a smoke-developed rating of 50 for thicknesses up to 3/4" and 200 for one inch (1") thickness. Provide manufacturers recommended adhesive (Armstrong 520 or an approved equal.)
- B. High Temperature (200°F and Above) Surfaces: Provide Schuller "Thermo-12" or an approved equal hydrous calcium silicate in scored block or beveled block form, as best suited for the intended use. Where exposed to weather, provide Schuller "Metal-On" or approved equal metal weatherproof jacket.

2.4 PIPING:

- A. Chilled and Hot Water Pipe Insulation: Provide Resolco International by (Insul-Phen) or an approved equal pre-formed Phenolic closed cell insulation; ASTM E96, maximum water vapor transmission rating of 0.02 Perm-In; ASTM C1126 rigid foam, 3.75 lbs. nominal density, CFC free; ASTM C518, 'k' value of 0.16 at 75 degrees F., and 5.0 lbs. nominal density, CFC free; ASTM C518, 'k' value of 0.21 at 75 degrees F. (Note material thickness limit is 3 inches as tested in accordance with ASTM E84).
- B. Calcium Silicate Pipe Insulation (Steam Supply Piping): Provide Schuller Thermo-12, Owens/Corning Kaylo AF or an approved equal pre-formed calcium silicate insulation. Calcium silicate pipe insulation sections shall be pre-formed specifically for the pipe sizes on which it is used. Calcium silicate insulation shall be held in place with 20 gauge galvanized wire on 9" centers. Sections shall be formed to provide tightly butted joints. Material shall have a K factor of 0.55 at 500° F mean.
- C. Fitting Insulation: Provide pre-molded rigid insulation for valves, fittings, flanges, strainers, and unions. Insulation shall be as specified for pipe insulation, except without the all-service jacket, where applicable.
- D. Factory Applied Jackets: White kraft bonded to reinforced foil vapor barrier with self-sealing adhesive joints.
- E. Existing and/or repaired Phenolic Insulation: Provide Venture 1577 W/U, 0 perm and mold resistant jacket material, 5 ply laminate with 6 mil film on with adhesive on one side. .
- F. Fiberglass Cloth Reinforced Mesh: Provide # 10 glass cloth with minimum weight of 3.9 ounces per square yard. Color shall be white unless noted otherwise.
- G. PVC Jacketing: Provide pre-rolled protective jacketing where required or specified for protection of the insulation all service jacket. PVC jacketing shall be 30 mil thickness. All joints shall be made by lapping the jacket and sealing with an approved PVC welding adhesive.
- H. Metal Jacketing: Provide 0.016" thick aluminum jacketing where required or specified. 3/4" x 0.015" stainless steel bands and straps shall be provided for banding insulation jacketing.
- I. Elastomeric Insulation: Provide Armstrong Type II "Armaflex" or approved equal closed cell elastomeric insulation. Insulation shall have a K factor of not more than 0.28 Btu/inch per degree F-per hour at 75° F mean temperature and a water vapor permeability of 0.15 perm-inch or less. Insulation shall have a flame spread rating of 25 and a smoke developed rating of 50. Provide manufacturers recommended adhesive (Armstrong 520 or Manville No. 57).
- J. Lavatory Piping: Provide Truebro Model #102 or Plumberex PR0-2000 series or equal fully molded, flexible vinyl insulation system for insulating lavatory traps and hot and cold water supplies.
- K. Miscellaneous: Provide all miscellaneous accessories, components and materials required for installation of a complete insulation system.

2.5 DUCTWORK:

- A. External Ductwork Insulation: Provide Schuller "Microlite" R-Series or an approved equal **[1-1/2"] [2"] [2-1/2"] [3"]** thick flexible fiberglass duct wrap with fiberglass reinforced kraft-scrim-foil vapor barrier jacket. Ductwrap shall have a density of 0.75 pounds per cubic foot, K factor of 0.31 at 75° F and a permeability of 0.04 perm. Insulation shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.
- B. Acoustical Duct Lining: Lining provided with ductwork, refer to Section 23 31 13.
- C. Kitchen Exhaust Ductwork: Provide **[calcium silicate insulation as specified hereinabove for "High Temperature (200° F and Above) Surfaces".] [High temperature fiberglass blanket (1000° F) insulation, 2# density with a K-factor of 0.23 at 75° F. Insulation shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less.]**

PART 3 - EXECUTION

3.1 INSTALLATION:

- A. General: Install insulation products in accordance with the manufacturer's written instructions, the Midwest Insulation Contractors Association (MICA) Commercial and Industrial Insulation Standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces to be insulated shall be thoroughly cleaned with all testing successfully completed prior to insulation.

3.2 EQUIPMENT APPLICATION:

- A. Chilled [and Heating Hot] Water Pumps: Apply sheet insulation to the surface to be insulated with adhesive over the entire surface. The entire insulation installation shall be in accordance with application recommendation described in the latest published manufacturers pamphlets. All lap and butt joints shall be sealed vapor tight. The insulation shall be finished with two coats of manufacturer's finish coating, vinyl-lacquer coating, or approved equal, color to be [manufacturer's standard] [as selected by the Owner]. Application shall be such that removal of the pump casing or a pump casing section will not destroy the installation, and as detailed on the Drawings.
- B. Water Chillers and Heat Exchangers: Apply sheet insulation to hot heat exchangers and non-factory insulated cold surfaces on water chillers with adhesive over the entire surface being insulated. The entire insulation installation shall be in accordance with application recommendations described in the latest published manufacturers pamphlets. All lap and butt joints shall be sealed, vaportight on cold surfaces, using the manufacturers recommended adhesive. The insulation shall be finished using two coats of the manufacturer's finish coating, vinyl-lacquer coating, or approved equal, color to be [manufacturer's standard] [or selected by the Owner]. Insulation installation shall have removable sections to allow maintenance access.
- C. Compression/Expansion Tanks and Water Storage Tanks: Apply sheet insulation to the entire surface with recommended adhesive. Apply adhesive over the entire clean dry bare metal surface and all butt and lap joints shall be sealed vaportight. The entire insulation installation shall be in accordance with application recommendations described in the latest manufacturers pamphlets. The insulation shall be finished with two coats of manufacturer's finish coating, vinyl-lacquer coating, or approved equal, color to be [manufacturer's standard] [as selected by the Owner].
- D. Diesel Engine Exhaust Pipes and Silencer, Boiler Stack, and Breeching and High Temperature Heat Exchangers and Converters: After all pressure tests have been completed, apply calcium silicate insulation with joints staggered to clean, dry metal surfaces, which have not been factory-insulated and hold in place with one inch (1") galvanized hexagonal wire mesh with edges laced together. Where necessary to achieve snug fit of insulation on large surfaces, install weld clips 18" on center to surfaces before installation of insulation and tie to wire mesh with 20 gauge galvanized wire. [Cover insulation with two 1/4" thick coats of insulating cement troweled to a smooth finish and reinforced with one inch (1") hex wire mesh. When cement has cured, apply a layer of 20 x 20 mesh glass fabric adhered with Insul-Coustic IC 102 and then give a flooding brush coating of IC 102.] [Cover insulation with 2" fiberglass pipe insulation as specified for heating hot water piping.]
- E. Exterior Installations: Where systems are exposed to ambient temperatures or wet conditions and elsewhere as specified, provide an aluminum jacketing system specifically designed for exterior installation. All longitudinal seams shall be located at the 3 o'clock and 9 o'clock position with a minimum 3" overlap oriented to shed water from entry. Butt joints shall be overlapped a minimum of 3" in a manner to prevent the entry of water. Seal metal jacketing with straps on maximum 12" centers. Locate strap joints so as to prevent personnel contact. A factory-applied metal jacket on calcium silicate systems meeting all aspects of this specification may be used where exposed to ambient temperatures or wet conditions if installed per the manufacturers recommendations.
- F. Cooling Tower Basins and Sumps: Insulate as specified for water chillers. Finish with two coats of exterior grade vinyl coating applied per the manufacturers recommendations.
- G. Outside Air Fans: Insulate all outside air fans located in enclosed spaces and not exposed to outside temperatures as specified for water chillers.

- H. Condensate Drain Pans: Insulate all non-factory-insulated drain pans as specified for water chillers.
- I. Steam and Steam Condensate Vessels: Insulate all non-factory-insulated surfaces as specified for boiler breaching where surface temperatures exceed 200°F. [Atmospheric pressure receiver condensate pump units do not require full insulation.]
- J. Heating and Cooling Coils: Insulate all coil perimeter surfaces that are not factory-insulated with fiberglass insulation as specified for external duct insulation.

3.3 PIPING APPLICATION:

- A. General: Apply insulation to clean, dry pipes after all pressure tests have been completed. Firmly butt all joints of insulation and seal all joints per manufacturers recommendations. Install insulation in strict accordance with these specifications and the manufacturer's printed instructions.
- B. Flanges, Strainers and Unions: Insulate flanges, strainers, and unions with pre-molded or shop-fabricated rigid insulation of same material and thickness as specified for adjacent piping. Cover fiberglass **[and polyurethane]** insulation with pre-molded PVC covers, held in place with Zeston "Z-tape" or an approved equal. Covers and finish for foam glass and calcium silicate insulation shall be as specified for the adjacent pipe insulation. Ensure that insulation and covers for flanges, unions, and access plates shall be removable without damage to insulation or jackets.
- C. Valves and Fittings: Insulate and cover valves, tees, elbows, test parts, and other fittings the same as flanges and unions.
- D. Lavatories: Where specified, insulate exposed tailpieces, traps, and hot and cold water supplies with fully molded, flexible vinyl insulation installed per the manufacturers recommendations.
- E. Chilled Water Piping: Install pre-formed Phenolic insulation to provide a continuous vapor barrier/insulation system. Insulation shall be installed on piping with butt joints staggered and all joints buttered with Pittseal 444 or approved equal sealant and tightly butted together. Secure insulation with stainless steel bands with a minimum of two bands per insulation section. Cracked or damaged insulation shall be replaced. Valves, fittings, and accessories shall be insulated to the same thickness of insulation specified for piping and shall use step-type layering or pre-formed insulation. Butt joints shall be rested to avoid gaps or voids. Fill contour space between insulation and valves and fittings with light density fiberglass. At valves, fittings, and accessories and at intervals not exceeding 50' on straight runs of pipe, form an isolating seal between the insulation and the bare pipe by liberal application of butt joint sealant. Coat the installed Phenolic with a tack coat of Pittcoat 300 or approved equal vapor barrier mastic per manufacturers recommendations, embed a layer of PC Fabric 79 or approved equal reinforcing fabric in wet mastic, smooth and without wrinkles and then apply a second coat of mastic (before the tack coat cures) such that there is no fabric visible through the mastic. Size and pre-treat coating as recommended by manufacturer where piping is to be painted in mechanical rooms [and tunnels].]
- F. **[Chilled Water,] [Domestic Refrigerated Water, [Pumped AHU Condensate,] Condensate Drains, Drains Receiving Condensate and from Refrigerated Water Drinking Fountains, Roof Drains, Overflow Roof Drains, and Horizontal Roof, Areaway, and Overflow Roof Drain Leader Piping]**: Install pre formed fiberglass insulation to provide a continuous external vapor barrier on all pipe insulation. Seal insulation lap joints using [Insul-Coustic No. 215 or equal vapor barrier adhesive on insulation butts and] the manufacturer's standard pressure sensitive self-sealing lap joint system. Seal butt joints using [Insul-Coustic No. 215 or equal vapor barrier adhesive on insulation butts and] the manufacturer's standard pressure-sensitive closure strip system. Butt strips shall be a minimum of 3" wide. Where insulation is interrupted at fittings, unions, flanges, or valves and at intervals not exceeding [24'] [50'] on straight runs of pipe, form an isolating seal between the insulation vapor barrier and the bare pipe by liberal application of Insul-Coustic No. 215 or equal vapor barrier adhesive. Extend the adhesive 2" along the insulation jacket, across the face of the insulation and 4" along the pipe. [At the Contractors option, roof drain bodies and horizontal roof drain piping may be insulated using exterior ductwrap installation with a continuous vapor barrier.] [Install a protective outer covering using a metal jacket system over [all] [exposed interior

and exterior] pipe [and fitting] insulation. [Metal jacketing is not required over indoor PVC fitting covers.] Refer to Paragraph 3.03/P for additional requirements.]

- G. **Domestic Hot and Cold Water Piping, Heating Hot Water Piping, Kitchen Grease and Kitchen General Waste Lines and other Piping which is Insulated where Exposed to Outdoor Temperatures:** Install phenolic insulation to provide a continuous external vapor barrier on all pipe insulation. Seal insulation lap joints using the manufacturer's standard pressure-sensitive self-sealing lap joint system. Seal butt joints using the manufacturer's standard pressure-sensitive closure strip system. Butt strips shall be a minimum of 3" wide. At the Contractor's option, staples (as specified for steam and condensate piping) may be used in lieu of self-sealing closures for hot piping. [Install a protective outer covering using a metal jacket system over [all] [exposed interior and exterior] pipe [and fitting] insulation. [Metal jacket is not required over indoor PVC fitting covers.] Refer to Paragraph 3.03/P for additional requirements.]
- H. **Steam and Steam Condensate Piping:** [Install calcium silicate insulation on the entire piping system. Seal insulation lap joints on pre-formed fiberglass using insulation staples on 2" centers. Seal edge of lap joints with Insul-Coustic No. 215 or equal adhesive or a pressure sensitive tape strip to provide a seal to prevent water entry. Seal butt joints using the manufacturer's standard pressure-sensitive closure strip system. Butt strips shall be a minimum of 3" wide.] [Install pre-formed calcium silicate insulation on piping and fittings with butt joints staggered and with insulation firmly wired in place with a minimum of six loops of 16 gauge copper clad iron wire per 3' section. Loop ends shall be twisted together tightly and bent over and hammered into the insulation so as to leave no projection. All cracks and voids in the insulation shall be filled with Manville 301 or approved equal cement such that the resulting surface is smooth and continuous. A layer of 40 pound rosin-sizing paper shall be wrapped around the insulation and an 8 ounce canvas jacket shall be pasted in place. The canvas jacket shall be finish-coated and sized for color-coded finish-painting.] [Install a protective outer covering using a metal jacket system over [all] [exposed interior and exterior] pipe [and fitting] insulation. [Metal jacket is not required over indoor PVC fitting covers.] Refer to Paragraph 3.03/P for additional requirements.]
- I. **Refrigerant Piping:** Install phenolic insulation (if specs allow) to refrigerant and hot gas lines. Seal all butt joints using the manufacturers recommended adhesive.
- J. **Hangers and Supports:** Blocking (for piping with a vapor barrier) or saddles (for piping without a vapor barrier) shall be provided at all hanger and support locations. Install insulation inside all pipe saddles. Extend vapor barrier across all pipe blocking. Refer to Section 230300, "Basic Materials and Methods", for additional requirements.
- K. **Pipe Anchors:** Insulate pipe anchors as specified for piping. Provide an isolating seal at anchors on piping with a vapor barrier as specified under Paragraph 3.03/D.
- L. **Pipe Accessories:** Valve operators, pressure/temperatures plugs, meters and gauge fittings and all other items which extend through required insulation shall be suitably insulated with removable caps to allow use without disturbing the insulation.
- M. **Heat Tracing:** Where pipe is heat-traced, the insulation size shall be increased accordingly.
- N. **Central Plant [and] [,] [Mechanical Room] [and Tunnel] Protective Covering:** Protect the insulation jacket on all fiberglass [and polyurethane] insulation and accessories in the Central Plant [and] [,] [mechanical room] [and tunnels] [and within 6'-0" of finished floor in mechanical and air handling unit rooms] with a field-installed covering using [vapor barrier mastic and reinforcing mesh installed per the manufacturers recommendations] [except where metal jacket is specified]. [The insulation surface, covering or jacket on all piping in the Pump Room, Mechanical Rooms, and tunnels shall be sized, coated and prepared as required for finish color-coded painting.]

- O. Below Grade Protective Jacket: Protect outer covering of insulation on below grade piping to 2' above grade with a sealed PVC jacket. All joints shall be sealed watertight. The outer jacket shall be protected with a double layer wrap of 30 pound roofing felt prior to backfill. Care shall be taken during backfill to avoid damage to the insulation and jacket.
- P. Metal Protective Jacket: Protect outer covering of insulation with a metal jacket system over both pipe and fitting insulation where exposed to weather [, where _____] [or where exposed indoors]. Metal jacket shall extend over PVC jacketing or vapor barrier, down to grade at riser locations or building entrance. Longitudinal seals shall provide a 3" overlap installed at the 9 o'clock or 3 o'clock position to shed water. Butt joints shall be overlapped a minimum of 3" in a manner to prevent the entry of water. Seal metal jacketing with 3/4" stainless steel sealing bands shall be installed on 12" centers along the metal jacket. Locate strap joints so as to prevent personnel contact. Metal jacket on valves and flanges shall be removable without disturbing the adjacent jacket.
- Q. Vapor Barrier: Maintain integrity of vapor barrier on chilled water [and all other cold] pipe insulation and protect barrier to prevent puncture and other damage.
- R. Penetrations: Extend piping insulation without interruption through walls, floors, and similar penetrations, except where otherwise indicated. Where insulation is interrupted on chilled water piping, an isolating seal shall be provided between the insulation vapor barrier and the pipe and penetration seal as specified under Paragraph 3.03/D. Where insulation is interrupted on steam and condensate piping, the penetration seal shall be insulated as specified for the penetrating piping, such that no high temperature surfaces are exposed.
- S. Ventilation: Provide adequate ventilation during initial start-up of piping systems to remove smoke and odor given off when the organic binders in the insulation are initially heated.

3.4 DUCTWORK APPLICATION:

- A. Exterior Ductwrap Insulation On [Supply], [Return] [and General Exhaust] Ductwork: After ductwork testing has been completed, insulate [Supply], [Return], [and General Exhaust] ductwork as specified in section 2.5 above. On ducts over 18" wide, apply weld clips to bottom of duct, spaced 18" on center each way, maximum. Seal all longitudinal and transverse seams and all punctures caused by weld clips or stick clips with 2" wide SMACNA-labeled duct tape and mastic.
- B. Acoustical Duct Lining For Supply, Return and General Exhaust Ductwork: Refer to Section 22 31 13 for additional information.
- C. Rigid Ductwork Insulation: Provide rigid external duct insulation where shown on the drawings and for all exposed ductwork in the [] Room. Insulation shall be secured to the ductwork with mechanical fasteners, "stick clips", Graham Pins or Speed Clips spaced on maximum 12" centers on the bottom of the duct and maximum 24" centers on the top and side of the duct. Additional fasteners shall be provided as recommended by the insulation manufacturer or required to hold insulation securely against the duct. After the insulation is in place, all joints, seams and protrusions through the duct shall be thoroughly sealed with Foster 30-35 or approved equal white vapor barrier emulsion applied over 3" wide Duramesh Glass Fabric or approved equal glass fabric strips. Where ductwork has standing seams or external angle bracing, insulation shall be built up over protrusions and sealed as described hereinabove.
- D. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles, cements adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by the insulation manufacturer for the applications indicated.
- E. Air Devices: Insulate all air devices not factory-insulated with fiberglass ductwrap where diffusers are located in ceilings that are not used as return air plenums.
- F. Special Applications: Roof drains and floor drains may be insulated with duct wrap if the Contractor submits and receives approval on his recommended means of maintaining a vapor seal.

- G. **Kitchen Exhaust Ductwork:** After duct testing has been completed, apply insulation with joints staggered, to clean dry ductwork surfaces and hold in place with one inch (1") galvanized hexagonal wire mesh with edges laced together. Where necessary to achieve a snug fit of insulation on large surfaces, install weld clips 18" on center to surfaces before installation of insulation and tie to wire mesh with 20 gauge galvanized wire. Insulation will be enclosed in a 2 hour duct enclosure installed under other Divisions.]
- H. Surfaces: Install insulation materials with smooth, even surfaces.
- I. Butt Joints: Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- J. Vapor Barrier: Maintain integrity of vapor barrier on ductwrap insulation and protect barrier to prevent puncture and other damage.
- K. Penetrations: Extend ductwrap insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.
- L. Corner Angles: Install corner angles on external corners of insulation on ductwrap in exposed finished spaces before covering with jacketing.
- 3.5 INSPECTION:
- A. General: Visually inspect the completed insulation installation and repair or replace any improperly sealed joints.
- B. Wet Insulation: Where there is evidence of vapor barrier failure or "wet" insulation after installation, the damaged insulation shall be removed, the pipe or duct surface shall be cleaned and dried and new insulation shall be installed.
- 3.6 IDENTIFICATION:
- A. Refer to Section 23 03 00 for applicable painting and labeling requirements.

END OF SECTION 23 07 00