SECTION 15250

INSULATION FOR EXPOSED PIPING AND EQUIPMENT

PART 1--GENERAL

1.01 DESCRIPTION

A. SCOPE:

This section specifies insulation for exposed piping and related equipment and appurtenant surfaces.

B. TEMPERATURE CLASSES:

Insulation for exposed piping and equipment is classified for the following temperature ranges: low and very high.

Low temperature class insulation shall be suitable for an operating temperature range of minus 100 to plus 100 degrees F.

Very high temperature class insulation shall be suitable for an operating temperature range of 1200 to 1800 degrees F.

1.02 REFERENCES

This section contains references to the following documents. They are a part of this section as specified and modified. Where a referenced document contains references to other standards, those documents are included as references under this section as if referenced directly. In the event of conflict between the requirements of this section and those of the listed documents, the requirements of this section shall prevail.

Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid (or on the effective date of the Agreement if there were no Bids). If referenced documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, regardless of whether the document has been superseded by a version with a later date, discontinued or replaced.

Reference	Title
ASTM B209	Aluminum and Aluminum-Alloy Sheet and Plate
ASTM C533	Calcium Silicate Block and Pipe Thermal Insulation
ASTM C534	Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form

Reference	Title
ASTM C552	Cellular Glass Thermal Insulation
ASTM E96	Water Vapor Transmission of Materials
FEDSPEC L-P-535E	Plastic Sheet (Sheeting) "Plastic Strip" Poly (Vinyl Chloride) and Poly (Vinyl Chloride-Vinyl Acetate), Rigid
FEDSPEC HH-I-558B(3)	Insulation, Blocks, Boards, Blankets, Felt Sleeving (Pipe and Tube Covering), and Pipe Fitting Covering, Thermal (Mineral Fiber, Industrial Type)

PART 2--PRODUCTS

2.01 GENERAL

Piping insulation shall be tubular type or the flexible blanket type. Insulation for valves, strainers, fittings, expansion joints, flanges and other connections shall be segmented sections, molded, or blanket type coverings of the specified type and thickness of pipe insulation, or the flexible blanket type. Equipment insulation shall be flexible blanket type or rigid board type cut to fit the surface.

2.02 INSULATION

A. GENERAL:

Low temperature class insulation shall be of the unicellular elastomeric thermal, cellular glass, or fiberglass type.

Very high temperature class insulation shall be of the calcium silicate type or the flexible blanket type. Piping and equipment subjected to vibration (such as engine exhaust) shall be insulated with flexible blanket type.

B. UNICELLULAR ELASTOMERIC THERMAL TYPE:

Unicellular elastomeric thermal type insulation shall conform to the requirements of ASTM C534, Type I.

C. CELLULAR GLASS TYPE:

Cellular glass type insulation shall conform to the requirements of ASTM C552, Type II.

D. FIBERGLASS TYPE:

Fiberglass type insulation shall conform to the requirements of FEDSPEC HH-I-558B.

E. CALCIUM SILICATE TYPE:

Calcium silicate type insulation shall conform to the requirements of ASTM C533, Type II, Class C.

F. FLEXIBLE BLANKET TYPE:

1. VERY HIGH TEMPERATURE CLASS: Very high temperature insulation shall be removable 1-inch or 2-inch thick blanket-type insulation designed for continuous 1800 degree F service. The blanket shall be a custom sewn, flexible, reusable jacket, custom designed to closely fit the piping or the equipment housing. Blanket shall be custom-fitted to not restrict access to any instrumentation or equipment. Insulation shall not compact or shake down in vibrating service. Blanket insulation shall consist of a noncombustible silica cloth jacket and high purity alumina and silica nonasbestos white ceramic fiber insulation. Insulating blanket shall be Thermazip Hi-Temp blanket Style 2000-61-3000 by Accessible Products Company, Hitco AIM, Advanced Thermal Products, or equal.

2.03 INSULATION JACKETS

A. LAMINATED JACKETS:

Laminated jackets shall consist of aluminum and white kraft paper. Jackets shall have a perm rating for water vapor transmission of not more than 0.02 in accordance with procedure A of ASTM E96.

B. ALUMINUM JACKETS:

Aluminum jackets shall be constructed of smooth finish aluminum sheet conforming to ASTM B209, alloy 5005, temper H16, with integral vapor barrier. Jackets shall be 0.016 inch thick.

Sheet metal screws shall be aluminum or stainless steel.

Jackets shall be secured with 0.020 by 3/4 inch type 304 stainless steel expansion bands.

2.04 INSULATION COVERS

A. POLYVINYLCHLORIDE (PVC) COVERS:

Polyvinylchloride covers shall be one piece, premolded polyvinylchloride conforming to FEDSPEC L-P-535E, Composition A, Type II, Grade E4.

B. ALUMINUM COVERS:

Aluminum covers shall be constructed of smooth finish aluminum sheet conforming to ASTM B209, alloy 5005, temper H16, with integral vapor barrier. Covers shall be 0.016 inch thick.

2.05 SHIELDS

Unless otherwise specified, thermal pipe hanger shields shall be provided at pipe supports.

2.06 FLASHING

Flashing shall include aluminum caps, sealant and reinforcing. Aluminum caps shall be 20 gage thick and shall be cut to completely cover the insulation. Sealants shall be as recommended by the insulation manufacturer.

Reinforcement in flashing heated up to 370 degrees F shall be nylon fabric. Reinforcement in flashing for hotter surfaces shall be wire mesh or as recommended by the insulation manufacturer.

2.07 PRODUCT DATA

The following information shall be provided in accordance with Section 01300:

1. Manufacturer and manufacturer's type designation.

2. Samples, for each insulation material type, of typical jacket and closures for fittings, valves and appurtenances.

3. Descriptive literature and catalog data for materials to be used showing methods of installation.

4. Certification of ratings for water vapor transmission and puncture and stiffness as specified in paragraph 15250-2.03 A.

PART 3--EXECUTION

3.01 INSTALLATION

A. GENERAL:

Insulation shall be applied over clean, dry surfaces. Double layer insulation, where specified or required to achieve the specified surface temperature, shall be provided with staggered section joints.

B. PIPE SUPPORTS AND SHIELDS:

Unless otherwise specified, thermal pipe hanger shields shall be provided by the Contractor and installed during pipe support installation. Where thermal pipe hanger shields are used, apply the following to all butt joints:

1. On hot pipe systems, the Contractor shall apply 3-inch wide vapor barrier tape or band over the butt joints.

2. On cold water, chilled water, or refrigerant piping, the Contractor shall apply a wet coat of vapor barrier lap cement on all butt joints and seal the joints with a minimum 3-inch wide vapor barrier tape or band.

C. PROTECTION:

Insulation and jackets shall be protected from crushing, denting, and similar damage during construction. Vapor barriers shall not be penetrated or otherwise damaged. Insulation, jacket, and vapor barriers damaged during construction shall be removed and new material shall be installed.

D. PIPING INSULATION:

1. GENERAL:

a. PIPE: Piping shall be continuously insulated along its entire length including all in-line devices such as valves, fittings, flanges, couplings, strainers and other piping appurtenances. Unless otherwise specified, piping insulation shall be provided with laminated jackets specified in paragraph 15250-2.03 A. Insulation shall be butted firmly together and jacket laps and joint strips provided with lap adhesive. Jackets shall be provided with their seams located on the underside of pipe.

PVC covers specified in paragraph 15250-2.04 A shall not be used with medium- or high-temperature class insulation. Removable flexible blanket-type insulation need not be jacketed.

b. FITTINGS, CONNECTIONS, FLANGES AND VALVES: Fitting, connection, flange and valve insulation shall be provided with covers specified in paragraph 15250-2.04. Insulation shall be secured in place with 20-gage wire and a coat of insulating cement. Covers shall overlap the adjoining pipe insulation and jackets. Covers shall be provided with their seams located on the underside of fittings and valves.

2. LOW TEMPERATURE CLASS:

a. PIPE: Insulation shall have ends sealed off with a vapor barrier coating.

b. FITTINGS, CONNECTIONS, FLANGES AND VALVES: Except where soft covers are specified, insulation for pipe sizes 2 inches and less, shall be provided with rigid PVC covers specified in paragraph 15250-2.04 A. Covers shall be sealed at edges with vapor barrier adhesive. The ends of covers shall be secured with vinyl tape. The tape shall overlap the jacket and the cover at least 1 inch. Vapor barrier shall not be penetrated.

Except where soft covers are specified, insulation for pipes 2 1/2 inches and larger shall be provided with rigid aluminum covers specified in paragraph 15250-2.04 B. Covers shall be mechanically secured by corrosion-resistant tacks pushed into the overlapping throat joint.

3. VERY HIGH TEMPERATURE CLASS:

a. PIPE: Except for flexible blanket type, insulation shall have ends sealed with end joint strips and held in place by waterproof adhesive.

b. FITTINGS, CONNECTIONS, FLANGES AND VALVES: Except where soft covers are specified, rigid insulation shall be provided with rigid aluminum covers specified in paragraph 15250-2.04 B. Covers shall be mechanically secured by corrosion-resistant tacks pushed into the overlapping throat joint.

4. OUTDOOR PIPING:

a. PIPE: Rigid insulation shall be provided with aluminum jackets specified in paragraph 15250-2.03 B. Flexible blanket-type insulation shall be designed for outdoor, weather-exposed service.

b. FITTINGS, CONNECTIONS, FLANGES AND VALVES: Rigid insulation shall be provided with rigid aluminum covers specified in paragraph 15250-2.04 B. Flexible blanket type insulation shall be designed for outdoor, weather-exposed service.

E. MECHANICAL EQUIPMENT INSULATION:

1. GENERAL: Unless otherwise specified, insulation shall fit the contours of equipment and shall be secured with 1/2 by 0.015 inch galvanized steel bands. Weld pins or stick clips with washers may be used for flat surfaces and spaced a maximum 18 inches apart. Joints shall be staggered and voids filled with insulating cement. Unless otherwise specified, insulation shall be provided with laminated jackets specified in paragraph 15250-2.03 A.

Unless specifically specified to be uninsulated, equipment connected to insulated piping shall be insulated.

2. OUTDOOR EQUIPMENT: Insulation shall be provided with a coat of weatherproof mastic and a layer of open-weave glass cloth embedded into a wet tack coat. Seams shall overlap at least 2 inches. A finish coat of weatherproof mastic shall be provided. The total coating thickness shall be a minimum of 1/8 inch.

3. LOW TEMPERATURE: Insulation shall have joints, breaks, and punctures sealed in facing with fire-retardant vapor barrier adhesive reinforced with 4-inch tape.

Insulation shall be provided with a layer of open-weave glass cloth embedded into a wet coat of fire-retardant adhesive. Seams shall overlap at least 2 inches. A finish coat of fire-retardant adhesive shall be provided.

4. VERY HIGH TEMPERATURE: Very high temperature equipment shall be covered with custom-fitted removable blanket-type insulation. Blanket-type insulation shall be secured with stainless steel wire lacing and hooks. Ends of blanket segments shall overlap to prevent gaps and voids when the piping and equipment is heated. Blankets shall be snugly secured under nuts and bolt heads to assure complete coverage during operation and to prevent vibration-induced gaps or voids. Blankets shall be secured in strict accordance with the manufacturer's instructions.

F. FLASHING:

Flashing shall be provided at jacket penetrations and terminations. Clearance for flashing shall be provided between insulation system and piping supports.

A heavy tack coat of sealant shall be troweled over the insulation, extending over the jacket edge 1 inch and over the pipe or protrusion 2 inches. Reinforcement shall be stretched over the tack coat after clipping to fit over pipe and jacket. Clipped reinforcing shall be strapped with a

continuous band of reinforcing to prevent curling. Sealant shall then be troweled over the reinforcement to a minimum thickness of 1/8 inch.

Aluminum caps shall be formed to fit over the adjacent jacketing and to completely cover coated insulation. Cap shall be held in place with a jacket strap.

3.02 INSULATION THICKNESS SCHEDULE

The insulation dimensional tolerances shall comply with the specified standards. Equipment insulation shall match thickness of attached piping. The minimum insulation thicknesses, exclusive of jacket, shall be as follows:

Piping service[a]	Fluid temperature range, degrees F	Insulation thickness in inches for nominal pipe sizes					
		Runouts up to 2 inches[b]	1 inch and less	1.25 to 2 inches	2.50 to 4 inches	5 and 6 inches	8 inches and larger
Heating:							
EE[c]	600-1500	-	-	-	4	4	4
EE[d]	350-500	-	-	-	2	2	2
Cooling:							
CWR, CWS	40-60	0.5	0.5	0.75	1.0	1.0	1.0
Process:							
SA, STA[f]	150-250	1.0	1.0	1.5	1.5	-	-
Plumbing:							
HW	100-150	1.0	1.0	1.0	1.0	1.0	1.5
1W, 1WS[g]	55-65	1.0	1.0	1.0	1.0	1.0	1.0

[a] See specification Section 15050.
[b] Runouts to individual terminal units (not exceeding 12 feet in length).
[c] Engine exhaust from the engine to the exhaust heat recovery silencer. Catalytic converters, where used, shall be insulated with very high temperature insulating blankets. Additional insulation blankets shall be provided, if required, to limit the external surface temperature to a maximum of 200 degrees F or to achieve the required minimum thickness.
[d] Engine exhaust downstream of the exhaust heat recovery silencer. Additional insulation shall be provided, if required, to limit external jacket temperature to a maximum of 200 degrees F. Engine exhaust piping on building roof need not be insulated.
[e] Refrigerant insulation by air conditioning equipment supplier.
[f] Insulate piping for personnel protection between compressor and after cooler only. Include drip legs.
[g] For condensation control, see specification Section 15050. Unless otherwise specified, connected equipment shall be uninsulated.

****END OF SECTION****