

 BAYTOWN ENGINEERING STANDARD 		HOT EQUIPMENT INSULATION APPLICATION	BTES 14-1-2.1C
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SCOPE

- 1.1 This standard covers the mandatory requirements for materials and application of external insulation for equipment within the design temperature range of 78 to 1200°F.
- 1.2 This standard is not applicable to boilers, furnaces, and storage tanks.

SUMMARY OF ADDITIONAL REQUIREMENTS

- 2.1 Baytown Engineering Standard BTES 14-2-50.1B, "Insulation Materials, Purchase Descriptions," shall be used with this standard.
- 2.2 The following information shall be obtained from the drawings or insulation schedules:
 - a. Equipment to be insulated and extent of insulation if partial coverage is required.
 - b. Equipment that requires special insulation to prevent stress corrosion cracking of austenitic stainless steel.
 - c. Total thickness of insulation required.
 - d. Insulation design temperature.
 - e. Extent of insulation designated as fireproofing.
 - f. Equipment that requires insulation only for personnel protection.
 - g. Equipment to be heat traced.

DEFINITIONS

- 3.1 The term equipment is both mechanical equipment and vessels.
- 3.2 The term mechanical equipment is defined to include turbines and pumps.
- 3.3 The term vessel is defined to include drums, towers, reactors, spheres, and exchangers.

MATERIALS

- 4.1 Materials shall be per BTES 14-2-50.1B with code numbers, sizes, widths, etc., as specified herein. Insulation materials, insulation covering, cements, accessories, etc. shall not contain any asbestos.

INSULATION

- 4.2 Board insulation shall be semirigid mineral wool Code No. 134, good for at least 700°F.
- 4.3 Block insulation shall be flat or curved calcium silicate blocks per Code No. 11.

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PLAINTIFF'S EXHIBIT

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- 4.4 Pipe insulation shall be calcium silicate sectional or segmental pipe covering Code No. I4.
- 4.5 Special insulation shall be mineral wool board, calcium silicate block, or calcium silicate pipe covering that contains less than 25 ppm chlorides or contains an inhibitor that will prevent stress corrosion cracking of austenitic stainless steel.
- 4.6 Blanket insulation shall be 3-inch-thick mineral fiber material with high permanent resilience per Code No. I31.
- 4.7 Insulating cement shall be mineral fiber per Code No. I103.

INSULATION COVERING

- 4.8 The color of all finish coatings and mastics shall be gray to match the color of Enjay coating Rust-Ban AK-6414.
- 4.9 Weatherproofing jacket shall be aluminum according to the following:
 - a. Sheets shall be 1-1/4-inch corrugated by 33-inch minimum width, Code No. J5, and rolls shall be 3/16-inch corrugated by 48-inch minimum width per Code No. J6 according to the following thickness schedule:

Outside Diameter of Vessel in Feet	Jacket Thickness in Inches
Under 6	0.012
6 to 18	0.016
18 and Over	0.019

- b. Prefabricated heads shall be per Code No. J4.
- 4.10 Weatherproofing mastic shall be a breathing type per Code No. J17.
- 4.11 Fireproof covering shall be electrogalvanized carbon steel jacket according to the following:
 - a. Sheets shall be 0.010 inch thick by 33-inch minimum width with 1-1/4-inch corrugations in the long direction per Code No. J13.
 - b. Rolls shall be 0.010 inch thick by 48-inch minimum width with 3/16-inch cross corrugations per Code No. J15.
 - c. Preformed heads shall be 0.010 inch thick, smooth, interlocking gore type per Code No. J14.
- 4.12 Fireproofing mastic shall be a breather type per Code No. J19.

ACCESSORIES

- 4.13 Bands shall be stainless steel, 3/4 inch wide x 0.015 inch thick, Code No. A2.
- 4.14 Seals shall be stainless steel, closed type, for 3/4-inch x 0.015-inch bands, Code No. A23.
- 4.15 Wire shall be 16 BWG stainless steel, Code No. A30.
- 4.16 Wire mesh shall be Monel, Code No. A37.

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- 4.17 Screws shall be No. 8 x 1/2 inch long, sheet metal, stainless steel, Code No. A19.
- 4.18 Welding stud caps shall be aluminum to match weld stud, Code No. A19.
- 4.19 Expansion springs shall be stainless steel for 3/4-inch-wide bands, Code No. A5.
- 4.20 Mastic sealer/flashing shall be per Code No. J20.

INSULATION APPLICATION

GENERAL

- 5.1 Manholes and nozzles of vessels and equipment that are specified to be insulated shall only be insulated when required for personnel protection or when they are heat traced or contain steam.
- 5.2 Skirts or the bottom head of vessels inside skirts where the diameter is less than 4 feet 0 inch shall not be insulated, unless otherwise specified by Owner.
- 5.3 Surfaces to which insulation is applied shall be dry and free of all foreign matter.
- 5.4 Insulation for personnel protection shall extend to a minimum height of 7 feet 0 inch above grade or platform.
- 5.5 Pressure test shall be completed and all repairs made prior to installing insulation over welds, flanges, or threaded connections.
- 5.6 Insulation shall be kept dry and protected against the elements during storage and all stages of application until the weatherproofing has been installed.
- 5.7 Install insulation with all joints tightly butted together. Stagger joints of multilayer construction. Point up cracks and voids with insulating cement.
- 5.8 Install each board of mineral wool insulation in a slightly compressed condition in both directions.
- 5.9 Install insulation in two layers of equal thickness if the insulation design temperature is above 600°F.
- 5.10 For insulation design temperatures through 700°F, install board insulation. Above 700°F, install pipe or block insulation as the inner layer and board insulation as the outer layer.
- 5.11 When special insulation is specified to prevent stress corrosion cracking, use low chloride insulation and/or inhibited insulation.

VESSELS

- 5.12 Secure insulation on cylindrical vessels as follows:
 - a. Use wire on the bottom head of skirt-supported vessels. Use bands and seals in all other cases, except wire may be used to secure block or pipe insulation on vessels less than 4 feet in diameter.

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- b. Space bands and wires as required to secure insulation but in no case shall they be spaced more than 12 inches apart.
- c. Secure insulation on the top head of vertical vessels per Figure 1 and the heads of horizontal vessels and the bottom head of vessels not supported on skirts per Figure 2.
- d. Secure insulation on the bottom head of skirt-supported vertical vessels by diagonally crossing wires in both directions between adjacent rows of clips. Secure ends of wire by twisting at every third clip.
- e. Install expansion springs on all bands that secure the outer layer of insulation on the cylindrical sections of vessels equally spaced around the circumference according to the following schedule:

QUANTITY OF EXPANSION SPRINGS
REQUIRED PER BAND

Diameter Section in Feet	Insulation Design Temperature Range, °F			
	400-600	601-800	801-1000	1001-1200
4 to 8	-	1	1	2
8 to 12	1	1	1	2
12 to 16	1	2	2	3
16 to 20	1	2	2	3
20 to 24	2	3	3	4
24 to 26	2	3	3	4
26 to 30	3	3	4	5

- f. With vessel in the cold condition, each spring shall be installed in tension to produce a 3/4-inch spring expansion.
- 5.13 Secure insulation on noncylindrical vessels (spheres, spheroids, etc.) by diagonally crossing wires in both directions between adjacent rows of clips. Secure ends of wire by twisting at every third clip.
- 5.14 Vertical vessels having insulation design temperatures above 400°F shall have expansion joints installed below all support rings except at the bottom support. Installation shall be per Figure 3.
- 5.15 Weatherproof cylindrical vessels as follows:
- a. Install aluminum weatherproofing jacket on all sections except the bottom head of skirt-supported vertical vessels.
 - b. Use sheets on vertical vessels and rolls on horizontal or inclined vessels.
 - c. Install the jacket to shed water and overlap all edges 3 inches, but in no case less than two full corrugations. This includes lapping the bottom course over the lower insulation support ring of vertical vessels.
 - d. Support the bottom course on vertical vessels using welding studs and caps. A minimum of two studs shall be used through each sheet. Owner will provide studs installed on not more than 14-inch centers and installer of jacket shall provide caps. Support the other courses with "S" clips fabricated from 1-inch-wide x 0.030-inch-thick stainless steel, Type 302 or 304 material per Figure 4. Space "S" clips on centers not to exceed 14 inches.
 - e. Secure the rolls and sheets with bands spaced on not more than 6-inch centers. On vertical vessels, secure bands to sheets with screws on not more than 5-foot centers and in no case less than two screws per band.

- f. Expansion springs shall be provided for each band on cylindrical sections according to the schedule for securing insulation. With the vessel in the cold condition, each spring shall have an initial tension to produce 1-1/2-inch spring expansion.
- g. Secure gore sections of prefabricated heads with screws on not more than 6-inch centers. Attach prefabricated heads to shell jacket with screws on not more than 6-inch centers.
- 5.16 Weatherproof the bottom head of skirt-supported vessels and noncylindrical vessels such as spheres, spheroids, etc., as follows:
 - a. Cover insulation with wire mesh and lace with wire.
 - b. Apply a 1/4-inch-thick wet coat of weatherproofing mastic over the wire mesh. The mastic shall be smooth and completely cover the netting.
- 5.17 For insulation design temperatures below 401°F, apply a 1/4-inch minimum fillet of sealer/flashing mastic to weatherproof small openings between the jacket and vessel surfaces such as nozzles, manholes, etc. For temperatures of 401°F and above, do not install the sealer/flashing but take extra precautions to insure a good fit-up.

MECHANICAL EQUIPMENT

- 5.18 If those insulating materials specified in the General Section of this specification cannot be economically applied, insulating cement may be installed but the thickness shall be increased 50%.
- 5.19 Weatherproof the insulation with weatherproofing mastic and wire mesh as specified for noncylindrical vessels.

APPLICATION FOR FIREPROOFING

- 6.1 Application for fireproofing shall be per the section, "Application for Insulation," with the following exceptions:
 - a. Use calcium silicate insulation and insulating cement only. Do not use mineral fiber insulation.
 - b. Insulation used to fireproof equipment composed of low melting point metals such as aluminum shall be installed in two layers regardless of the insulation design temperature.
 - c. Fireproofing jacketing shall be installed in place of aluminum jacketing.
 - d. A band shall be installed not more than 2 inches above all rows of studs supporting fireproofing jacket on vertical cylindrical vessels.
 - e. The insulation of equipment, noncylindrical vessels, and the bottom head of vertical vessels supported on skirts shall be coated with the fireproofing mastic reinforced with wire mesh in place of the weatherproofing mastic.

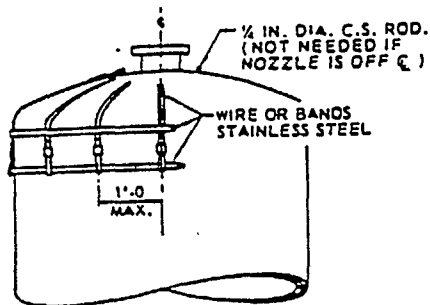


FIGURE 1 - ATTACHMENT OF INSULATION TO TOP OF VERTICAL VESSELS

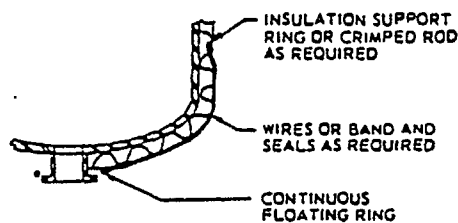


FIGURE 2 - ATTACHMENTS FOR HORIZONTAL VESSEL HEADS AND BOTTOM HEAD OF VERTICAL VESSELS WITHOUT SKIRT

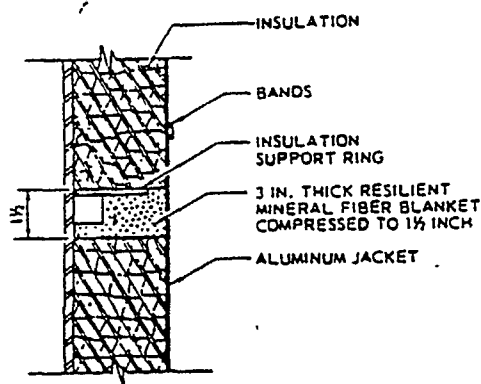


FIGURE 3 - EXPANSION JOINT DETAILS

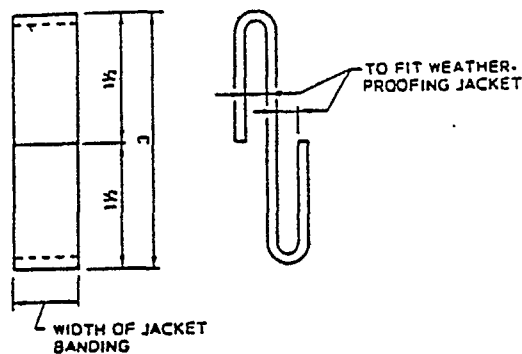


FIGURE 4 - "S" CLIP

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SCOPE

- 1.1 This standard covers the mandatory requirements for materials and application of external insulation for aboveground piping and instruments within the insulation design temperature range of 78 to 1200°F.

SUMMARY OF ADDITIONAL REQUIREMENTS

- 2.1 Baytown Engineering Standard BTES 14-2-50.18, "Insulation Materials, Purchase Descriptions," shall be used with this standard.
- 2.2 The following information shall be obtained from piping drawings, instrument sketches, or insulation schedules:
- Piping and instruments to be insulated and extent of insulation if only partial coverage is required.
 - The piping and instruments that require a special insulation to prevent stress corrosion cracking.
 - Total thickness of insulation required.
 - Insulation design temperature.
 - Extent of insulation designated as fireproofing.
 - Piping and instruments that only require insulation for personnel protection.
 - Piping and instruments that are heat traced.
 - Areas specified to be insulated and subject to foot traffic.

MATERIALS

- 3.1 Materials shall be per BTES 14-2-50.18 with code numbers, sizes, widths, etc., as specified herein. Insulation materials, insulation covering, cements, accessories, etc. shall not contain any asbestos.

INSULATION

- 3.2 Mineral fiber insulation shall be molded pipe covering per Code Number I40, prefabricated ell fitting Code Number I36, and prefabricated flange insulation Code Number I38.
- 3.3 Calcium silicate shall be molded pipe covering per Code Number I4, prefabricated ell fitting Code Number I2, and prefabricated flange insulation Code Number I3.
- 3.4 Special insulation shall be mineral fiber or calcium silicate pipe covering that contains less than 25 ppm chlorides or contains an inhibitor that will prevent stress corrosion cracking of austenitic stainless steel.
- 3.5 Blanket insulation shall be 3-inch-thick mineral fiber material with high permanent resilience per Code Number I31.
- 3.6 Insulation cement shall be mineral fiber type per Code Number I103.

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INSULATION COVERING

- 3.7 The color of all outside coatings and mastics shall be gray to match the color of Enjay coating Rust-Ban AK-6414.
- 3.8 Weatherproofing for pipe, weld tees, and end pieces shall be 0.012-inch-thick aluminum jacket, preformed sections with a longitudinal lock joint or roll stock per Code Number J6.
- 3.9 Weatherproofing for weld ells shall be 0.016-inch-thick aluminum jacket, preformed or gore type with overlapping beaded joints per Code Number J1.
- 3.10 Weatherproofing mastic shall be a breathing type per Code Number J17.
- 3.11 Fireproof covering for pipe, weld tees, and end pieces shall be 0.010-inch-thick electrogalvanized steel jacket, preformed sections with a longitudinal lock joint or roll stock per Code Number J15.
- 3.12 Fireproof covering for weld ells shall be 0.010-inch-thick, electrogalvanized steel jacket, preformed or gore type with overlapping beaded joints per Code Number J16.
- 3.13 Fireproof mastic shall be a breathing type per Code Number J19.

ACCESSORIES

- 3.14 Fiber cloth shall be white, glass fiber per Code Number A7.
- 3.15 Wire shall be 16 Bwg stainless steel per Code Number A30.
- 3.16 Bands shall be:
a. Aluminum, 3/8 inch wide x 0.020 inch thick per Code Number A3.
b. Stainless steel, 3/4 inch wide x 0.015 inch thick per Code Number A2.
- 3.17 Seals shall be:
a. Aluminum, short-wing type, for 3/8-inch x 0.020-inch aluminum bands per Code Number A24.
b. Stainless steel, regular-wing type, for 3/4-inch x 0.015-inch stainless steel bands per Code Number A23.
- 3.18 Screws shall be 1/2 inch long x No. 8 pan head.
a. Code Number A18 for aluminum.
b. Code Number A19 for stainless steel.
- 3.19 Insulation supports shall be 1/8-inch-thick carbon steel clamp-on type. The outside diameter, after installation, shall be 1/2 to 3/4 inch less than the outside diameter of the insulation.

APPLICATION

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GENERAL

- 4.1 Because of painting and pressure testing requirements, permission shall be obtained from Owner's representative before installing insulation.

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- 4.2 Piping, instruments, and heat tracing shall be dry and free of loose scale and foreign matter before insulation application.
- 4.3 Insulation and electric tracing shall be kept dry and shall be protected from the weather until the final weatherproofing or fireproofing covering has been installed.
- 4.4 All heat-traced lines and instruments shall be insulated.

INSULATION

- 4.5 Lines and instruments specified to be insulated shall be insulated individually and all components of the lines shall be insulated completely with the following exceptions:
 - a. Only valves, flanges, and flanged fittings that are in steam service, are heat traced, or that are specified to be fireproofed shall be insulated.
 - b. When specified for personnel protection only, insulation shall be installed to a height of 7 feet above grade or platforms.
 - c. Rotation joints, steam traps, corrugated pipe expansion joints, and similar mechanical equipment shall not be insulated.
 - d. Insulation shall be notched 5 inches on each side of obstructions that protrude into insulation, such as pipe supports adjacent to pipe flanges, etc.
 - e. Steam traps, bypass block valve, and piping downstream of both shall not be insulated.
- 4.6 Mineral fiber insulation shall be used for design temperatures below 451°F, calcium silicate shall be used for design temperatures of 451°F and above, and insulation cement shall be used for all design temperatures with the following additions and exceptions:
 - a. Use special insulation for stainless steel tubing and for piping and instruments where special insulation to prevent stress corrosion cracking of stainless steel is specified. Insulation cement shall not be used on these items. Use blanket insulation to point-up cracks and to insulate instruments that cannot be insulated with pipe covering.
 - b. Insulation cement shall only be used when special insulation is not specified and only to insulate 1-1/2-inch and smaller valves, connections, and fittings or point-up cracks. The thickness shall be 1-1/2 times the pipe insulation thickness specified.
- 4.7 Insulation for tees and valves shall be fabricated from pipe insulation (all joints glued) except where insulation cement is allowed herein.
- 4.8 Insulation shall be installed in two layers of equal thickness if the insulation design temperature is above 600°F.
- 4.9 Insulation joints shall be butted together tightly and the joints of multilayer construction shall be staggered.
- 4.10 The insulation shall be secured with wires spaced on centers not to exceed 9 inches for pipe and not less than three wires each for each fitting, flange, or valve.

- 4.11 Pipe insulation shall be stopped at flanges and the ends shall be tapered so flange bolts can be removed without damaging insulation or covering.
- 4.12 Clamp-on-type insulation supports shall be provided on existing piping according to the following:
 - a. Near the base of vertical lines when the insulation will extend more than 12 feet vertically.
 - b. Above flanges when the insulation will extend more than 6 feet vertically above the flange.
 - c. Space the supports on not more than 21 feet 1-1/2-inch centers.
 - d. Locate supports above flanges so the flange bolts can be removed.
- 4.13 When the insulation design temperature is above 400°F, insulation expansion joints shall be installed below insulation supports or where effective for expansion.

WEATHERPROOFING

- 4.14 Aluminum jacket shall be installed on all insulation except fittings smaller than 2 inches NPS, all insulated valves, flanges, flanged fittings, and items insulated with insulation cement. For these exceptions weatherproofing shall be mastic reinforced with glass cloth.
- 4.15 Weatherproofing covering shall be installed over insulation so as to shed water, lapping all weatherproofing joints a minimum of 3 inches. Lock-type joints that are self-sealing do not require a 3-inch lap.
- 4.16 Jacket, except self-supporting lock jacket, shall be secured on centers not to exceed 6 inches according to the following:
 - a. Use aluminum bands on horizontal lines.
 - b. Use aluminum screws on the longitudinal joint of vertical lines and support each section with a minimum of three "S" clips per Figure 2. In addition, install one aluminum band at the middle of each section and secure to jacket with at least two aluminum screws.
 - c. Use no less than three aluminum screws per joint on weld ell jacket.
- 4.17 Junctions of end pieces to pipe for insulation design temperatures below 401°F and all projections through the jacket shall be sealed with a 1/4-inch fillet of sealer/flashings mastic.
- 4.18 Weatherproofing mastic shall be 3/32-inch minimum dry film thickness with glass cloth completely embedded in the mastic.

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APPLICATION FOR FIREPROOFING

- 5.1 Application for fireproofing shall be per the section "Application for Insulation" with the following exceptions:
 - a. Install calcium silicate insulation and insulation cement only; not mineral fiber insulation.
 - b. Insulation, used to fireproof piping composed of low melting metals such as aluminum, shall be installed in two layers regardless of the insulation design temperature.
 - c. Install fireproofing jackets and mastics in place of weatherproofing.
 - d. Use only stainless steel bands, clips, screws, and wire, not aluminum.

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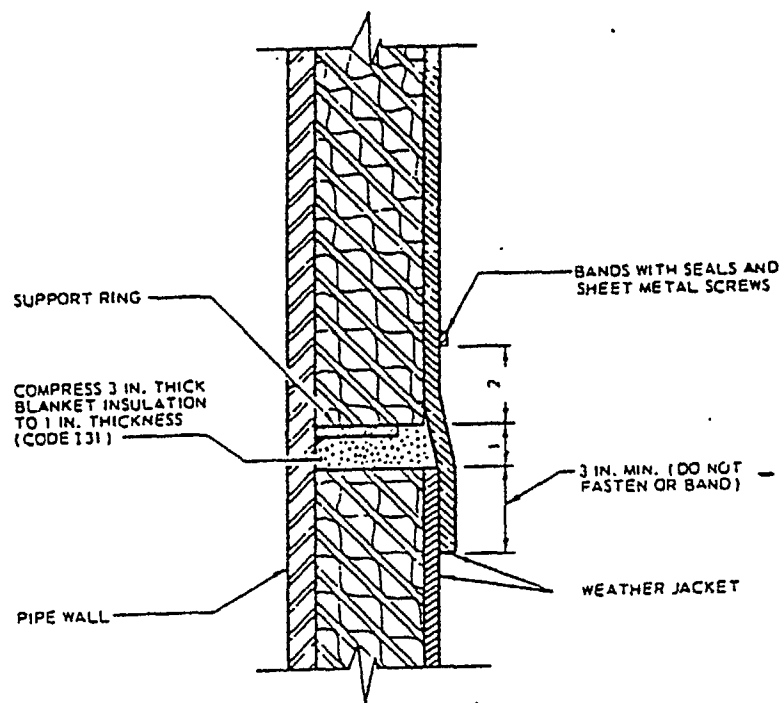


FIGURE 1 . TYPICAL INSULATION EXPANSION JOINT

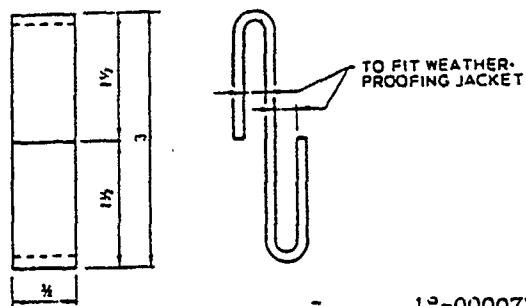


FIGURE 2 . STAINLESS STEEL 'S' CLIP

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 RAYTOWN ENGINEERING STANDARD 		INSULATION MATERIALS PURCHASE DESCRIPTIONS	BTES 14-2-50.1B
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SCOPE

- 1.1 This standard contains purchase descriptions of insulation materials. The term "MIT" used herein is the abbreviation for nominal insulation thickness. The contents of this standard are arranged as follows:

<u>Item</u>	<u>Code Numbers</u>	<u>Page</u>
ACCESSORIES		
Bands.....	A2 - A3	2
Breather Springs.....	A5	2
Fiber Cloth.....	A6 - A7	2
Finger Straps.....	A9	2
Joint Sealer.....	A12 - A13	2
Rivets.....	A15	2
Screws.....	A18 - A19	2
Seals.....	A23 - A24	2
Welding Pins.....	A26	3
Welding Studs and Caps...	A27 - A28	3
Wire.....	A30 - A31	3
Wire Mesh.....	A37	3
INSULATION		
← Calcium Silicate.....	I1 - I4	3,4
Diatomaceous Earth.....	I21 - I25	4
Mineral Fiber.....	I31 - I40	5
Polyurethane.....	I51 - I57	5,6
INSULATION CEMENT		
Mineral Fiber.....	I103	7
JACKETS AND MASTICS		
← Aluminum Jackets.....	J1 - J6	7,8
Felt Jackets.....	J11	8
Steel Jackets.....	J13 - J16	8,9
Mastics.....	J17 - J20	9

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PURCHASE DESCRIPTIONS

2.1 Accessories

Code Nos.	Description
A2	Bands, specify size (thickness x width x length), 18-8 Cr-Ni stainless steel, AISI Type 302 or Type 304, annealed temper.
A3	Bands, specify size (thickness x width x length), aluminum alloy Type 3003 or Type 5005, annealed temper.
A5	Breather springs, to fit (specify size of band) 18-8 Cr-Ni stainless steel, AISI Type 302 or Type 304, 5-inch minimum expansion with 125 pounds pull, 98% minimum return after relaxation.
A6	Fiber cloth, specify number of square feet, specify width, open weave (10 x 10) mesh, asphalt-coated glass fiber.
A7	Glass fiber cloth, specify number of square feet, specify roll width, open weave, 10 x 10 mesh, white starch sized, 0.256 ounce per square foot, equal to Perma-Glass-Mesh Corporation's No. 207.
A9	Finger straps, 0.020-inch minimum thickness x 3/4-inch minimum width x specify length, with approximately 1/4-inch-wide x 1-1/2-inch-long fingers spaced on 9-inch centers, 18-8 Cr-Ni stainless steel, AISI Type 302 or Type 304, annealed temper.
A12	Joint sealer, specify container size, permanently soft mastic sealer (Benjamin Foster Company 30-45).
A13	Rubber cement, insulation bonding adhesive, equal to Benjamin Foster 81-81, in 5-gallon or 1-gallon containers (specify which).
A15	Rivets, pop, specify size (diameter x length), aluminum.
A18	Screws, self-tapping, slotted pan head, sheet metal, specify size (number x length), aluminum.
A19	Screws, self-tapping, sheet metal, specify size (number x length), slotted pan-head type, AISI Type 302 or Type 304 stainless steel.
A23	Seals, banding, specify band size (thickness x width), specify type (closed, regular wing, or short wing), 18-8 Cr-Ni stainless steel, AISI Type 302 or Type 304.
A24	Seals, banding, specify band size (thickness x width), specify type (closed, regular wing, or short wing), aluminum alloy Type 3003 or Type 5005.

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PURCHASE DESCRIPTIONS (CONT'D)

Code Nos.	Description
A26	Rectangular welding pin, 1/4 inch x 1-1/4 inches, specify length, pierced, specify hole diameter, carbon steel equal to KSM Division of Omark Industries' Type AW.
A27	Welding stud, specify size, 18-8 Cr-Ni stainless steel, AISI Type 302 or Type 304. (Nelson Stud Welding's S2F Setlok Stud or KSM's Multiple Groove Korr Pin No. FB-5)
A28	Welding stud cap, aluminum, to fit Nelson Stud Welding's S2F Setlok Stud or KSM's Multiple Groove Korr Pin No. FB-5 with a 3/16-inch-diameter x 3/8-inch-long extension.
A30	Wire, specify size (Bwg x length), 18-8 Cr-Ni stainless steel, AISI Type 302 or Type 304, annealed temper.
A31	Wire, specify size (Bwg x length), aluminum, annealed temper.
A37	Wire mesh, specify width, specify square feet, 0.028-inch-diameter wire, 1-inch-hexagonal openings, Monel, poultry netting.

2.2 Insulation

Code Nos.	Description
I1	Block insulation, calcium silicate, ASTM C 533, except contains no asbestos, specify number of square feet, specify NIT, specify block width, 36 inches long, flat blocks or curved blocks, specify which; if curved, specify diameter to fit.
I2	Fitting insulation, calcium silicate, ASTM C 533, except contains no asbestos, specify NPS, specify NIT, specify fitting (if ell, specify long or short radius and 45 or 90 degree), specify flange, weld or screw ends; if flange ends, specify rating, if for weld ells and tees, specify with or without 2-inch tangent. If fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to pipe fitting dimensions plus insulation thickness with a plus 3/16-inch tolerance.

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PURCHASE DESCRIPTIONS (CONT'D)

Code Nos.	Description
I3	Flange insulation, calcium silicate, ASTM C 533, except contains no asbestos, specify NPS, specify NIT, specify flange type and rating. If fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to flange dimensions plus insulation thickness with a plus 3/16-inch tolerance.
I4	Pipe insulation, calcium silicate, ASTM C 533, except contains no asbestos, specify number of feet, specify NPS, specify NIT; if for lines with parallel tracers, specify location and size of grooving, when required.
I21	Block insulation, diatomaceous earth, ASTM C 517, except contains no asbestos, specify Class 1 or Class 2, specify number of square feet, specify NIT, specify class, specify block width, 36 inches long, specify flat blocks or curved blocks; if curved blocks, specify diameter to fit.
I22	Fitting insulation, diatomaceous earth, ASTM C 517, except contains no asbestos, specify Class 1 or Class 2, specify NIT, specify class, specify fitting (if ell, specify long or short radius and 45 or 90 degree), specify flange, weld, or screw ends; if flange end, specify rating; if for weld ells and tees, specify with or without 2-inch tangent. If fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to pipe fitting dimensions plus insulation thickness with a plus 3/16-inch tolerance.
I23	Flange insulation, diatomaceous earth, ASTM C 517, except contains no asbestos, specify Class 1 or Class 2, specify NPS, specify NIT, specify class, specify flange type and rating. If fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to flange dimensions plus insulation thickness with a plus 3/16-inch tolerance.
I24	Pipe insulation, diatomaceous earth, ASTM C 517, except contains no asbestos, specify Class 1 or Class 2, less jacket, specify number of feet, specify NPS, specify NIT, specify class; if for lines with parallel tracers, specify location and size of grooving.
I25	Valve insulation, diatomaceous earth, ASTM C 517, except contains no asbestos, specify Class 1 or Class 2, specify NPS, specify NIT, specify class, specify valve description (manufacturer name, valve identification number, type ends, and rating), insulate to valve bonnet; if fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to valve dimensions plus insulation thickness with a plus 3/16-inch tolerance.

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PURCHASE DESCRIPTIONS (CONT'D)

Code Nos.	Description
I31	Blanket insulation, <u>mineral fiber</u> , specify number of square feet, specify NIT, specify size (width x length), without metal fabric backing, -250 to 1500°F continuous temperature limit of fiber, high permanent resilience.
I32	Block insulation, <u>mineral fiber</u> , ASTM C 612, specify class, specify number of square feet, specify NIT, specify block size, specify flat blocks or curved blocks, if curved blocks, specify diameter to fit.
I34	Board insulation, <u>mineral fiber</u> , ASTM C 612, specify Class 3 with a minimum density of 8 lbs/ft ³ , a minimum continuous service temperature of 700°F, and a minimum compressive strength of 200 psf at 10% deflection, specify number of square feet, specify NIT, specify size (width x length), nonpinking binder.
I36	Fitting insulation, <u>mineral fiber</u> , ASTM C 547, 450°F minimum service temperature and 7 pcf minimum density, specify NPS; specify NIT, specify fitting (if ell, specify long or short radius and 45 or 90 degree) specify flange, weld or screw ends; if flange ends, specify rating, nonpinking binder; if fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to pipe fitting dimensions plus insulation thicknesses with a plus 3/16-inch tolerance.
I38	Flange insulation, <u>mineral fiber</u> , ASTM C 547, 450°F minimum service temperature and 7 pcf minimum density, specify NPS, specify NIT, specify flange type and rating, nonpinking binder; if fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to flange dimensions plus insulation thicknesses with a plus 3/16-inch tolerance.
I40	Pipe insulation, <u>mineral fiber</u> , ASTM C 547, 450°F minimum service temperature and 7 pcf minimum density, specify number of feet, specify NPS, specify NIT; if for lines with parallel tracers, specify location and size of grooving, nonpinking binder.
I51	Block insulation, <u>rigid polyurethane foam</u> , ASTM C 591 Type II, Grade 2 (self-extinguishing), -250 to +230°F continuous service temperature limits, specify number of square feet, specify NIT, specify block width, 36 inches long, flat blocks.

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PURCHASE DESCRIPTIONS (CONT'D)

Code Nos.	Description
153	Fitting insulation, rigid polyurethane foam, ASTM C 591 Type II, Grade 2 (self-extinguishing), -250 to +230°F continuous service temperature limits, specify NPS, specify NIT, specify fitting (if ell, specify long or short radius and 45 or 90 degree), specify flange, weld, or screw ends (if flange end, specify rating); if fabricated, all pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to pipe fitting dimensions plus insulation thickness with a plus 3/16-inch tolerance.
154	Flange insulation, rigid polyurethane foam, ASTM C 591 Type II, Grade 2 (self-extinguishing), -250 to +230°F continuous service temperature limits, specify NPS, specify NIT, specify flange type and rating; if fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to flange dimensions plus insulation thickness with a plus 3/16-inch tolerance.
155	Pipe insulation, rigid polyurethane foam, ASTM C 591 Type II, Grade 2 (self-extinguishing), -250 to +230°F continuous service temperature limits, sectional, specify number of feet, specify NPS, specify NIT.
156	Valve insulation, rigid polyurethane foam, ASTM C 591 Type II, Grade 2 (self-extinguishing), -250 to +230°F continuous service temperature limits, specify NPS, specify NIT, specify valve description (manufacturer's name, valve identification number, type ends, rating); if fabricated, pieces shall be fitted without gaps and shall be permanently joined, dimensions shall be equal to valve dimensions plus insulation thickness with a plus 3/16-inch tolerance.
157	Pipe insulation, load-bearing rigid polyurethane, ASTM C 591 Grade 2 (self-extinguishing), sectional, -250 to +230°F continuous service temperature limits, 250 psi minimum yield strength in compression, 180 psi minimum compressive strength at 5% deflection, specify number of linear feet, specify NPS, specify NIT, 3 perm-inches maximum water vapor transmission rate. Thermal conductivity per ASTM C 177 and C 420, aged at 140°F for 150 days expressed in Btu per (hour) (square foot) (Fahrenheit degree per inch) shall not exceed 0.25 at 100°F mean temperature and 0.22 at -100°F mean temperature.

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PURCHASE DESCRIPTIONS (CONT'D)

2.3 Insulation Cement

Code Nos.	Description
I103	Insulation cement, mineral fiber, ASTM C 195, containing no asbestos, specify number of sacks.

2.4 Jackets and Mastics

Code Nos.	Description
J1	Jacket, insulated fitting, smooth aluminum alloy Type 3003-H14 or Type 5005-H14, 0.016-inch minimum metal thickness, 2-inch minimum extension on both ends of weld ell, joints designed to effectively and permanently shed water, free of burrs and sharp edges, baked-on colored converted epoxy on inside and outside, specify the following: Type of fitting (if ell, specify long or short radius and degree of direction change), type ends (if flanged, give rating), NPS, NIT, and color of outside coating.
J2	Jacket, aluminum alloy Type 3003-H14 or Type 5005-H14, for insulated flange, specify NPS, specify NIT, specify flange type and rating, 0.012-inch minimum thickness, smooth surface, tinted, converted epoxy coating on inside, outside coating, baked-on, converted epoxy (specify color), all joints and seams shall be joined to effectively and permanently shed water, 1-inch minimum overlap at longitudinal joints, free of all burrs and sharp edges.
J3	Jacket, aluminum alloy Type 3003-H14 or Type 5005-H14, for insulated valve, specify NPS, specify NIT, specify valve description (manufacturer name, valve identification number, type ends and rating), specify if valve is insulated to bonnet or to packing gland, 0.012-inch minimum thickness, smooth surface, tinted, converted epoxy coating on inside, outside coating, baked-on, converted epoxy (specify color) all joints and seams shall be joined to effectively and permanently shed water, 1-inch minimum overlap at longitudinal joints, free of all burrs and sharp edges.
J4	Jacket, prefabricated head, aluminum alloy Type 3003-H14 or Type 5005-H14, gore type with overlapping beaded joints and screws on centers not to exceed 6 inches, 0.020-inch minimum metal thickness, smooth surface, 6-inch minimum flange length, free of burrs and sharp edges; colored polyethylene, colored converted epoxy, or 50-pound polyethylene-kraft paper moisture barrier 100% permanently bonded to inside; baked-on colored converted epoxy coating on outside, specify the description of head, insulation thickness and color of outside coating.

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PURCHASE DESCRIPTIONS (CONT'D)

Code Nos.	Description
J16	Jacket, insulated fitting, smooth electrogalvanized steel, 0.010-inch minimum metal thickness, 2-inch minimum extension on both ends of weld ells, joints designed to effectively and permanently shed water, free of burrs and sharp edges, vapor barrier continuously bonded to inside surface, baked vinyl enamel or vinyl organosol chemical and weather-resistant outside coating, specify the following: Type of fitting (if ell, specify long or short radius and degree of direction change), type ends (if flanged, give rating), NPS, NIT, and color of outside coating.
J17	Mastic, <u>weatherproofing</u> for high-temperature insulation, containing no asbestos, breathing type, vinyl acrylic or polyvinyl acetate, nonflammables in noncured state, flame spread less than 20 when cured, not less than 180°F constant service temperature limit, specify color and specify trowel, spray or brush grade.
J19	Mastic, <u>fireproofing</u> , breathing type, containing no asbestos, nonflammable with a flame spread index of four or less, specify color. (Vimasco WC-1FR)
J20	Mastic, <u>sealer/flashng</u> for high-temperature insulation, containing no asbestos, nonshrinking, permanently flexible, less than one perm water vapor permeable for 1/16-inch thickness, not less than 400°F constant service temperature limit, specify color. (Childers' Chi-Joint CP-70)

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