

**PLAINTIFF'S
EXHIBIT**

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STANDARD OIL COMPANY OF CALIFORNIA
ENGINEERING DEPARTMENT - SAN FRANCISCO

SPECIFICATION NO. EG-1381-F

MAY 25, 1967

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THERMAL INSULATION FOR HOT LINES AND VESSELS

SECTION A

TECHNICAL REQUIREMENTS

1.0 SCOPE

This Specification covers the requirements for insulating vessels, tanks, heat exchangers and lines with hot surfaces.

2.0 PIPING

2.1 Piping shall be insulated in accordance with form EF-630 and Drawing GA-N-99783. The specified thickness of insulation does not include weather coating.

2.2 Emulsion type weather coating shall not be applied when atmospheric precipitation or condensation may wet the finished surface within 24 hours after application.

2.3 Traced lines shall be insulated with oversized rigid pipe covering, calcium silicate of a brand approved by COMPANY.

Covering sections shall all be of the same I.D. with a maximum clearance of 1/4-inch between the tracer or pipe and insulation. Materials and insulating techniques used shall be as shown on Drawing GA-N-99783 except as follows:

At points where steam tracing is helically wound, the tracing shall be covered with 28 ga. galv. steel to support the insulation and an oversized insulation sleeve, tightly fitting over the pipe insulation, shall be used. The thickness of the sleeve shall be the same as that of the pipe insulation. At each such helix, the pipe insulation shall be ended at a point 1-inch short of each end of helix. The oversized sleeve shall be lapped 2 inches past the ends of the pipe insulation.

On all steam traced lines, a bare copper wire (14 gage) shall be installed under the tie wire of the weather coat for the full length of the steam tracer to mark its route.

2.4 All metal jacket weather coating shall be secured with stainless steel straps.

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- 2.5 All insulation and weathercoating used on or within 25 feet of furnaces shall be fire resistant. Galvanized steel or stainless steel weathercoating shall be used instead of aluminum. Asphalt or other flammable weathercoatings are not acceptable.

3.0 VESSELS, COLUMNS, AND HEAT EXCHANGERS

- 3.1 Block insulation shall be applied in accordance with form EF-630 and Drawing GA-N-99785. The specified thickness of insulation does not include weather coating.

- 3.2 Vertical vessels 3-ft and larger in diameter, operating below 350F may be insulated with glass or mineral wool fiber blankets. Details shall be as specified in Paragraph 4.0 below.

- 3.3 Acceptable weather coat materials are:

3.31 Asbestos cement sheet 3/16-inch thick, conforming to ASTM C-220, type F (Johns-Manville Asbestocite unless otherwise specified), applied as specified in Paragraph 4.3 below. Precurved sheets are required for diameters 10-ft and under.

3.32 Corrugated (0.016" min. thickness) or flat (0.019" min. thickness) aluminum sheet with vapor barrier (Childers or Premetco unless otherwise specified). Application shall be as specified in Paragraph 4.3.

3.33 Asphalt emulsion coatings (Chevron Asphalt Co's Laykold, or Johns-Manville Insulkote unless otherwise specified). These may be used only on block or rigid insulation where temperature of insulation surface will not exceed 175F. They shall not be applied when atmospheric precipitation or condensation may wet the finished surface within 24 hours after application.

- 3.4 Nameplates and weep-hole nipples on reinforcing pads shall not be covered.

- 3.5 Insulation for exchanger channels shall not include insulation of channel covers. Exchanger flanges shall not be insulated.

- 3.6 Each section of a double pipe exchanger shall be insulated as a single unit. Continuous insulation around a multi-sectional unit is permissible only with specific written approval by COMPANY.

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4.0 TANKS

4.1 Shell Insulation - Tank shells shall be insulated with glass or mineral wool (Owens-Corning PF-613 semi-rigid board), maximum temperature limit 350°F. The material shall have a minimum density of 3 lbs/cubic ft. Refer to Drawing GB-N99995.

4.11 Blankets shall be placed with the long dimension vertical and with vertical joints staggered. Blankets shall be secured to the tank with 14-gage galvanized wire fastened to welding studs (See 4.22 and 4.32 below) to hold blanket in place until weather coating is applied. The blanket insulation shall extend to within 12 inches of tank bottom. The space between bottom of insulation and tank bottom shall be filled with 12-inch high foam glass block. Blocks shall be held tight to tank with 14-gage 300 series stainless steel wire.

4.12 Insulation shall be fitted around nozzles, manways, and other appurtenances to allow room for bolt removal. These appurtenances shall not be insulated and weather coat shall be completely sealed with weather-proof material to prevent leakage into the insulation. Insulation around structural members supporting stairs, etc., shall be suitably weather-proofed and flashed with aluminum (16-gage minimum) or galvanized steel.

4.2 Asbestos Cement Sheet Weather Coating

4.21 Materials - Weather coating shall be 3/16-inch thick asbestos cement sheets per ASTM C-220 type F.

Threaded welding studs shall be solid type 304 austenitic stainless steel or composite with type 304 steel at exposed end and carbon steel at tank attachment end. Minimum diameter shall be 5/16 inch. Stainless steel stud nuts or aluminum caps shall be used.

All external metal on the surface of the finished asbestos cement weather coating, except flashing but including studs, stud nuts, battens and bands, shall be austenitic stainless steel. Flashing may be aluminum (16 gage minimum) or lead.

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- 4.22 Installation - The 4-ft by 8-ft asbestos cement sheets shall be oriented with the long dimension horizontal. Threaded welding studs shall be spaced between the sheets of the asbestos cement board on 2-ft vertical centers and 8-ft horizontal centers, and in addition there shall be one stud in the center of each asbestos cement board. Center studs shall be on 8-ft horizontal centers and 45-inch vertical centers. Studs shall be secured with a stud welding gun and tested with a light hammer blow to be sure the weld is sound. Asbestos cement sheets shall be drilled to fit studs snugly and mastic compound shall be used to seal the outer washer to prevent entrance of water at stud holes.

The asbestos cement sheets shall be lapped 3 inches on the horizontal joints, with the upper sheet on the outside. The upper sheet shall be supported from the lower by stainless steel "S" or "Z" clips, or by providing a supporting ledge in the batten over the vertical joint. The sheets in each row shall be placed with vertical edges not more than 2 inches apart, centered on studs, and the joint covered with 1/16-inch minimum thickness by 4-inch wide austenitic stainless steel battens secured with threaded stainless steel nuts to the studs on 2-ft vertical centers. The sheets shall be further secured by austenitic stainless steel straps, 3/4-inch wide by 0.020 inches thick placed above the studs at each 3-inch horizontal lap and the center of each sheet "on approximate 2-ft vertical centers." Straps for tanks 18-ft and larger in diameter shall be secured to heavy stainless steel spring clips. See Drg. GE-N99995 Det. "K".

Shell insulation shall be flashed with lead (minimum 2-1/2 lbs) or aluminum (16-gage minimum) to prevent moisture from entering the insulation at openings, structural connections, or at the eaves.

- 4.23 Where asbestos cement sheet weather coating is to be painted, the sheets shall be sealed on back and edges (before installation on tank) with a vinyl sealer (Amercoat 1637 unless otherwise specified).

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4.3 Aluminum Weather Coating

When aluminum weather coating is specified, the following procedures shall be used.

- 4.31 Materials - Materials shall be 1-1/4 inch or 2-1/2 inch deep corrugated aluminum sheet, 0.016 inch minimum thickness. Temper shall be 3/4 hard with copper content not exceeding 0.40%.

All attaching fixtures shall be austenitic stainless steel except: (a) sheet metal screws may be aluminum; (b) stud caps may be aluminum; and (c) studs may be composite, i.e., austenitic top and carbon steel base.

All aluminum sheets shall have a vapor barrier (Childers or Premetco) unless specified otherwise.

- 4.32 Installation - All sheets shall be lapped two corrugations on the vertical and 4 inches on horizontal seams (see drawing GB-N99995). Each sheet shall be supported horizontally by two "S" clips and shall be attached to tank by three 5/16-inch diameter welding studs (Nelson Setlok type unless otherwise specified) on each vertical seam. Studs shall be located in the crown of corrugation nearest to edge of sheet. First stud shall be 6 inches from bottom of sheet. The other two studs shall be equally spaced between bottom studs and bottom studs in next sheet above. Maximum vertical spacing between studs shall be 48 inches (12-ft sheets). Studs shall be secured with a stud welding gun and tested with a light hammer blow to be sure the weld is sound. If stud spacing exceeds 48 inches, additional equally spaced studs shall be used. In line with and spaced on center between studs shall be a 1/2-inch No. 10 sheet metal screw to assure tight contact between lapped sheets. Aluminum sheets shall be impaled on the studs using a rubber hammer. Sheets shall not be drilled.

Horizontal joints shall be fastened on 6-inch centers with gasketed, self-tapping, sheet metal screws (see drawing GB-N99995 for spacing and types of studs and screws).

Aluminum sheeting shall be held against the insulation by 0.020 inch by 3/4-inch stainless steel straps on 4-ft maximum vertical centers. Maximum length of strap without a break shall be 50 ft. Expansion springs as shown on drawing GB-N99995 shall be installed in each strap. Folded straps or

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corrugated straps or other tensioning devices having relaxation tendencies are not acceptable. Straps shall be supported with J-clips fastened to the 1/2-inch No. 10 sheet metal screws shown on drawing GB-N99995.

Weather coating shall terminate 2 inch from tank bottom. Typical details for finishing top of weather coating are shown on drawing GB-N99995.

4.4 Roof Insulation

Roof insulation shall be 12-lb Fiberglas roof deck, J-M Thermobestos unless otherwise specified, and shall be secured by impaling the blocks on welding studs spaced to provide four studs per block of insulation. Lengths of studs shall equal but not exceed the thickness of the insulation. The roof shall be finished either with 1/4-inch thick asbestos cement sheets meeting ASTM C-220, Class F, or with a mopped down 1/2-inch thick fiberboard. Joints shall be butted and topped with a built-up four layers of 15-lb asphalt saturated asbestos roofing felt.

5.0 MISCELLANEOUS EQUIPMENT

- 5.1 Pumps, turbines, and other miscellaneous equipment shall be insulated only when specified by COMPANY. Access shall be provided to pump and turbine glands and other points requiring periodic maintenance.
- 5.2 Plastic insulation, Johns-Manville No. 450 unless otherwise specified, shall be used on any surface which is not suited to block insulation, but the use of plastic insulation shall be kept to a minimum. Insulation shall be applied on clean surfaces to recommended thicknesses. If a second layer is required plastic insulation shall be allowed to set and 1-inch by 20-gage galvanized hexagonal mesh applied over the entire plastic insulation surface with butted joints laced together with No. 18 gage galvanized iron wire and secured to the insulation with 1-1/2-inch copper vine staples, placed to hold mesh snugly against the insulation. The insulation, when dry, shall be covered with weather coating per drawing GA-N99785.

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6.0 POLYURETHANE INSULATION

- 6.1 Preformed block or foamed-in-place polyurethane foam insulation may be used to insulate piping and equipment operating up to a maximum metal temperature of 180°F when specifically approved by COMPANY in writing.

Polyurethane insulation shall not be used within 25 feet of any fired heater.

- 6.11 Materials: All polyurethane insulation shall have a fire-retardant additive, and shall be classified non-burning by ASTM D-1692-59T, Test for Flammability of Plastics, Foams and Sheeting (Tentative). Insulation shall have a maximum thermal conductivity of 0.15 Btu/hr-sq.ft./F per inch at 0°F. The insulation shall have a minimum density of 2.0 lb/ft³ and a maximum density of 2.5 lb/ft³.

- 6.2 Preformed Block Application - Preformed block insulation shall be installed in accordance with paragraphs 2.0, 3.0, and 4.0 of this Specification. Polyurethane shall not be used on traced lines where the tracer metal temperature is over 180°F.

- 6.3 Foamed-in-Place Application - Polyurethane resins shall contain suitable admixtures and shall be applied in such a manner that the insulation is of the required thickness and of unicellular construction. The insulation shall consist of many small cells approximately equal in size. The polyurethane liquid shall have a 30-40 second delay before foaming takes place to allow time for the liquid to run into confined areas and hard-to-get-at locations such as around vacuum rings on vessels and large piping.

- 6.31 Application may be by gunning, by frothing, or by pouring in place, in accordance with paragraphs 2.0, 3.0, and 4.0 above.

- 6.32 All polyurethane pre-foam liquid shall be placed into forms made of 0.016 inch flat or corrugated aluminum sheets (weather coating) spaced from the vessel by polyurethane blocks. Sheets shall be sized to reduce the number of joint overlaps as much as possible. "S" clips shall be used to keep the aluminum sheets in place. The sheets shall be lapped 4 inches on both horizontal and vertical seams. The sheets shall be fastened on with stainless steel straps. All edges of the sheets shall be sealed by pop rivets or sheet metal screws at 12 inch maximum spacing.

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- 6.321 Aluminum sheeting shall be held against the insulation by 0.020 inch by 3/4-inch stainless steel straps on 4-ft maximum vertical centers. Expansion springs as shown on drawing GA-N99995 shall be installed in each strap. Folded straps, corrugated straps, or other tensioning devices having relaxation tendencies are not acceptable. Straps shall be supported with J-clips fastened to the 1/2-inch No. 10 sheet metal screws shown on drawing GA-N99995.
- 6.33 Gunning, frothing, or pouring in place shall be done so that there are essentially no voids in the insulation and in areas around stiffening rings. Any voids shall be repaired by refoaming or by installation of fitted preformed blocks glued to trimmed foam.
- 6.34 Individual pours or lifts shall be limited to 18 inches vertical rise to avoid compression of the foam.
- 6.4 Weather Coating - Banded aluminum shall be used as a weather coating for preformed block or foamed-in-place insulation. No vapor barrier is required under the weather coating.
- 6.5 Inspection - Foam density shall be checked by taking one-inch diameter core samples through the metal jacket and visually comparing the core with a polyurethane standard of known thermal conductivity. The core shall be inspected for cell size and homogeneity. The core shall be refoamed and a weather-tight patch placed over the metal jacket. Sample cores shall be taken at points indicated by COMPANY.
- 7.0 FORMS AND DRAWINGS
The following forms and drawings are a part of this Specification:
- | | |
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| EF-630 | Summary of Fireproofing and Insulation for Equipment and Piping |
| GA-N-99783 | Standard Insulation for Hot Piping |
| GA-N-99785 | Standard Insulation for Hot Vessels |
| GA-N-99995 | Standard Insulation and Weather Proofing Details |
| GB-N-99993 | Standard Insulation Item Numbers |