KAISER ENGINEERS
DIVISION OF HENRY J. KAISER COMPANY

KAISER ALUMINUM AND CHEMICAL CORPORATION
Ravenswood, West Virginia

SPECIFICATION
FOR
ALUMINUM REDUCTION PLANT - RAVENSWOOD WORKS

INSULATION FOR STEAM PIPING

No. 55105-13

March 8, 1957

ENGINEERS CONTRACTORS

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Approved for Specification Section _____

Date 3-8-57

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Chief Design Engineer

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Kaiser Engineers
Standard Specification
No. 525

GILSONITE INSULATION FOR UNDERGROUND PIPING - UP TO 520° F OPERATING TEMPERATURE

1. SCOPE

1.1 This specification describes the materials and the method of installation of processed gilsonite for insulating hot underground pipe having operating temperatures up to 520° F.

1.2 This method of insulation shall be used only on welded steel pipe or copper pipe with hard soldered connections.

2. GENERAL

2.1 Prior to placing insulation, all pipes to be insulated shall have been tested as specified, properly aligned, anchored and supported.

2.2 Where trenches are wider than required to accommodate the specified insulation envelope, form boards may be installed and removed after placing the insulation and backfilling between the trench wall and the form.

2.3 An additional 3" of insulation material shall be placed over pipes passing under streets, highways, railroads or other areas subject to heavy loading. This additional thickness shall be increased to 5" over expansion loops. In such cases, the insulating structure shall be formed and the backfill well compacted and brought to grade before construction of pavement.

2.4 Where insulation is placed against manhole or building walls, the annular space between the pipe and the sleeve in the wall shall be packed with lead or asbestos pipe caulking.

2.5 Trench walls need not be dry during the placing of insulation; however, all water in the trench shall be removed prior to placing the insulation and trenches shall be kept unwatered until after the curing of the insulation structure.

5.2 Pipe guides permitting free movement of the pipe shall be placed near the ends of straight runs where the pipes enter expansion loops and outside the manholes and building walls where pipes enter bellows or slip type expansion joints.

5.3 Anchors shall be as indicated on the design drawings.

6. PLACING

6.1 No earth or other material shall be mixed with the gilsonite either before or during the placing.

6.2 The insulation shall be poured directly from the shipping container into the trench, filling under and up to mid-diameter of the pipe. Insulation shall then be worked under and around the pipe completely filling all voids. Additional insulation shall be added to cover the pipe to the specified depth and then tamped with an 8" x 8" square tamp weighing approximately 10 lbs. The entire surface shall be covered in the tamping operation. One 10" stroke of the tamper shall be applied to each 8" x 8" square.

6.3 Where pipe expansion is accommodated by loops or offsets, 5 extra inches of insulation thickness in addition to the specified envelope shall be placed on the side of each leg of the loop in the direction of the expansion.

7. FORMING THE INSULATING STRUCTURE

7.1 When the insulation is placed below ground water table or during inclement weather the insulating structure shall be formed before backfilling, otherwise it can be formed satisfactorily after backfilling.

7.2 The insulating structure shall be formed by the application of heat for the times and at the curing temperatures listed in Table II. The sections being cured shall be raised to the curing temperatures in a maximum of 12 hours. When the curing temperature is reached, the curing shall be continuous for the times and at the temperatures listed.

EXHIBIT "A"

SPECIFICATION
FOR
ALUMINUM REDUCTION PLANT - RAVENSWOOD WORKS

INSULATION FOR STEAM PIPING

1. GENERAL REQUIREMENTS - The requirements of this specification shall be applicable to the insulation for all steam piping for the Reduction Plant unless otherwise particularly specified or indicated on the drawings.

2. KAISER ENGINEERS STANDARD SPECIFICATIONS

The following Standard Specifications are referred to herein and by such references made a part hereof. Where conflict occurs between the Standard Specifications and the drawings, the drawings shall govern.

No.	Title
522	Thermal Pipe Insulation (Above ground)
523	Aluminum Jacketing for Insulated Piping
525	Gilsonite Insulation for Underground Piping

3. ABOVE GROUND STEAM PIPING - including piping located in open trenches, shall be insulated in accordance with Standard Specification No. 522, as modified by the drawings and this specification.

3.1 Alternate jacketing - Where directed by the Owner, Protective Finishes specified by Standard Specification No. 522 shall not be furnished and the above ground piping shall be protected with aluminum jacketing in accordance with Standard Specification No. 523.

4. UNDERGROUND STEAM PIPING - shall be insulated in accordance with Standard Specification No. 525. Installation shall be in accordance with "Gilsulate Installation Instructions" and particular job recommendations of the manufacturer's field engineer. This publication and service are available from: American Gilsonite Company
1145 East Jersey Street
Elizabeth 4, New Jersey

Kaiser Engineers
Standard Specification
No. 522

THERMAL PIPE INSULATION (Above Ground)

1. SCOPE

1.1 This specification covers the requirements for acceptable materials thicknesses and methods of application for external thermal insulation of above-ground piping.

1.2 Protective coatings are included herein.

2. GENERAL

2.1 Where brands or trade names appear in this specification, it is for the purpose of identifying insulation type, quality and class.

2.2 Unless the project specification or drawings indicate otherwise, the insulation shall be preformed pipe insulation and blocks as required of 85% magnesia, hydrous calcium silicate, mineral wool or other approved standard material meeting the maximum heat loss and total thickness limitations set out in Tables I and II which are reproductions of Kaiser Engineers Standard Material Specification No. P-INS-1. Proposals shall state the type and thickness proposed for each pipe size and service.

2.2.1 Pipe insulation shall conform to the following:

ASTM C320	85% Magnesia Moulded Type Thermal Insulation for Pipes
MIL-I-2781B	Insulation Pipe Covering, Thermal Grade III, Type I
ASTM C281	Mineral Wool Moulded Type Pipe Insulation for Elevated Temperatures

2.3 Unless otherwise specified, surfaces below 200° F shall not be insulated.

2.4 Valves and flanges shall be insulated only where specified.

2.5 Steam trap, drip leg, and condensate piping shall be insulated only where specified.

2.6 Vertical piping 6" and larger in lengths over 35' shall be provided with insulation supports at 10' intervals. These supports shall be located at least one bolt length from adjoining flanges.

4. PIPE INSULATION - APPLICATION

4.1 Insulation -

4.1.1 When insulation is specified for valves and flanges, it shall be applied in the following manner.

4.1.1.1 For piping smaller than 4" diameter - Valves and flanges shall be covered with insulating cement in two or more layers (each 1/2" thick) bringing the total thickness to that of the insulation of the adjacent piping. Permit each layer to dry before applying the next.

4.1.1.2 For piping 4" diameter and larger - The bodies of valves and flanges shall be insulated with block or pipe insulation of the same material as the insulation on the adjacent piping, but 1/2" less in thickness. This insulation must be carefully fitted and firmly wired in place with annealed wire. Loop the wire as many times as necessary to make the blocks secure. Apply two 1/4" coats of finishing cement over the insulation, allowing the first coat to dry before the second is applied.

4.1.1.3 Flanges (not on valves) requiring insulation shall be covered and finished in the same manner as described in paragraph 4.1.1.2 above. The flange insulation shall extend not less than 2" over the adjacent pipe insulation on each side of the flange. The annular space between the pipe and flange insulation shall be filled with insulating material. Flange insulation shall be applied in such a manner that it can be removed without damage to the adjacent pipe insulation.

4.1.2 Pipe insulation shall be fitted to the pipe and held in place with tie wires. For 6" pipe and below, use three loops per each 36" section of pipe covering. For over 6" pipe, use four loops per each 36" section of covering.

4.1.3 Where bands are required, at least four shall be used for each 36" section of insulation. For multiple layers of insulation, stagger both longitudinal and circumferential joints and wire or band each layer separately.

4.1.4 The ends of the loops of wire shall be tightly twisted together and bent over and hammered into the insulation so as to leave no projection.

4.1.5 Insulation shall be terminated and beveled at a sufficient distance from flanges to permit free removal of bolts where flanges are not insulated.

4.1.6 Any irregular or wide openings in joints shall be packed with insulating material.

4.2 Protective finishes -

TABLE I (K. E. Standard Material Specification No. P-INS-1)

MAXIMUM NOMINAL INSULATION THICKNESSES IN INCHES

Nominal Pipe Size	△T = Temperature Difference Between Pipe and Still Air - °F																
	25	75	125	175	225	275	325	375	425	475	525	625	725	825	925	1025	1125
1½" & Under	1	1	1	1	1	1	1	1½	1½	2	2	2½	2½	3	3	3½	3½
2"						1½	1½					3	3	3½	3½		
2½"								2	2							4	4
3"																	
4"				1½	1½	2	2			2½	2½					4	4½
5"						2½	2½	2½	2½				3½	4	4½	4½	5
6"	1½	1½	1½														
8"						3	3	3	3	3	3					5	
10"				2	2							3½	4				
12"														4½			5½
14"										3½	3½						
16"																	
18"																	

NOTES:

1. Nominal thicknesses in table above shall not be exceeded by more than 3/16".

Kaiser Engineers
Standard Specification
No. 523

ALUMINUM JACKETING FOR INSULATED PIPING

HAVING AN INSULATION O.D. LESS THAN 36 INCHES

1. SCOPE

1.1 Scope - This specification covers the quality and type of materials and the general requirements for the fabrication and installation of aluminum jackets as finishing over insulated piping and fittings which have an insulation o.d. smaller than 36 inches. Unless otherwise indicated or specified, jackets and fittings may be formed either in the shop or in the field.

2. MATERIALS

2.1 Pipe jacketing material shall be 5005-H16 Kaiser Aluminum sheet or approved equal supplied in 36" wide coiled form. Thicknesses shall be 0.020" for insulation o.d. 12.75" and smaller and 0.024" for insulation o.d. larger than 12.75" and smaller than 36". Aluminum shall be supplied in plain finish.

2.2 Jackets for pipe fittings - Material for L's, T's, reducers, expansion joints, valves, flanges, gored loops and large bends shall be the same as specified for pipe jackets. However, where lock seams are required aluminum shall be furnished in H-14 temper.

2.2.1 Spiral wrapped loops and large bends - Material shall be 5005-H16 aluminum sheet supplied in minimum 2" wide coils, 0.020" thick, plain finish.

2.3 Sheet metal screws shall be Type A, #7 x 1/2" self-tapping, pan head, 6061-T6 alloy or anodized 2024 aluminum; or Type 18-8 or 410 stainless steel, Type B, #14 hex head. For outdoor service, all screws shall be furnished with neoprene washers attached. Aluminum screws shall be used for fastening aluminum sheet to aluminum sheet; stainless steel screws shall be used for fastening aluminum sheet to steel.

2.4 Bands and seals may be slit from the same aluminum sheet used for pipe jackets or they may be purchased as standard stock items. Bands slit from coils shall be de-burred by rolling edges.

2.4.1 For pipe insulation o.d. 12.75" and smaller, bands shall be 1/2" wide x 0.020" thick, equal to A. J. Gerrard Co. No. 305-AL; seals shall be equal to A. J. Gerrard Co. No. 202-AL.

3.2.1 Elbows - All pre-fabricated elbow jackets shall be made by hammering, spinning or stamping aluminum of thickness equal to or greater than adjacent pipe jacketing. Jackets shall be furnished in half-sections and fastened with the bands and seals used on pipe jacketing or with aluminum screws as required. Where butt joints exist, they shall be flashed with aluminum strips or with fire-retardant aluminum pigmented mastic reinforced with knitted glass tape. Jackets shall not be applied until mastic is dry.

3.2.1.1 Field alternate - Elbow jackets shall be made of individual strips or gores cut from the same sheet used for pipe jacketing. Gores shall be wrapped around insulated elbow allowing a minimum lap of one inch with adjacent jacketing and with each other. All laps shall be placed in weatherwise fashion. Gores shall be fastened with at least one aluminum screw through each lap. After cutting, and before wrapping, the center area of the gores may be bumped to obtain slight concave curvature needed to fit curves of elbows.

Spiral wrapped jackets may be applied over long radius bends. A coiled strip 2" or more wide shall be wrapped around the insulation and lapped 1" at each turn. One or more aluminum screws shall be used at each turn. For weatherproofing, a thick coating of fire-retardant aluminum pigmented mastic shall be applied over insulation just prior to wrapping.

3.2.2 Tees - All tees shall be jacketed in the same manner as adjacent piping. Open area in jacket at cutout for branch leg shall be weatherproofed as follows:

> A heavy tack coat of fire-retardant aluminum pigmented mastic shall be trowelled or palmed over insulation and extended over aluminum edges at least 1". Knitted glass tape of convenient width shall be stretched over the tack coat and smoothly embedded into it. Mastic shall be trowelled over the tape to a minimum thickness of 1/8".

3.2.3 Flanges and bellows type expansion joints - All jackets shall be pre-fabricated from 0.024" thick aluminum sheet and supplied in two half-cylinder sections. Side laps shall be 1-1/2" to 2". Ends shall be closed and jointed to cylindrical wall with lock seam or brazing.

A 3"-wide flange shall be attached to end pieces by lock seam or brazing and shall be lapped weatherwise with adjacent pipe jacketing. Expansion joint jackets shall be of sufficient length, and bands shall be of proper tension, to permit full movement of bellows.

Jackets may be made so that the insulation will be exposed when the jacket is removed; or, the insulation may be fastened to the jacket so that the flanges are exposed when the jacket is removed.

4.4 Galvanic corrosion (dissimilar metals) - Aluminum contact with copper or copper alloys, tin, lead, nickel or monel specifically shall be avoided. When aluminum is to be attached to or in direct contact with steel where moisture may be expected, the steel shall be primed with zinc chromate and painted with aluminum paint. Lead base paints shall not be used .

4.5 Dry insulation - When any insulating material (85% magnesia, calcium silicates, asbestos fibers, fibrous glass, cellular plastic, mineral wool, cork, hair or wool felt) is dry, aluminum may be applied directly to the surface.

4.6 Wet insulation - Wherever corrosion problems may be created by prolonged contact between aluminum and wet insulation, aluminum manufacturer's representatives shall be consulted to determine whether an installation method which would completely break contact between the aluminum jacketing and the wet insulation is justified.

4.7 Storage of aluminum - Aluminum that is not to be applied immediately should always be stored in a clean, dry place. Wherever possible, coils should be stored on edge.