APPROVED BY C & CCC
January 9, 1953

THE LUMMUS COMPANY

Job 3215
Rev. (1) January 13, 195
Rev. (4) November 9, 195

PLAINTIFF'S EXHIBIT
UC-4916

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SPECIFICATION
FOR
INSULATION
ITEM L

Rev. (1) January 13, 1953 Page 4

Rev. (4) November 9, 1953 - Hot Insulation
Pages 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12.
Add Pages 13, 14, 15, 16.
Add Drawings C3215-480-1 & C3215-486-2
Note: Page Nos. 7a, 8, 9, 10, and 11 were changed to 8, 9, 10, 11, and 12.

Cold Insulation
Page 1, 2

The Lummus Company
385 Madison Avenue
New York, 17, New York

ITEM L - INSULATION - HOT - Page 1

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A. GENERAL

1. Scope

a. Complete hot insulation for vessels, equipment and piping shall be furnished and installed in strict accordance with this specification and shall include and be limited to the materials, thicknesses, surfaces to be insulated, temperature and other limitations, weather-proofing or other covering, application, etc., all as specified below either in the written matter, in the tables which forms a part of this specification, or the Drawings referred to herein which also form a part of this specification.

b. All insulation materials whether wet or dry, shall be non-corrosive to the surfaces insulated and to galvanized or aluminum metal jacketing. Plastic insulating cement shall, of itself, be non-corrosive whether wet or dry.

c. In all cases where a device, part, item or material is herein referred to in the singular, it is intended and shall be understood that such reference shall apply to as many such devices, parts, items or materials as are required for the complete installation.

d. The insulation contractor shall furnish, deliver and apply all material and provide all labor, transportation, tools, apparatus and scaffolding for the proper execution of the work. He shall furnish such buildings as he may need for storage of materials, etc. on site provided by others, do all unloading and handling and shall furnish a competent superintendent experienced in this class of work. He shall start work on the various vessels, items of equipment, pipe lines, etc. promptly upon notification by the construction contractor to do so.

e. The insulation contractor shall at all times assume full responsibility for the complete protection of his property and for damage to the property of others caused by his work, including, but not limited to, the protection of adjacent equipment, pavements, etc. from dripping or sprayed paints, asphalts, compounds, cements, etc. used by him and he shall clean up and repair, or cause to be repaired at his expense any damage due to failure of his protective measures. He shall not be responsible for completed insulation removed or damaged by others.

f. After the work covered by this specification has been completed, the insulation contractor shall remove from the premises all of his property, including buildings, scaffolding, etc., and all rubbish, debris, etc. resulting from his work and shall leave the premises in a condition satisfactory to the Purchaser and the construction contractor insofar as his work is concerned. Also, during construction, the insulation contractor shall clean up his debris and clean the site of his refuse periodically to the satisfaction of the construction contractor.

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A. GENERAL

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1. Scope - (cont'd.)

g. Insulation for fire protection is not included in this section of the specifications. For fireproofing and fire protection items, see Item MA of these General Mechanical Specifications.

h. Any change in or variation from these specifications or the included Table or Drawings shall be considered a change in the scope of the work and shall be made only after mutual agreement and written permission or written instructions from Purchaser to Lummus.

The entrie job shall be executed in accordance with the best practice for this class of work and shall present a neat and workmanlike appearance.

i. The insulation contractor shall properly clean all surfaces to be insulated by him immediately prior to the application of his insulation so that the surface is clean at the time of application.

B. GENERAL - VESSELS, EQUIPMENT AND PIPING

1. Insulation shall be supplied, applied and weatherproofed in accordance with the following specifications.

2. All towers, tanks, heat exchange equipment, and piping which require insulation for the conservation of heat essential to the process, for special operating conditions, for the reduction of steam losses or for personnel protection shall be insulated.

3. Conservation insulation for equipment and piping shall start at 200°F (93°C).

3a. Equipment or piping operating at temperatures above 180°F and below 6'-0" elevation from grade or so located that the operating personnel might come in contact with it and be burned in the normal course of their duties shall be insulated for personnel protection. This type of insulation is not to be continued beyond normal working locations. Where these specifications call for particular items to remain uninsulated, such as tower manways, etc., they shall not be insulated regardless of location.

4. Unless so specified above, vessels, piping and other equipment shall remain uninsulated.

5. The insulation contractor shall supply all insulation and application materials and apply them in accordance with the following specifications.

6. Where insulation joints occur, they shall be staggered. This applies to both vertical and horizontal joints.

7. Insulation shall be applied to curved surfaces by curfing. Any small voids in the insulation either at joints or elsewhere shall be filled with powerhouse cement, in the case of block, sectional or segmental insulation.

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B. GENERAL - VESSELS, EQUIPMENT AND PIPING - (Cont'd.)

If large voids occur which may be considered defects either in the insulation or its application, filling with powerhouse cement will not be acceptable. Instead, the defective insulation shall be removed and replaced with acceptable insulation.

8, Manhole and handhole covers, flanges and nozzles on vessel are not to be insulated, and the shell insulation shall be beveled back from the necks of manholes and nozzles to permit easy removal of studs and nuts. Insulation shall likewise be beveled back at test plugs.

9. Insulation shall not be applied to any vessel or to any item of equipment or piping which is to be hydrostatically tested until the hydrostatic testing of such vessel or item has been successfully completed.

10. Nameplates, on vessels or equipment shall be left permanently visible by means of brackets and extension clips shown on C & CC Standard EQ-15 which provides means of mounting the nameplate outside the insulation.

11. Pipe flanges, valves and fittings on all lines shall be insulated.

12. Piping shall be insulated in accordance with the "Piping Insulation Schedules."

13. Vessel nozzles may be lengthened to 9" maximum where thick insulation requires extending the nozzle to clear the insulation.

14. When a vessel shell is reinforced by the manufacturer or as indicated on Lummus Drawing No. E3215-232, Shell Reinforcement Details for Columns, the thickness of insulation at the reinforced section shall be increased, if necessary, to cover the reinforcing members.

15. Connections between the jackets of steam jacketed pipe shall not be insulated.

C. BLOCK INSULATION - VESSELS AND EQUIPMENT

1. Materials

a. Block insulation shall be Kaylo block where required.

b. The blocks shall be furnished in 36" lengths.

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C. BLOCK INSULATION - VESSELS AND EQUIPMENT - (Cont'd.)

2. Application

a. On vertical tanks the block insulation shall be supported on an angle iron ring spot welded to the shell at the lower tangent line. The support angle and clips shall be installed as shown on C & CCC Standard EQ-17.

b. On towers and exchangers the flanges are not to be covered and the blocks are to be applied to each section between flanges. The blocks to extend to 1/2" from flange bolts and to be beveled on a 45° angle at each flange.

c. The insulation blocks shall be held against the shell of equipment by stainless steel band irons, 3/4" wide, spaced on 12" centers applied over the insulation. Application of these band irons shall be over the exterior layer of insulation blocks when two or more layers are applied. These band irons shall be tightened by mechanical stretch tighteners at 10 foot or less intervals on the circumference and secured with seals 3/4" long.

d. Anchors of 3/8" diameter pencil rod in the form of rings of sufficient diameter to pass over the nozzles in the center of the dished or elliptical heads shall be provided for the anchorage of the stainless steel band irons on the dished or elliptical heads. A ring angle may be substituted for the pencil rod or similar approved equal may be used.

e. All seams shall be pointed with powerhouse cement as block application proceeds.

3. Weatherproofing - Vessels and Equipment

After bands have been applied as described in "c" above, and the insulation has become thoroughly dry, it shall be weatherproofed by the application of a coat of Insul-Mastic #4010, covered with Glas-Phalt and a final sprayed coat of Insul-Mastic #4010 over the Glas-Phalt applied to manufacturers specifications.

The weatherproofing of towers and exchangers shall extend down the 45° beveled ends to the metal of the shell.

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C. BLOCK INSULATION - VESSELS AND EQUIPMENT - (Cont'd.)

4. Expansion Joints

a. An expansion joint not less than 1" wide, packed with twisted glass woolfilling material, shall be provided under the upper cover ring.

b. No other expansion joints will be required on vessels.

5. Insulation Thickness

Service	Thickness of Kaylo
Personnel Protection (180°F and above) 82°C	1"
(200°F - 219°F) 93°C - 103°C - Conservation	1"
(220°F - 400°F) 104°C - 204°C - Conservation	1 1/2"
(401°F - 500°F) 205°C - 260°C - Conservation	2"
(501°F - 650°F) 261°C - 343°C - Conservation	2 1/2"

6. Pipe Connections on Towers, Tanks and Exchangers

Where pipe connections occur on towers, tanks and exchangers, the insulation block shall be cut out to fit around the pipes, any space between insulation block and pipe connection pointed with powerhouse cement.

D. PIPING

1. Segmental Insulation - Piping

a. Materials

(1) Unibestos Pipe Insulation shall be used for steam traced pipe lines. All other insulated pipe lines shall be covered with K Insulation.

(2) Insulation shall be sectional for pipe sizes 10" and smaller and segmental for sizes 12" and larger.

b. Application

(1) Single Layer Insulation

(a) The sectional pipe covering shall be applied with ends tightly butted together and the joints properly "Pointed Up" with powerhouse cement.

(b) All joints, whether circumferential or longitudinal shall so arranged that they are broken or staggered as far as possible.

(c) Pipe, 10" and smaller, insulation shall be wired in place #16 gauge Monel wire ties. Ties shall be single loops a the insulation and the ends shall (h

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D. PIPING

1. Segemental Insulation - Piping - (Cont'd.)

b. Application

(1) Single Layer Insulation

(c) be securely twisted together. Surplus wire shall be cut off and ends imbedded in the insulation in order to present a smooth surface for subsequent weatherproofing. Wire ties shall be spaced on not greater than 12" on centers.

On pipe over 10", insulation shall be held in place with 1/2" stainless steel bands.

(d) Where necessary, pointing shall be done with powerhouse cement.

(2) Valves, fittings and flanges on insulated lines shall be boxed in with segmental covering fitted over the flanges and any space between the pipe covering and flange covering shall be filled with segmental covering of proper size or with powerhouse cement A 4" long section shall be cut in the pipe covering at each flang for easy removal to permit withdrawal of flange bolts. On valve bonnets the segmental covering shall be used where possible and flat block insulation cut to fit flat surfaces. Where not practical to use solid insulation, cover valve bonnet or elbow with powerhouse cement.

(3) Steam Traced Lines

(a) Traced lines shall be insulated over the line and tracer by means of pipe insulation of proper size to fit the line and tracer pipe.

(b) The inside diameter of insulation for steam traced lines shall be in accordance with Lummus Dwgs. C3215-486 and C3215-480. For thickness of insulation see Piping & Insulation Schedules.

c. Insulation Thickness

(1) Insulation thickness shall be in accordance with attached table of thicknesses.

d. Jacketing

(1) Piping shall be weatherproofed by a coat of Insul-Mastic #4010, applied on either the Kaylo or Unibestos pipe covering, and wrapped with Glas-Phalt and the Glas-Phalt spray covered with Insul-Mastic #4010 applied to manufacturers specifications

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D. PIPING

1. Segmental Insulation - Piping

d. Jacketing - (cont'd.)

(2) Piping in locations where there is a possibility of injury to insulation from walking on lines or from severe service, shall be jacketed with flat sheet iron galvanized, #26 BWG, on straight runs.

TABLE I
PERMANENTLY HOT PIPE SURFACES
Insulation Thickness for Limiting Temperatures
(For Insulation Thickness of Special Lines see Page 8) (4)

Group	I	II	III	IV
Pipe Size		For Conservation of Heat		
	Protection (Over 180°F) Over 82°C	(200 - 300°F) 93°C-149°C	(301 - 500°F) 150°C - 260°C	(501 - 650°F) 261 - 343°C
1/2"	1"	1"	1"	1½"
3/4"	"	"	1½"	"
1"	"	"	"	"
1½"	"	"	"	2"
2"	"	"	"	"
2½"	"	"	1½"	"
3"	"	"	"	"
4"	"	"	"	"
6"	"	"	"	2"
8"	1½"	1½"	"	"
10"	"	"	"	"
12"	"	"	1½"	"
14"	"	"	"	"
16"	"	"	"	"
18"	"	"	"	"

NOTE: All pipe leads carrying 75 PSI or 200 PSI steam from the steam header to the tracer of steam traced pipe lines shall receive a (1") one inch thickness of insulation.

Union Carbide trial exhibit UC-4916: Lummus Company Specification for Hot and Cold Insulation (Item L, Job 3215...
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JJM:ms D. PIPING - cont'd.

Insulation Thickness For Special Pipe Lines

Pipe Line Designation	Pipe Size	Insulation Thickness	
P-106	14"	4"	
P-107	14"	4"	
P-118	18"	4"	
P-203,204	16"	4"	(4)
P-240, PP299	18"	4"	(4)
P-241	18"	4"	
P-309	18"	4"	
P-310	18"	4"	
P-311	18"	4"	
P-404	8"	6"	
P-405	8"	6"	
P-712	10"	4"	
P-713	10"	4"	
P-809	6"	4"	
P-1007	16"	4"	
P-1008	16"	4"	
P-1103	12"	4"	
P-1221	6"	4"	
P-1412	16"	4"	
P-1413	16"	4"	
P-1509	16"	4"	
PP-1502	16"	4"	
P-1635	10"	6"	
P-1636	10"	6"	
P-1637	10"	6"	

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TABLE NO. II

EQUIPMENT INSULATION

(4)

Kaylo for temperatures 10°C to 343°C. (50°F to 650°F)
Foamglas for temperatures - 18°C to 9°C (0°F to 49°F).
Equipment not listed does not require insulation.
For application of Foamglas see Cold Insulation following this table.
All items are insulated for conservation of heat unless otherwise noted.

Towers and Vessels

Number	Name	Temp. °C	Insul. Thickness	Top Support Req'd.	Remarks
AL-101	Anhydrous Reactor	200	1½"	Yes	
AL-102	Reactor Column	200	1½"	No	
AL-104	Decanter	50	1"	No	
AL-105	Wetted Reactor	200	1½"	Yes	
AL-106A	Seal Pot	100	1"	No	Prevent Freezing
AL-122	Storage Tank	150	1½"	No	
AL-133	Condenser Seal Tank	100	1"	No	Protection
AL-201	Anhydrous Reactor	300	2½"	Yes	
AL-201F	Charge Pot	200	1½"	No	Steam Traced for 25°C.
AL-202	Reactor Column	300 to 160	2½"	No	
AL-204	Decanter	150	1½"	No	
AL-205A	Seal Pot	100	1"	No	Prevent Freezing
AL-208	Wetted Reactor	160	1½"	Yes	
AL-209	Column	200	1½"	No	
AL-211	Decanter	150	1"	No	Protection
AL-212A	Seal Pot	100	1"	No	Prevent Freezing
AL-218	Still Receiver	160	1½"	No	
AL-259	Condenser Seal Tank	150	1½"	No	
AL-260	Condenser Seal Tank	150	1"	No	Protection
*AL-301	Reactor	5 to 200	2"	Yes	Foamglas
*AL-302	Reactor	5 to 200	2"	Yes	Foamglas
AL-303	Column	200	1½"	No	
AL-304B	Condenser Seal Tank	150	1"	No	Protection
AL-305	Decanter	50	1"	No	
AL-306A	Seal Pot	100	1"	No	Prevent Freezing
AL-327	Slurry Tank	100	1"	No	Heating Coil-Protecti
*AL-401	Reactor	5 to 200	2"	Yes	Foamglas
*AL-402	Reactor	5 to 200	2"	Yes	Foamglas
AL-405	Decanter	5 to 100	1½"	No	Foamglas
AL-406A	Seal Pot	100	1"	No	Prevent Freezing
AL-415	Decanter	50	1"	No	
AL-422	Mixing Tank	160	1½"	Yes	
AL-423	Mixing Tank	160	1½"	Yes	
AL-426	Discharge Trap	110	1"	No	Protection

* These vessels shall have a 1" thick blanket of Fiberglas Areocor stretched to ½" thick around the vessel shell prior to applying the 2" thick Foamglas.

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TABLE NO. II - cont'd

Tower and Vessels

Number	Name	Temp. °C	Insul. Thickness	Top Support Req	Remarks
AL-428	Cone Bottom Tank	100	1"	No	Heating Coil
AL-429	Cone Bottom Tank	100	1"	No	Heating Coil
AL-430	Cone Bottom Tank	100	1"	No	Heating Coil
AL-431	Cone Bottom Tank	100	1"	No	Heating Coil
AL-502	Chlorine Vaporizer	160	1½"	No	
AL-503	Reactor-Mixer	5	1½"	No	Foamglas
AL-504	Scrubber	5	2"	No	Foamglas
AL-506	Decanter	25	1"	No	
AL-507	Stripping Still Kettle	100-170	1½"	No	
AL-515	Recycle Tank	30	1"	No	
AL-520	Expansion Chamber	130	1½"	NO	Steam Traced
AL-525	Expansion Chamber	130	1½"	NO	Steam Traced
AL-535	Overflow Tank	25-110	1½"	No	
AL-605	Wash Tank	100	1"	No	Protection
AL-606	Tank	100	1"	No	
AL-616	Tank	40	1"	No	
AL-701	Batch Kettle	160	1½"	Yes	
AL-702	Column	160	1½"	No	
AL-707	Decanter	50	1"	No	Prevent Freezing
AL-708	Seal Pot	100	1"	No	Prevent Freezing
AL-716	Melting Pot	180	1½"	No	
AL-717	Condenser Seal Tank	150	1½"	No	
AL-734	Entrainment Separator	110	1"	No	Protection
AL-736	Melting Pot	180	1½"	No	
AL-801	Reactor	160	1½"	No	
AL-802	Column	160	1½"	No	
AL-804	Decanter	40	1"	No	
AL-815	Storage Tank	100	1"	No	Jacketed
AL-844	Condenser Seal Tank	150	1½"	No	
AL-902	Soaking Tank	25	2"	No	Foamglas Water Traced
AL-903	Decanter	25	2"	No	Foamglas Water Traced
AL-908	Reactor	105	1½"	No	
AL-908C	Charge Pot	110	1"	No	Steam Traced for 20°C.
AL-923	Surge Tank	25	2"	No	Foamglas-Water Traced
AL-924	Wash Tank	15	2"	No	Foamglas-Cooling Coil
AL-932	Receiver	50	1"	No	Steam Traced for 20°C.
AL-943	Receiver	28	1"	No	
AL-1001	Batch Kettle	200	1½"	Yes	
AL-1001C	Catalyst Lock	200	1½"	No	Steam Traced for 25°C.
AL-1002	Column	160	1½"	No	
AL-1003B	Condenser Seal Tank	150	1½"	No	
AL-1004D	Entrainment Separator	100	1"	No	Protection
AL-1006A	Seal Pot	100	1"	No	Prevent Freezing

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ITEM L - INSULATION - HOT AND COLD - Page 11

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TABLE NO. II - (cont'd.)

Towers and Vessels

Number	Name	Temp. °C	Insul. Thickness	Top Support Req'd.	Remarks
AL-1009	Decanter	50	1"	No	
AL-1101	Kettle	235	2"	Yes	
AL-1102	Column	180-235	2"	No	
AL-1107	Seal Tank	150	1"	No	Protection
AL-1115A	Seal Pot	100	1"	No	Prevent Freezing
AL-1141	Entrainment Separator	110	1"	No	Protection
AL-1201	Reactor	200	1½"	Yes	
AL-1202	Column	180	1½"	No	
AL-1204	Decanter	40	1"	No	
AL-1206A	Seal Pot	100	1"	No	Prevent Freezing
AL-1243	Seal Tank	150	1"	No	Protection
AL-1301	Reaction Column	89	1"	No	
AL-1305	Water Layer Still	92	1"	No	
AL-1401	Batch Kettle	250	2"	Yes	
AL-1401A	Catalyst Tank	100	1"	No	Steam Traced for 25°C.
AL-1402	Column	250	2"	No	
AL-1413	Decanter	50	1"	No	
AL-1416	Batch Column Receiver	100	1"	No	Heating Coil
AL-1423	Seal Pot	100	1"	No	Prevent Freezing
AL-1432	Seal Tank	150	1½"	No	
AL-1501	Kettle	160	1½"	Yes	
AL-1502	Column	200	1½"	No	
AL-1513	Decanter	50	1"	No	
AL-1514	Storage	100	1"	No	Heating Coil
AL-1523	Seal Pot	100	1"	No	Prevent Freezing
AL-1532	Condenser Seal Tank	150	1½"	No	
AL-1562	Entrainment Separator	100	1"	No	Protection
AL-1601	Evaporator	325	2½"	No	
AL-1602	Column	250	2"	No	
AL-1609	Seal Pot	100	1"	No	Prevent Freezing
AL-1613	Tar	130	1½"	No	Heating Coil
AL-1629	Residue	100-240	1"	No	Prevent Freezing
AL-1636	Seal Tank	150	1"	No	Protection
AL-1701	Evaporator	5	2"	No	Foamglas
AL-1715	Condensate Tank	130	1½"	No	
AL-1721	Separator	130	1½"	No	
AL-1801	Entrainment Separator	160	1½"	No	
GRI-1701	Dryer	200	1½"	No	
GRI-1707	Chlorine Storage	5	2"	No	Foamglas

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TABLE II - (cont'd.)

Heat Exchangers

Number	Name	Temp. °C	Insulation Thickness	Remarks
AL-103	Condenser	160	1½"	
AL-203	Condenser	260	2½"	
AL-210	Condenser	160	1½"	
AL-234	Calandria	325	2½"	
AL-293	Cooler	110-300	1"	Protection
AL-304	Condenser	160	1½"	
AL-403	Condenser	100	1"	Bottom Head Only-Freezing
AL-427	After Cooler	110	1"	Protection
AL-505	Water Cooler	30-5	2"	Foamglas-Heads Only
AL-524	Chlorine Cooler	5	2"	Foamglas
AL-602	Condenser	65-5	2"	Foamglas-Shell only
AL-603	Condenser	100	1"	Protection-Top Head only
AL-703	Condenser	160	1½"	
AL-704	Calandria	170	1½"	
AL-901	Reactor Cooler	5	2"	Foamglas-Shell only
AL-941	Evaporator	70	1"	Steam Traced for 70°C.
AL-942	Heater	160	1½"	
AL-1003	Condenser	160	1½"	
AL-1004	Calandria	170	1½"	
AL-1101A	Calandria	235	2"	
AL-1103	Condenser	180	2"	
AL-1106	Heater	160	1½"	
AL-1302	Calandria	159	1½"	
AL-1403	Condenser	250	2"	
AL-1404	Calandria	200	1½"	
AL-1424	Cooler	9 to 110	1"	Protection
AL-1425	Calandria	325	2½"	
AL-1503	Condenser	200	1½"	
AL-1504	Calandria	200	1½"	
AL-1602A	Condenser	250	2"	
AL-1603	Calandria	325	2½"	
AL-1604	Residue Cooler	20 to 300	1"	Protection
AL-1628	Preheater	200	1½"	
AL-1711	Condenser	130	1"	Protection-Heads only
AL-1727	Water Coolers	130	1"	Protection-Heads only
AL-1836	Desuperheater	165-280	1½"	Shell-10" Pipe

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TABLE NO. II - (Continued)

Pumps

Number	Name	Temp. °C.	Insulation Thickness	Remarks
AL-189	Transfer Pump	70	1"	* A, B, C
AL-225	Circulating Pump	300	1"	* B, C T & I to 150°C
AL-236	Condensate Pump	5 to 150	1"	* A, B, C
AL-298	Transfer Pump	5 to 150	1"	* A, B, C
AL-915	Feed Pump	50 to 100	1"	Steam Trace for 40°C
AL-1410	Transfer Pump	70 to 100	1"	* A, B, C
AL-1462	Condensate Pump	5 to 150	1"	* A, B, C
AL-1465	Circulating Pump	300	1"	* C, Steam Trace for 70°C
AL-1466	Residue Pump	100 to 200	1"	* C, Steam Trace for 70°C
AL-1467	Transfer Pump	5 to 100	1"	* C, Steam Trace for 70°C
AL-207	Residue Pump	5 to 150	1"	T & I to 120°C

Steam Jacketed Steam Jet Ejectors (First stage Only)

AL-106	Steam Jet Ejector	150	1"	Protection
AL-205	" " "	"	1"	"
AL-212	" " "	"	1"	"
AL-306	" " "	"	1"	"
AL-406	" " "	"	1"	"
AL-1006	" " "	"	1"	"
AL-1115	" " "	"	1"	"
AL-1206	" " "	"	1"	"
AL-1406	" " "	"	1"	"
AL-1506	" " "	"	1"	"
AL-1612	" " "	"	1"	"

* Note: A - Insulate Steam Jacket on Casing
B - Insulate Steam Jacket on Suction Cover
C - Insulate Steam Jacket on Stuffing Box

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ITEM L - INSULATION - HOT - Page 14

JJ. Ar Instruments

Number	Description	Refer to Inst. Spec. HF-630 Sheet No.	Insulation Thickness	Remarks
AL-257A	Transmitter	66	1"	T&I - 120°C
AL-729A	Transmitter	66	1"	T&I - 20°C
AL-730A	Transmitter	66	1"	T&I - 20°C
AL-741A	Transmitter	66	1"	T&I - 20°C
AL-1053A	Transmitter	66	1"	T&I - 20°C
AL-1445A	Transmitter	66	1"	T&I - 70°C
AL-1533A	Transmitter	66	1"	T&I - 20°C
AL-1547	Liquid Level Indicator	66	1"	T&I - 70°C
AL-1548	Liquid Level Indicator	66	1"	T&I - 70°C
AL-237G	Transmitter	66	1"	T&I - 150°C
AL-267A	Transmitter	66	1"	T&I - 120°C
AL-1038A	Transmitter	66	1"	T&I - 100°C
AL-1433A	Transmitter	66	1"	T&I - 70°C
AL-1556	Liquid Level Indicator	66	1"	T&I - 20°C
AL-1557	Liquid Level Indicator	66	1"	T&I - 20°C
AL-1625	Liquid Level Indicator	66	1"	T&I - 100°C
AL-266A	Transmitter	78	1"	T&I - 150°C
AL-297	Liquid Level Indicator	78	1"	T&I - 20°C
AL-929A	Transmitter	78	1"	T&I - 20°C
AL-1052A	Transmitter	78	1"	T&I - 20°C
AL-1444A	Transmitter	78	1"	T&I - 70°C
AL-1546	Liquid Level Indicator	78	1"	T&I - 70°C
AL-1555	Liquid Level Indicator	78	1"	T&I - 20°C
AL-1626	Liquid Level Indicator	78	1"	T&I - 100°C
AL-1630C	Transmitter	78	1"	T&I - 100°C
AL-701F	Pressure Gauge	83	As Required	T&I - 20°C
AL-720C	Transmitter	83	1"	T&I - 20°C
AL-1401J	Pressure Gauge	83	As Required	T&I - 70°C
AL-1428C	Transmitter	83	1"	T&I - 70°C
AL-1501J	Pressure Gauge	83	As Required	T&I - 20°C
AL-1528B	Transmitter	83	1"	T&I - 20°C
AL-934B	Transmitter	84	1"	T&I - 20°C
AL-1826	Flow Recorder	85	1"	T&I - 0°C
AL-1827	Flow Recorder	85	1"	T&I - 0°C
AL-1828	Flow Recorder	85	1"	T&I - 0°C
AL-542D	Transmitter	94	1"	T&I - 20°C

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ITEM L - INSULATION - HOT - Page 15

Instruments - (cont'd)

JJM/dr

Number	Description	Refer to Inst. Spec. HF-630 Sheet No.	Insulation Thickness	Remarks
AL-201N	Gauge Glass	97	As Required	T&I - 150°C
AL-506B	" "	97	" "	T&I - 20°C
AL-515D	" "	97	" "	T&I - 20°C
AL-932B	" "	97	" "	T&I - 20°C
AL-104D	Gauge Glasses	98	" "	T&I - 20°C
AL-106D	" "	98	" "	T&I - 70°C
AL-204F	" "	98	" "	T&I - 150°C
AL-205E	" "	98	" "	T&I - 20°C
AL-211B	" "	98	" "	T&I - 20°C
AL-212E	" "	98	" "	T&I - 20°C
AL-305F	" "	98	" "	T&I - 20°C
AL-306E	" "	98	" "	T&I - 20°C
AL-405F	" "	98	" "	T&I - 30°C
AL-406D	" "	98	" "	T&I - 20°C
AL-415B	" "	98	" "	T&I - 30°C
AL-616D	" "	98	" "	T&I - 20°C
AL-707G	" "	98	" "	T&I - 20°C
AL-708A	" "	98	" "	T&I - 20°C
AL-740J	" "	98	" "	T&I - 20°C
AL-804B	" "	98	" "	T&I - 20°C
AL-1006F	" "	98	" "	T&I - 20°C
AL-1009D	" "	98	" "	T&I - 25°C
AL-1115E	" "	98	" "	T&I - 20°C
AL-1204C	" "	98	" "	T&I - 20°C
AL-1206F	" "	98	" "	T&I - 20°C
AL-1413D	" "	98	" "	T&I - 20°C
AL-1513F	" "	98	" "	T&I - 20°C
AL-1609A	" "	98	" "	T&I - 20°C
AL-204D	Pressure Gauge	99	" "	T&I - 150°C
AL-707D	" "	99	" "	T&I - 20°C
AL-1009F	" "	99	" "	T&I - 25°C
AL-1413F	" "	99	" "	T&I - 70°C
AL-1513E	" "	99	" "	T&I - 20°C
AL-201R	Pressure Gauge	101	" "	T&I - 120°C
AL-740G	" "	101	" "	T&I - 20°C
AL-908E	" "	101	" "	T&I - 20°C

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JJM/dr

Instruments - (cont'd)

Number	Description	Refer to Inst. Spec. HF-630 Sheet No.	Insulation Thickness	Remarks
AL-739D	Pressure Gauge	102	As Required	T&I - 20°C
AL-739E	" "	102	" "	T&I - 20°C
AL-1317C	" "	102	" "	T&I - 20°C
AL-1355A	" "	102	" "	T&I - 20°C
AL-1511A	" "	102	" "	T&I - 20°C
AL-1611A	" "	102	" "	T&I - 20°C
AL-1713A	" "	102	" "	T&I - 20°C
AL-1714A	" "	102	" "	T&I - 20°C
AL-189A	Pressure Gauge	103	" "	T&I - 70°C
AL-207A	" "	103	" "	T&I - 150°C
AL-225A	" "	103	" "	T&I - 150°C
AL-235A	" "	103	" "	T&I - 20°C
AL-236A	" "	103	" "	T&I - 150°C
AL-298A	" "	103	" "	T&I - 150°C
AL-309B	" "	103	" "	T&I - 70°C
AL-326E	" "	103	" "	T&I - 70°C
AL-542C	" "	103	" "	T&I - 20°C
AL-710A	" "	103	" "	T&I - 20°C
AL-712A	" "	103	" "	T&I - 20°C
AL-719J	" "	103	" "	T&I - 20°C
AL-916A	" "	103	" "	T&I - 20°C
AL-808A	" "	103	" "	T&I - 30°C
AL-810A	" "	103	" "	T&I - 30°C
AL-934D	" "	103	" "	T&I - 20°C
AL-1011B	" "	103	" "	T&I - 20°C
AL-1040A	" "	103	" "	T&I - 25°C
AL-1410A	" "	103	" "	T&I - 70°C
AL-1430K	" "	103	" "	T&I - 70°C
AL-1462C	" "	103	" "	T&I - 70°C
AL-1466A	" "	103	" "	T&I - 70°C
AL-1467A	" "	103	" "	T&I - 70°C
AL-1465A	" "	103	" "	T&I - 70°C
AL-1530C	" "	103	" "	T&I - 20°C
AL-1606A	" "	103	" "	T&I - 100°C
AL-1618A	" "	103	" "	T&I - 100°C
AL-2012B	" "	103	" "	T&I - 25°C

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THE LUMMUS COMPANY

Job 3215
October 17, 1952
Rev. January 13,
Rev. (4) Nov. 9,

ITEM L - INSULATION - COLD - Page 1

JJM:sl

A. GENERAL

1. All equipment, vessels and piping operating at temperatures of 50°F and below shall be insulated with "Foamglas" as manufactured by the Pittsburgh Corning Glass Corp. for the conservation of refrigeration and drip protection in accordance with these specifications.

2. Cold insulation shall be furnished in blocks, or sectional pipe covering as required for equipment and piping to be insulated. Cold insulation for vessel heads shall be supplied in 12" x 18" x 5" rectangular blocks.

3. All pipe covering shall be supplied in two full half round sections regardless of thickness of pipe covering.

4. The cold adhesive used for the installation of blocks, sectional pipe covering, etc., shall be "Insul-Mastic No. 507 or approved equal.

5. All vessels and piping covered with "Foamglas" shall have an outer covering of Glas-Phalt membrane and a sprayed weathercoat of "Insul-Mastic #4010" or an approved equal.

B. APPLICATION

1. All surfaces to be insulated shall be thoroughly cleaned before the application of any insulation.

2. Insulation shall be fitted tightly against all surfaces and shall be so formed as to require a minimum amount of caulking. Flat "Foamglas" block of 5" thickness shall be shaped to fit around sharp bends of equipment, such as vessel heads, valves, etc.

3. The "Foamglas" blocks are installed dry on the surfaces of all piping and equipment where required except that the block to block surfaces shall be suitably covered with "Insul-Mastic No. 507 or equal, to insure a sealed joint. The block insulation on equipment shall have staggered joints.

4. "Foamglas" block insulation on vertical vessels shall be supported on an angle iron ring spot welded to the vessel at the bottom tangent line. The space between the block and the support angle shall be caulked with "Insul-Mastic No. 507".

5. The insulating blocks on all equipment shall be held firmly in place by machine tightened 3/4" wide stainless steel band irons on 12" centers. The band irons shall be tightened by mechanical stretch tighteners at 10 foot or less intervals on the circumference and secured with seals 3/4" long.

6. The insulation sections shall be secured to the piping with a minimum of three 16 gauge Monel wire per section of covering. On lines 8 inches and larger 1/2" wide stainless steel bands shall be used.

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JJM:sl

B. APPLICATION - (cont'd.)

7. If voids occur which may be considered defects either in the insulation or its application, filling with any caulking material will not be acceptable. Instead, the defective insulation shall be removed and replaced with acceptable insulation. (4

8. After the "Foamglas" has been secured to the surface to be insulated, all intersections in the insulation at nozzles, manways, clips, etc. shall be caulked with "Insul-Mastic No. 507." (4

9. The entire outer surface shall then be coated with a tack coat of "Insul-Mastic #4010." Glas-Phalt membrane shall be laid onto this tack coat, and a "Insul-Mastic #4010" shall then be sprayed over the Glas-Phalt to provide a complete finish coat. The application shall be in accordance with manufacturers specifications.

10. All attachments to cold vessels and piping shall be insulated half thickness where possible, a distance of 3' - 0" from the outside of insulation. (4

C. THICKNESS OF INSULATION

1. The thickness of insulation to be used for covering cold piping and equipment shall be as indicated in the following tables.

EQUIPMENT INSULATION THICKNESS

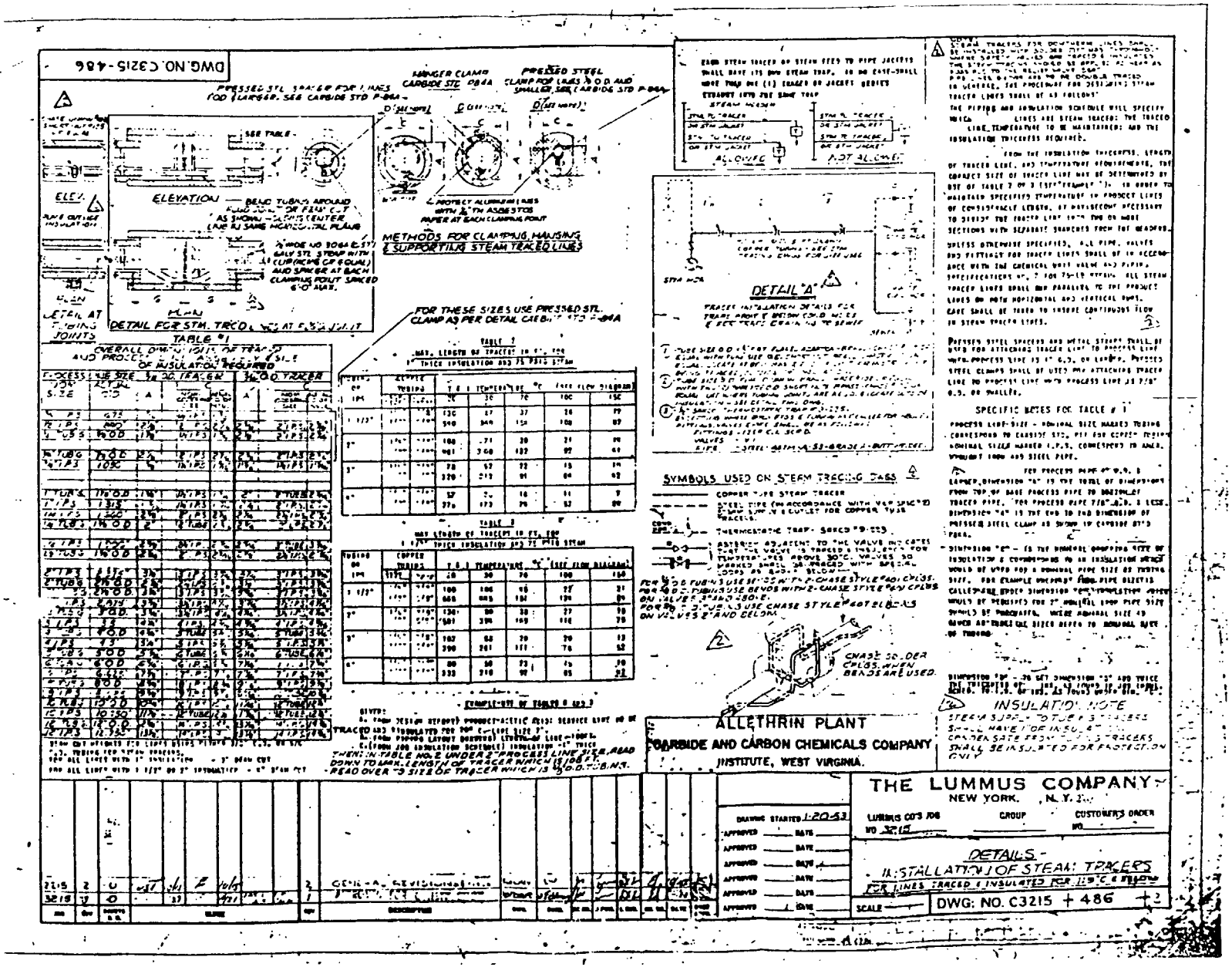
Operating Temp. Range	Foamglass Thickness
(75 to 35°F) 23°C to 1°C	2"
(34 to 0°F) 1°C to -17°C	4"

PIPING INSULATION THICKNESS (FOAMGLAS)

Nominal Pipe Size	23°C to 1°C (75 to 35°F)	1°C to -17°C (34 to 0°F)
1/2"		2"
3/4"		2"
1"		2"
1-1/2"		2-1/2"
2"	1-1/2"	2-1/2"
3"	All	2-3/4"
4"	Sizes	2-3/4"
6"		2-3/4"
8"		3"
10"		3"
12"		3-1/2"
14" & above		3-1/2"

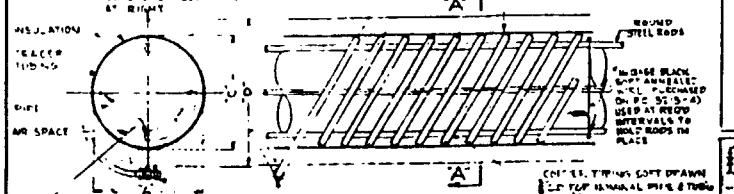
2. The thickness of Foamglas insulation to be used to prevent all exposed city water pipe lines from freezing shall be two inches. (4)

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DWG. NO. C 3215-480



SECTION A-A

TABLE #1

OVERALL DIMENSIONS OF TRACER AND PROCESS LINE ASSEMBLY & SIZE OF INSULATION REQUIRED.

PROCESS LINE SIZE NOMINAL SIZE	ACTUAL O.D.	"A"	"C"
½" I.P.S.	.840	1 1/8	½ I.P.S. 1.04
½" TUBE	.625	1.300	½ I.P.S. 1.04
¾" TUBE	.875	1.354	½ I.P.S. 1.04
¾" I.P.S.	1.050	1.903	1 1/4 I.P.S. 1.38
1" TUBE	1.125	2.000	1" I.P.S. 1.38
1" I.P.S.	1.315	2.190	1" I.P.S. 1.66
1½" I.P.S.	1.900	3.193	2" I.P.S. 2.38
1½ TUBE	1.625	2.875	2" I.P.S. 2.38
2" I.P.S.	2.375	3.693	2½ I.P.S. 2.88
2" TUBE	2.125	3.393	3" I.P.S. 3.38
3" TUBE	3.000	4.750	4 I.P.S. 4.51
3" I.P.S.	3.500	4.750	4½ I.P.S. 5.01
4" TUBE	4.000	5.250	5 I.P.S. 5.45
4" I.P.S.	4.500	5.750	6" TUBE 6.75
6" TUBE	6.000	7.250	7" I.P.S. 7.75
6" I.P.S.	6.625	7.875	8" TUBE 8.51
8" TUBE	8.000	9.250	9" I.P.S. 9.75
8" I.P.S.	8.625	9.875	10" TUBE 10.21
10" TUBE	10.000	11.250	11" I.P.S. 11.00
10" I.P.S.	10.750	11.000	12 TUBE 12.32

MATERIALS UPSTREAM & DOWNSTREAM OF COPPER TUBE STM. TRACERS.

300# STM - 1/2" TO 1" INC. IS ACCORDANCE WITH MAP SPEC #3 AS FOLLOWS:-
- BODY AND BONNET - 1/2" & 3/4" - 3000 F.S. - SOCKET WELDING
  1" TEES - FABRICATE FROM PIPE.
  1" ELLS - SCH 80 - SMLTD - BUTT WELDING TYPE
- PIPE - SCH 80 - STEEL - BUTT - WELDED ASTM - A-53 GRADE "B"
- VALVES - 1/2" TO 1" 3000 F.S. SCREWED U-86

150# STM - 1/2" TO 2-1/2" INC. IS ACCORDANCE WITH MAP SPEC #7 AS FOLLOWS:-
- BODY AND BONNET - CAST IRON - 125# ASA SCR.
- UNIONS - PETRO OR EQUAL
- PIPE - 1/2" TO 2-1/2" - STD. WEIGHT ASA GRADE "A" SCH 40 BUTT WELDED. 3" TO 4-1/2" - STD. WEIGHT ASTM A-106 GRADE "B" SMLTD.
- VALVES - BR.-SCR. - U-1

PIPE TRACED & INSULATED FOR 120°C SHALL HAVE TRACER TUBING ENCASED IN ALUMINUM SHEET WRAPPING (ALUMINUM SHEET WRAPPING TO BE PURCHASED BY FIELD).

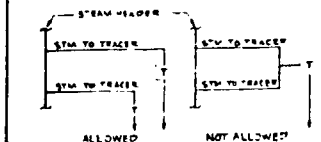
HOC FOR TRACER TUBES

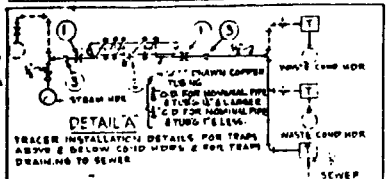
ALUMINUM SHEET WRAPPING FOR LINES TRACED & INSULATED FOR 120°C SHALL SEE NOTE 3 AT RIGHT

USE FOUR STEEL RODS TRACER TUBING PER TRACING PIPE SIZE 3" & ON PIPE & TUBING SIZE & LARGER USE ONE PIPE STRAP EACH 6 LEG

CONTROL TUBING SOFT DRAWN USE FOR NOMINAL PIPE & TUBE SIZES 1" AND LARGER. USE FOR NOMINAL PIPE & TUBE SIZES 1" AND LESS.

EACH STEAM TRACED OR STEAM FEED TO PIPE JACKETS SHALL HAVE ITS OWN STEAM TRAP. IN NO CASE SHALL MORE THAN ONE (1) TRACER EXHAUST INTO THE SAME TRAP





TRACER INSTALLATION DETAILS FOR TRAPS ABOVE & BELOW COND HDRS & FOR TRAPS DRAINING TO SEWER

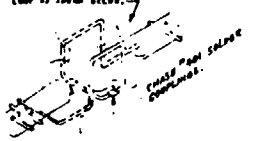
① TUBE SIZE O.D. × ¾ I.P.S. FLARED ADAPTOR-BRASS-CHASE PIPE OR EQUAL WITH TUBE SIZE O.D. SHORT NUT-BRASS-CHASE PIPE OR EQUAL. LOCATE AT BEGINNING & END OF LINE OR IN THEIR SHORT BEND TRACE, OUTSIDE OF INSULATION.

② TUBE SIZE O.D. FLARED UNION-BRASS-CHASE PIPE OR EQUAL WITH TWO (2) TUBE SIZE O.D. SHORT NUTS-BRASS-CHASE PIPE OR EQUAL. USE WHERE TUBING JOINTS ARE REQ'D. & LOCATE OUTSIDE INSULATION-SEE DETAIL THIS DWG.

③ ½" I.P.S. × ¼" I.P.S. REDUCER TO BE USED ONLY WHEN ¼ TUBING IS USED

SYMBOLS USED ON STEAM TRACING DWGS.

- COPPER TUBING STEAM TRACER FOR LINES TRACED AND INSULATED FOR 150° C.
- COPPER TUBING STEAM TRACER FOR LINES TRACED AND INSULATED FOR 120° C.
- 300# STEAM SUPPLY & OUTLET UPSTREAM & DOWNSTREAM OF COPPER TUBE STEAM TRACERS (MATERIALS OR ACCORDANCE WITH T & P SPEC #3)
- 150 STEAM SUPPLY & OUTLET UPSTREAM & DOWNSTREAM OF COPPER TUBE STEAM TRACERS (MATERIALS IN ACCORDANCE WITH T & P SPEC #7)
- ARMSTRONG THERMOSTATIC TRAP #6 - 226
- VALVES MARKED WITH AN ASTERISK ARE TRACED AND INSULATED FOR TEMPERATURES ABOVE 30° C. VALVES MARKED WITH AN ASTERISK SHALL BE PROVIDED WITH A SPECIAL LOOP AS SHOWN BELOW.



NOTE:

TRACING MATERIALS USED FOR PIPE TRACED & INSULATED FOR 120° C. ARE IDENTICAL TO TRACING MATERIALS USED TO TRACE & INSULATE PIPE FOR 150° C. EXCEPT FOR THE FOLLOWING:

1 - LINES TRACED & INSULATED FOR 120° SHALL HAVE THE EXTERIOR METAL ENCASEMENT OF ALUMINUM SHEET WRAPPING.

2 - LINES TRACED & INSULATED FOR 150° C. DO NOT REQUIRE ALUMINUM SHEET WRAPPING.

3 - PIPING UPSTREAM & DOWNSTREAM OF COPPER TUBING TRACERS CONFORMS TO THE FOLLOWING:
- T & T FOR 120° C - YAP-2
- T & T FOR 150° C - WAP-9

BEAM CUTS (PIPE SUPPORTS)

BEAM CUT DEPTHS FOR LINES USING EITHER 3/8" O.D. OR 1/4" O.D. TUBING FOR STEAM TRACING ARE AS FOLLOWS:
FOR ALL LINES WITH 1" INSULATION - 3" BEAM CUT
FOR ALL LINES WITH 1 1/2" OR 2" INSULATION - 4" BEAM CUT

SPECIFIC NOTES FOR TABLE # 1

PROCESS LINE SIZE - NOMINAL SIZE MARKED TUBING CORRESPOND TO CARBIDE STD. FIT FOR COPPER TUBING. NOMINAL SIZES MARKED I.P.S. CORRESPOND TO ANSI. WROUGHT IRON AND STEEL PIPE.

DIMENSION "A" IS THE TOTAL DIMENSIONS FROM TOP OF COPPER TRACING LOOP TO BOTTOM OF THE COPPER TRACING LOOP.

DIMENSION "C" - IS THE NOMINAL ORDERING SIZE OF INSULATION & CORRESPONDS TO AN INSULATION WHICH WOULD BE USED FOR A NOMINAL PIPE SIZE OR TUBING SIZE. FOR EXAMPLE WHERE 2" IRON PIPE SIZE IS CALLED FOR UNDER DIMENSION "C" INSULATION WHICH WOULD BE REQUIRED FOR 2" NOMINAL IRON PIPE SIZE SHOULD BE PURCHASED. WHERE NOMINAL SIZE IS GIVEN AS "TUBE", THE SIZES REFER TO NOMINAL SIZE OF TUBING

DIMENSION "B" - TO GET DIMENSION "B" ADD TWICE THE THICKNESS OF INS. AS FOUND IN JOB INSUL. SCHED. TO ACTUAL I.D OF INS." AS FOUND UNDER DIM. "C".

DIMENSIONS FOR INSULATION ARE TAKEN FROM ZONOLITE PRODUCTS BULLETINS SIZE FOR INSULATION IS AS PER T & T SUB-SECTION #14 DID ISSUED 1-15-52.

INSULATION NOTE

STEAM SUPPLY TO TUBING TRACERS SHALL HAVE 1" OF INSULATION. CONDENSATE FROM TUBING TRACERS SHALL BE INSULATED FOR PROTECTION ONLY.

THE PIPING AND INSULATION SCHEDULE WILL SPECIFY WHICH LINES ARE STEAM TRACED; THE TRACED LINE TEMPERATURE TO BE MAINTAINED; AND THE INSULATION THICKNESS REQUIRED.

ALLETHRIN PLANT
CARBIDE AND CARBON CHEMICALS COMPANY
INSTITUTE, WEST VIRGINIA.

THE LUMMUS COMPANY
NEW YORK, N. Y.

LUMMUS CO'S JOB NO. 3215 | GROUP | CUSTOMER'S ORDER NO.

DETAILS
INSTALLATION OF STM. TRACERS FOR LINES TRACED & INSULATED FOR 120° & 150°

SCALE NONE | DWG. NO. C 3215-480-1

DRAWING STARTED 2-20-53
APPROVED ____ DATE ____
APPROVED ____ DATE ____
APPROVED ____ DATE ____
APPROVED ____ DATE ____
APPROVED ____ DATE ____
APPROVED ____ DATE ____

JOB	REV	SHEETS & NO.	ISSUE	DESCRIPTION
3215	1	0	COST	1 APPROVED FOR CONSTRUCTION

Union Carbide trial exhibit UC-4916: Lummus Company Specification for Hot and Cold Insulation (Item L, Job 321...
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