J. E. O'NEAL 11148

PLAINTIFF'S EXHIBIT

UC-4035

DESIGN AND CONSTRUCTION
UNION CARBIDE CHEMICALS COMPANY
Division of
UNION CARBIDE CORPORATION

SPECIFICATIONS

For

Thermal Insulation
Material and Application

January 1958

SOUTH CHARLESTON
WEST VIRGINIA

UCC 021841

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

FOREWORD

A. General

These Specifications describe the essential requirements for the purchase and application of thermal insulation materials. They consist of two major parts: I - General Specifications, and II - Individual Specifications. Each Specification is divided into two parts: (A) Materials, and (B) Application. Individual Specifications are identified by a two-digit number, followed by a letter.

The applicable Individual Specification and the thickness of insulation to be used shall be indicated in an Insulation Design Schedule.

The General Specification constitutes an integral part of all the Individual Specifications.

B. Definitions

Where the following terms are found within the General and the Individual Specifications, they shall have meaning and significance as defined:

1. Blanket.....Insulating material consisting of organic or inorganic fibers, suitably felted, woven, stitched, bonded, or reinforced, into flexible form.

2. By Others.....Purchase or installation, or both, of subject material will be made by other than Insulation Contractor or insulation mechanics.

3. Curved Segment.....Block insulation of uniform thickness, formed to fit contour of curved surfaces and with longitudinal edges radially beveled.

4. Finish.....Material applied to surface of insulation for protection and/or appearance.

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B. Definitions — contd

5. Firmly.....A section of pipe insulation, when secured in the specified manner to a vertical pipe of corresponding dimension, shall remain at that elevation unsupported except by friction.

6. Fitting Cover.....Block and pipe insulation patterned to fit on flanges, valves, and other fittings, furnished in convenient and matching sections.

7. Lagging.....Relatively narrow, flat block insulation, rectangular in shape, of uniform thickness, and with longitudinal edges radially beveled.

8. Loose Fill .....Thermal insulating material in loose fibrous or powdery form, for application within enclosed spaces.

9. Molded-Type Pipe Insulation.....A rigid or semi-rigid thermal insulating material, preformed in semi-cylindrical or segmental sections, or both, usually 3 ft. in length; for application on pipe or tubing, furnished with or without finish or attachments.....(ASTM Standard C-168.)

10. Preformed Thermal Insulating Block .....A rigid or semi-rigid thermal insulating material, either flat or segmental, for application as received, and excluding brick of the 9-in. series.....(ASTM Standard C-168.)

11. Sectional Pipe Insulation.....Two semi-cylinders of pipe insulation combined to form a complete circumference.

12. Segmental Pipe Insulation.....Curved segments of pipe insulation of less than one-half circumference which, when grouped and combined with an odd width, where necessary, form a complete circumference.

13. Shaped Head Segment.....Block insulation patterned to fit on shperical, flanged and dished, or other type, vessel heads, usually with but a single radius - furnished in convenient and matching sections.

14. Staggered

a. Pipe insulation shall be in a staggered position when, upon application, the end joint between two abutting half -

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B. Definitions — contd

14. Staggered — contd

sections occurs at least one-third, but preferably one-half the length of a section, from either end of the opposing half-section.

b. Block (curved segments, lagging) insulation shall be in a staggered position when the abutting joint between two blocks occurs, upon application, at least one-third the length of a section from joints of adjacent blocks.

c. Multi-layer insulation shall be considered broken joint when applied so that no two joints coincide except where they cross at right angles.

15. Thermal Insulating Cement.....A prepared composition, in dry form, comprising granular, flaky, fibrous, or powdery materials, which, when mixed with a suitable proportion of water to develop a plastic consistency, and applied and dried in place, forms a coherent covering that affords substantial resistance to heat transmission.....(ASTM Standard C-168.)

16. Weather-Barrier (Weatherproofing).....Finish applied for moisture and weather protection.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

I. GENERAL SPECIFICATIONS

Scope

This specification describes the essential requirements for the purchase and application of thermal insulation materials. It also constitutes an integral part of the Individual Specifications.

A. MATERIAL

1. Types and Dimensions

a. Material furnished under these Specifications shall be of type and thickness listed on Insulation Design Schedules, Insulation Equipment and/or Line Lists, or as otherwise prescribed by the Department of Design and Construction.

b. Pipe insulation shall be furnished in convenient lengths, plus or minus not more than 3/32-inch, with ends cut square. Inside diameter shall fit firmly on specified pipe size and outside diameter shall correspond to an Iron Pipe Size.

2. Sampling and Testing

Where vendor is unable to provide acceptable test, or performance data, to meet the requirements of these Specifications, representative samples of insulating and accessory materials shall be submitted to the Department of Design and Construction in sizes and amounts required for testing. In all instances these samples, which shall be supplied without cost to purchaser, shall be shipped by vendor within seven days following receipt of written request.

3. Packaging

Unless otherwise agreed, material shall be packed in substantial containers, so constructed as to insure safe

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I. GENERAL SPECIFICATIONS

A. MATERIAL – contd

3. Packaging — contd

delivery of material, in a condition satisfactory to the purchaser, by common and other approved carrier.

4. Marking and Identification

Unless otherwise specified, shipping containers shall be legibly marked with name of material, size, type, and quantity contained therein; name of Insulation Contractor, if any, and purchase order number under which shipment is made. In addition, where required, container shall bear the work order number, the Item No. (if any) for which material is intended and its relative position and sequence of application.

5. Attachments

a. Standard lacquered or brass bands, customarily furnished by the manufacturer of pipe insulation, will not be required.

b. Canvas or other factory-applied surfacing, where required with insulating material, shall be as called for on bills of material or other purchase requisitions.

6. Approved Alternates

Alternate insulating and/or accessory materials may be approved by the Department of Design and Construction, but only where clearly shown that properties involved satisfy all requirements which this Specification prescribes.

7. Rejections

a. Insulation and/or accessory material will be rejected by purchaser, before or after delivery, where physical and other properties do not meet the requirements specified and no exemption has been granted by the Department of Design and Construction.

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I. GENERAL SPECIFICATIONS

A. MATERIAL - contd

7. Rejections — contd

b. All costs in connection with rejected material shall be borne by the vendor.

B. APPLICATION

1. Thickness Schedule

Unless otherwise specified, insulation in excess of 2-1/2 inches total thickness shall be applied in multi-layer construction in accordance with the following table:

Total Scheduled Thickness"	Inner Layer Thickness"	Middle Layer Thickness"	Outer Layer Thickness"
3	1-1/2	None	1-1/2
3-1/2	1-1/2	None	2
4	2	None	2
4-1/2	2	None	2-1/2
5	2-1/2	None	2-1/2
5-1/2	1-1/2	2	2
6	2	2	2
6-1/2	2	2	2-1/2
7	2	2-1/2	2-1/2
7-1/2	2-1/2	2-1/2	2-1/2
8	2-1/2	2-1/2	3
8-1/2	2-1/2	3	3
9	3	3	3

2. Condition of Material

Insulation materials, other than cements and mastics, may be applied only when dry.

3. Condition of Surfaces

a. Insulating material shall be applied to clean, dry surfaces only.

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3. Condition of Surfaces — contd

b. Where insulation is applied to piping and equipment operating in the temperature range of 0°F to 180°F, the metal surfaces of said piping and equipment shall be coated, in accordance with UCCC Coating Specifications, by others, prior to application of insulation.

c. Voids behind name plates and tank legs shall be filled and caulked, in accordance with UCCC Coating Specifications, by others, prior to application of insulation.

4. Insulation Supports

a. Insulation on vertical equipment, exceeding 1'-5" in diameter and 10'-0" in height, shall be supported by metal supports installed approximately every 12'-0" and above each vessel flange, in accordance with UCCC Standard IS-31. Length of horizontal leg or support angle shall be 1/2 inch less than total applied thickness of insulation.

b. Insulation on horizontal equipment, 4'-0" diameter and larger, shall be supported by metal supports installed in accordance with UCCC Standard IS-36.

c. Insulation applied to bottom head, or inside of skirt, on skirt supported vessels, shall be supported on metal supports installed in accordance with UCCC Standard IS-42.

d. Insulation on dished heads of vertical equipment shall be supported by metal supports in accordance with UCCC Standard IS-31.

e. Where necessary to prevent entrance of moisture, uppermost support shall be replaced with a metal protective plate, as described in section I.B.12, entitled "Protective Cover".

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I. GENERAL SPECIFICATIONS

B. APPLICATION - contd

5. Securement

a. Tie-Wire Anchors

Blank nuts, angle clips, and other approved attachments shall be used for insulation tie wire anchors, where shape of vessel prevents normal methods of securement of preformed insulating materials. Blank nuts, where required, shall be attached, standing-edge to vessel surface, by light fillet weld, or partially filled interface. Installation shall be done by the Insulation Contractor, prior to application of insulation.

b. Wire

(1) Wire shall be applied to insulation at proper intervals by looping about the circumference, twisting ends tightly together to provide proper securement, and depressing wire ends against insulation to prevent projections.

(2) Where shape of vessel prevents complete encirclement, securement shall be made to other tie-wires, wire cables, or other anchors for this purpose.

c. Insulation Strap

(1) All pipe insulation on steam traced lines shall be secured with stainless steel insulation strap.

(2) Strap shall be applied to cylindrical insulation at proper intervals by looping strap about the circumference, stretching to suitable tightness

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with an approved banding machine, and clamping in place at joint. Strap joint shall consist of one double-prong clip, or two clips furnished without prongs. Clips shall be located on the vertical side of pipe insulation.

(3) Where shape of vessel prevents complete encirclement of strap, securement shall be made to tie wires, wire cables, or other devices approved for this purpose.

(4) Insulation strap shall be divided into lengths based on one strap joint for the first 15 feet of vessel circumference and one strap joint for each additional 10 feet, or part thereof. These joints shall be spaced at equal distances about the vessel.

d. Spacing of Strap and Wire

(1) Spacing of insulation strap and wire over equipment and pipe insulation shall be based on length of block or section. Where 36-inch length insulation is applied in staggered arrangement, four loops will be required at average nine-inch intervals, so that no loop is located more than 4-1/2 inches from any end joint. Where 18-inch lengths are applied in staggered arrangement, only two loops per length shall be required.

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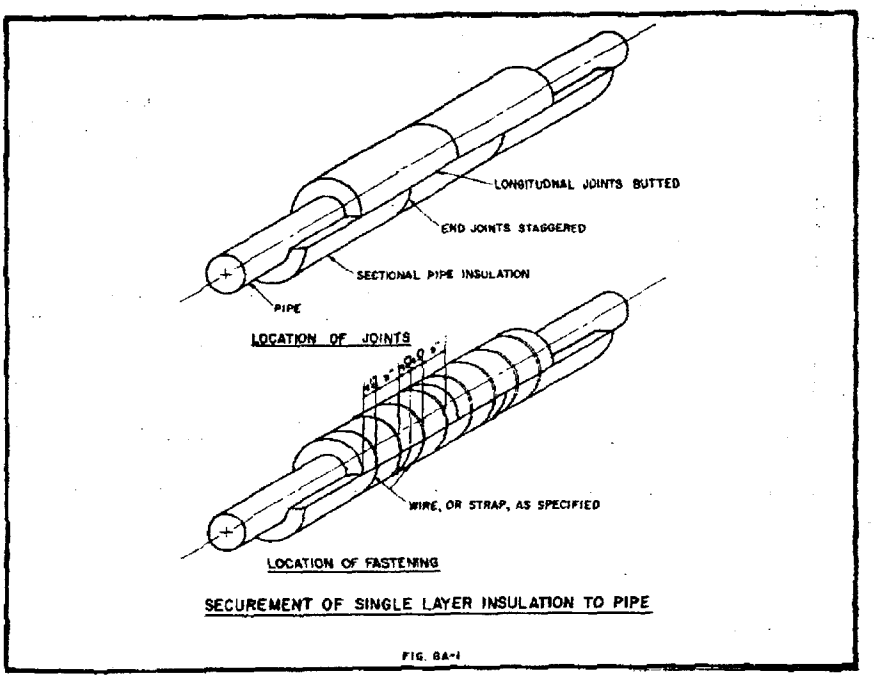
I. GENERAL SPECIFICATIONS

B. APPLICATION - contd

5. Securement - contd

d. Spacing of Strap and Wire - contd

(2) Spacing of strap and wire on pipe insulation shall correspond to Figures GA-1, and GA-2.



SECUREMENT OF SINGLE LAYER INSULATION TO PIPE

FIG. GA-1

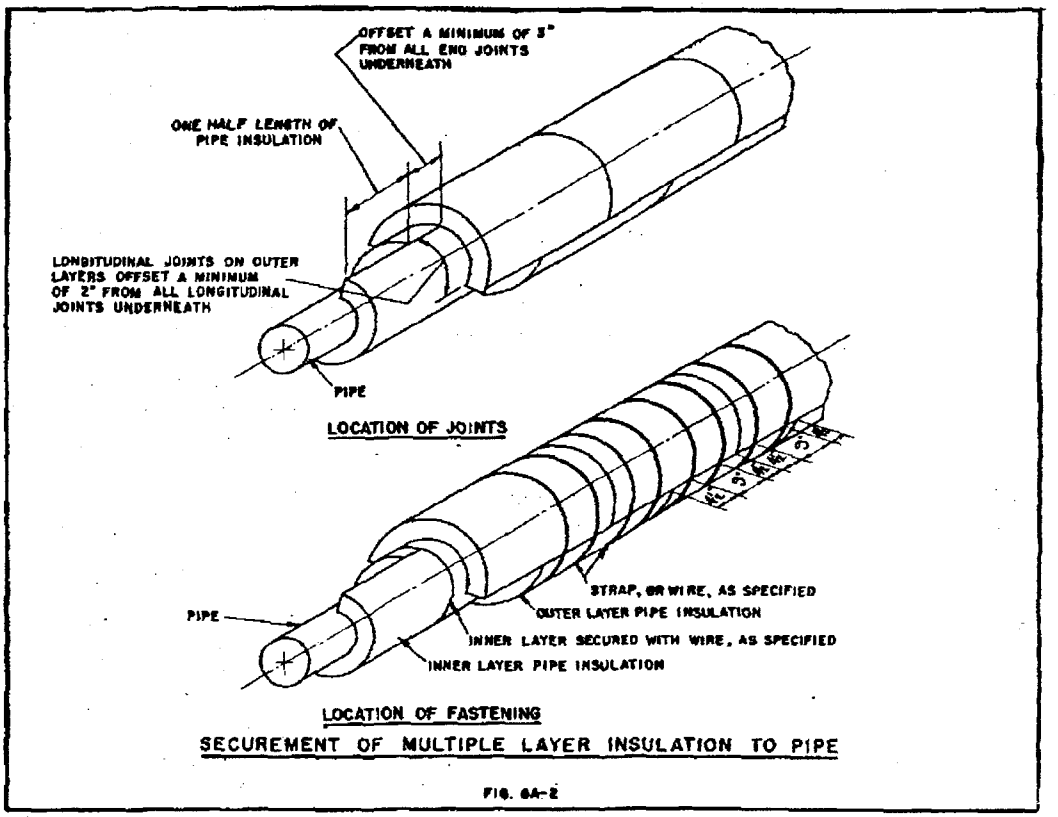
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I. GENERAL SPECIFICATIONS

B. APPLICATION - contd

5. Securement - contd

d. Spacing of Strap and Wire - contd



SECUREMENT OF MULTIPLE LAYER INSULATION TO PIPE

FIG. 6A-2

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I. GENERAL SPECIFICATIONS

B. APPLICATION - contd

6. Name Plate Clips

Insulation mechanics shall cooperate with others in the placement of name plates and name plate clips.

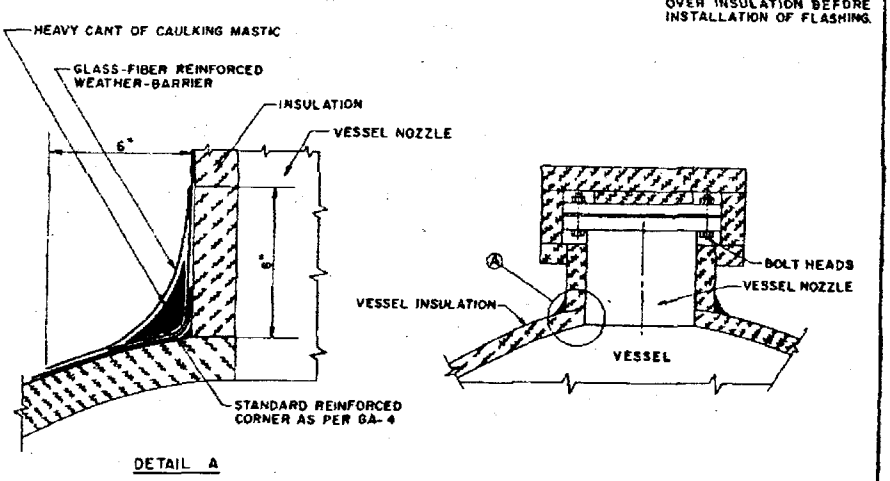
7. Junction of Thermal Insulation with Fire Resistant Materials

a. Insulation thickness on tank legs, and similar equipment supports, shall be not less than adjoining fire resistant materials. Where thickness of thermal insulation exceeds that of fire resistant materials, surface of insulation shall be neatly and uniformly finished with a wide bevel, - feathered to provide appearance of continuous surface and eliminate a definite surface joint.

b. Junction of insulation with fire-resistant materials shall be sealed with weather-barrier coating.

8. Nozzle Flashing

All nozzles on top of insulated equipment shall be provided with flashing as shown in Figure GA-3.



FLASHING ON TOP NOZZLES OF EQUIPMENT

FIG. GA-3

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I. GENERAL SPECIFICATIONS

B. APPLICATION – contd

9. Protection of Flammable Surfacings

When applying sheeting jacket, flammable surfacings shall be stopped at least six inches from brackets, hangers, and other hot projections, to avoid possibility of scorching or ignition. Where located indoors, such areas shall be surfaced with insulating cement to provide drainage. For other locations, a minimum 1/16 inch thick coat of heat-resistant sealer shall be applied.

10. Painting

Painting of bare and insulated surfaces, where required, will be done by others.

11. Protection from Abuse

a. Insulation subject to mechanical abuse, such as abrasion or crushing, or where otherwise required, as designated by the Department of Design and Construction, shall be protected with a covering jacket of not thinner than No. 26 gage sheet metal, or other approved media, as per UCCC Standard M-100. Jacket shall be secured firmly in place with insulation strap, spaced not greater than 10 inches on centers, or sheet metal screws where use of strap is impracticable. Sheet metal screws shall not be used on jackets over low temperature insulation where possibility exists of piercing weather-vapor barrier membrane. This protection will be provided by the Owner.

b. Corners of insulated ducts, breechings, and other flat-surfaced equipment shall be reinforced by installation of expanded metal lath corner bead, or corner inserts when approved. Bead and insert shall be provided by the Insulation Contractor and installed by insulation mechanics, following application of insulation block, securing it firmly to block tie wires. Cement shall be forced through lath flange to provide proper key.

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12. Protective Cover

Insulation terminating at an intermediate point on the side of a vessel shall be protected from physical abuse and moisture penetration, by installation of a continuour metal plate attached to vessel by means of a continuous weld immediately above insulation. This protection will be provided by the Owner.

13. Appearance

Lapped joints, selvage ends, and other irregularities of surfacing materials shall be concealed from general view wherever possible.

14. Insulation for Safety

a. Where it is required to insulate piping or equipment for safety, only that portion shall be insulated which is located not more than 6' -0" above operating levels, or where there exists possibility of human contact. Piping in trenches, unless otherwise specified, shall not be insulated for safety below grating level. Exposed ends of insulation shall be beveled with insulating cement to provide proper seal and drainage.

b. Where specified, thermal insulation shall be omitted and protection provided by erection of a suitable safety guard. This guard will be provided by the Owner.

15. Steam Traced Installations

a. Accessories - Pressed steel spacers shall be of No. 16 Gage (.0598"), constructed according to UCCC Standard P-84A, as manufactured by A. J. Gerrard. These spacers shall be furnished by the Insulation Contractor.

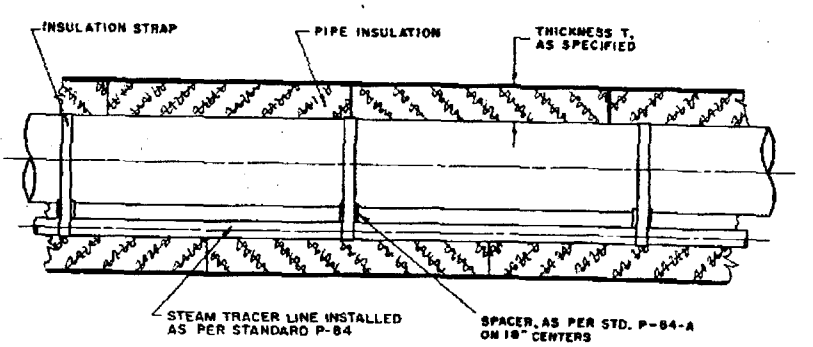
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I. GENERAL SPECIFICATIONS

B. APPLICATION - contd

15. Steam Traced Installations - contd

b. Assembly - Type and size of tracer lines; methods of clamping, hanging and supporting them; and size of pipe insulation to be applied, shall be in accordance with UCCC Standards P-84, P-84A and GA-4, supplemented by Insulation Design Schedules, where required. In addition to assembly directions contained in Standards P-84 and P-84A, pressed steel spacers (and pressed steel clamps, where installed) shall be spaced on 18-inch centers for copper tracer lines. Temporary installation of assembly will be done by others.



APPLICATION OF INSULATION TO STEAM TRACED LINES

FIG. GA-4

c. Pipe insulation shall be applied in required sizes and carefully fitted to heated companion lines in manner prescribed in these Specifications and in the Individual Specifications. Tracer assembly shall be firmly and permanently secured

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I. GENERAL SPECIFICATIONS

B. APPLICATION — contd

15. Steam Traced Installations — contd

in place by insulation mechanic during application of insulation, adding or relocating spacers where required to insure firmness of contact.

d. Protective Lining - When aluminum piping is to be steam traced, or where elsewhere required, aluminum piping shall be separated from tracer assembly by insertion of not less than two wrappings of glass fiber tape. Care shall be exercised that tracer line does not contact aluminum line at any point. Where tracer may touch, the aluminum line shall be wrapped with glass tape at that point.

16. Weather-Barrier Coatings

a. Insulation shall be coated with a weather-barrier at time of installation.

b. Coatings shall not be applied when atmospheric temperature is below 32°F. Where circumstances prevent immediate application of coating, insulation shall be temporarily protected from inclement weather.

c. Where sprayed weather-barrier is to be applied, adjacent areas not to be coated, such as valve stems, handles, gauge glasses, instruments and other adjacent equipment or structures, shall be masked or otherwise protected.

d. A heavy fillet of caulking mastic shall be applied at all inside corners of insulation and at all junctions of insulation and metal, prior to application of weather-barrier coating.

e. Weather-barrier membrane shall be carried out six inches onto metal, beyond termination of insulation at supports, skirts or other projections, and sealed to the metal.

f. All weather-barrier coatings shall be firmly bonded to insulation surface and reinforced with glass fiber

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cloth. Joints of reinforcing cloth shall be uniform in thickness and have a smooth unbroken surface, free of pin holes. Care shall be taken that openings in weave of cloth are completely sealed and hidden with specified coating.

g. (1) Where asphaltic weather-barrier coatings are used on large vessels and lines, they shall be applied by spraying, using the hot spray method. Where conditions make spraying practicable, such as small lines, application shall be by brushing, troweling, or palming.

(2) The combined thickness of the weather-barrier coating and reinforcing cloth shall be not less than 1/8 inch, when dry.

h. (1) Where flame-resistant, modified polyvinyl acetate emulsion weather-barrier is specified, it shall be applied by either cold spray, palming, troweling, or brushing.

(2) The combined thickness of the weather-barrier coating and reinforcing cloth shall be not less than 1/16 inch when dry.

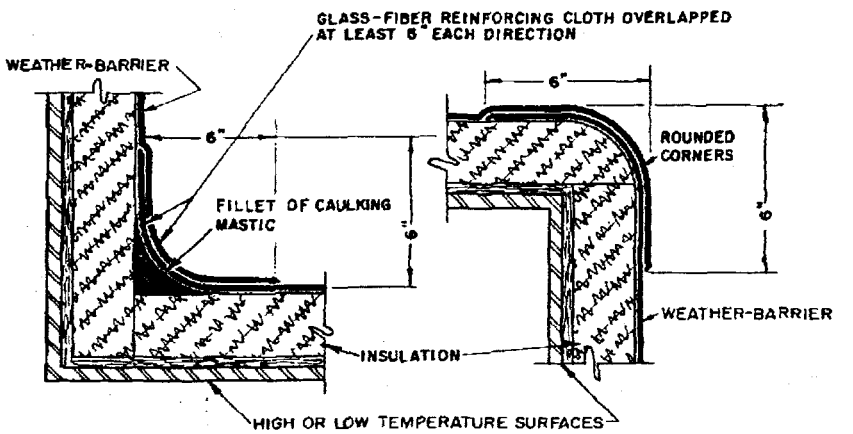
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I. GENERAL SPECIFICATIONS

B. APPLICATION — contd

16. Weather-Barrier Coatings — contd

(3) All outside corners of insulation shall be rounded and the weather-barrier coating provided with a double layer of reinforcing cloth as shown in Figure GA-5.



APPLICATION OF WEATHER-BARRIER COATING AT CORNERS

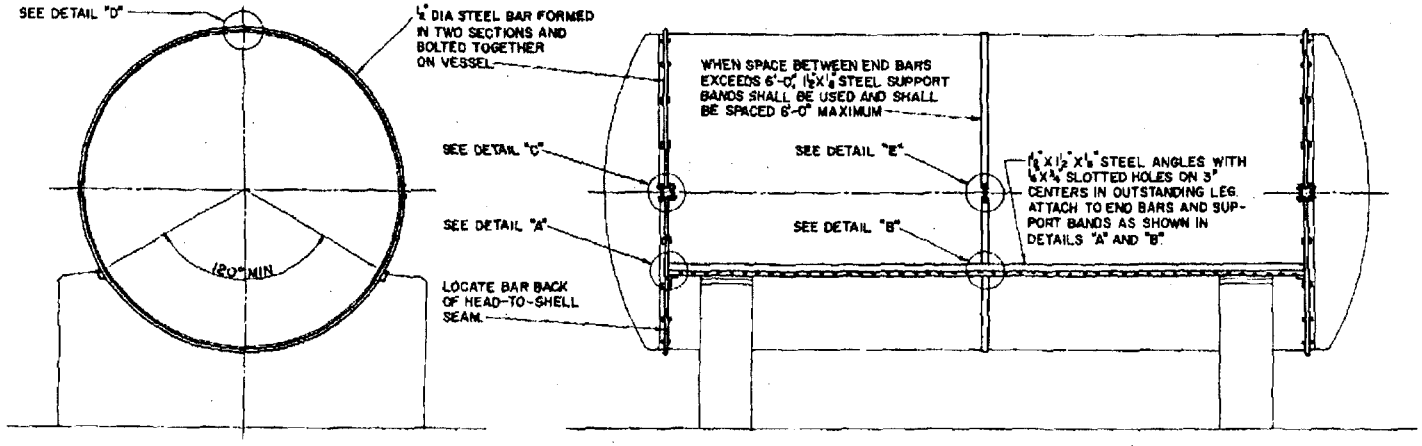
FIG. GA-5

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UNION CARBIDE AND CARBON CHEMICALS COMPANY
VERTICAL VESSELS
STANDARD
INSTALLATION SUPPORTS
No. 31-S
DETAIL
DETAIL "A"
SECTION "A-A"
DETAIL "B"
DETAIL "C"
DETAIL "D"
NOTE:
VESSEL SHELL
WELD
BOLT WITH HEX NUT
STEEL BAR
HOLES
SHELL
WELD

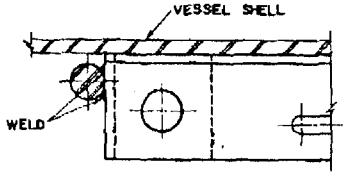
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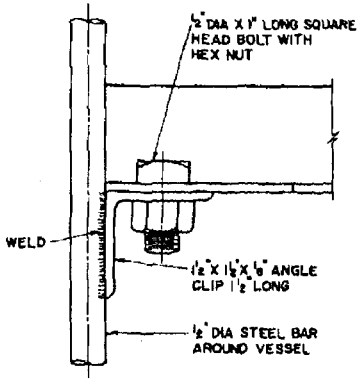
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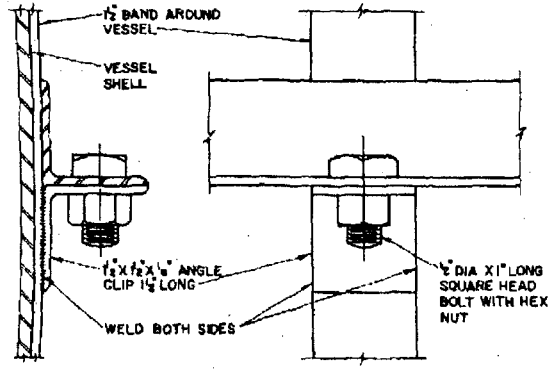
NOTE:

INSULATION SUPPORTS IN ACCORDANCE WITH THIS STANDARD (STD IS-36) SHALL BE FURNISHED FOR ALL HIGH AND LOW TEMPERATURE SERVICE HORIZONTAL VESSELS 4'-0" DIAMETER AND LARGER.

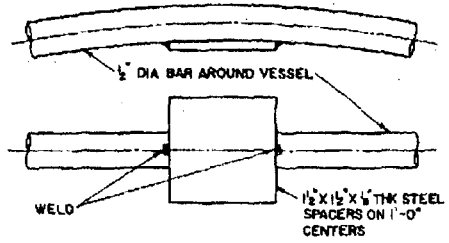




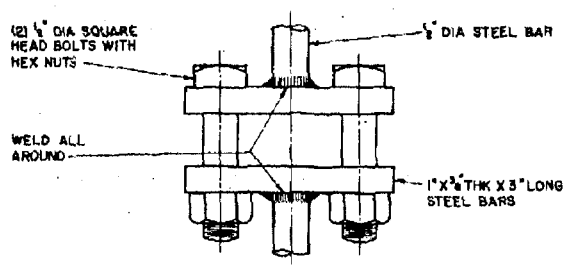
DETAIL "A"



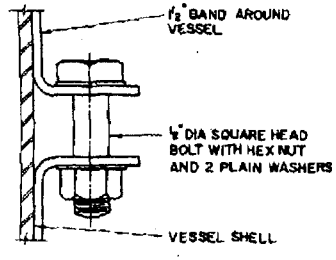
DETAIL "B"



DETAIL "D"



DETAIL "C"



DETAIL "E"

IS-36

REVISED:

THIS STANDARD IS MANDATORY ONLY WHEN INCORPORATED, WHOLLY OR WITH EXCEPTIONS, INTO DESIGN REPORTS, DESIGN DRAWINGS OR OTHER DESIGN DATA, OR INTO BILLS-OF-MATERIAL OR PURCHASE ORDERS.

ENGINEERING DEPARTMENT
CARBIDE AND CARBON CHEMICALS COMPANY
A DIVISION OF
UNION CARBIDE AND CARBON CORPORATION
SOUTH CHARLESTON, WEST VIRGINIA

STANDARD INSULATION SUPPORTS-HORIZONTAL VESSELS	No. IS-36

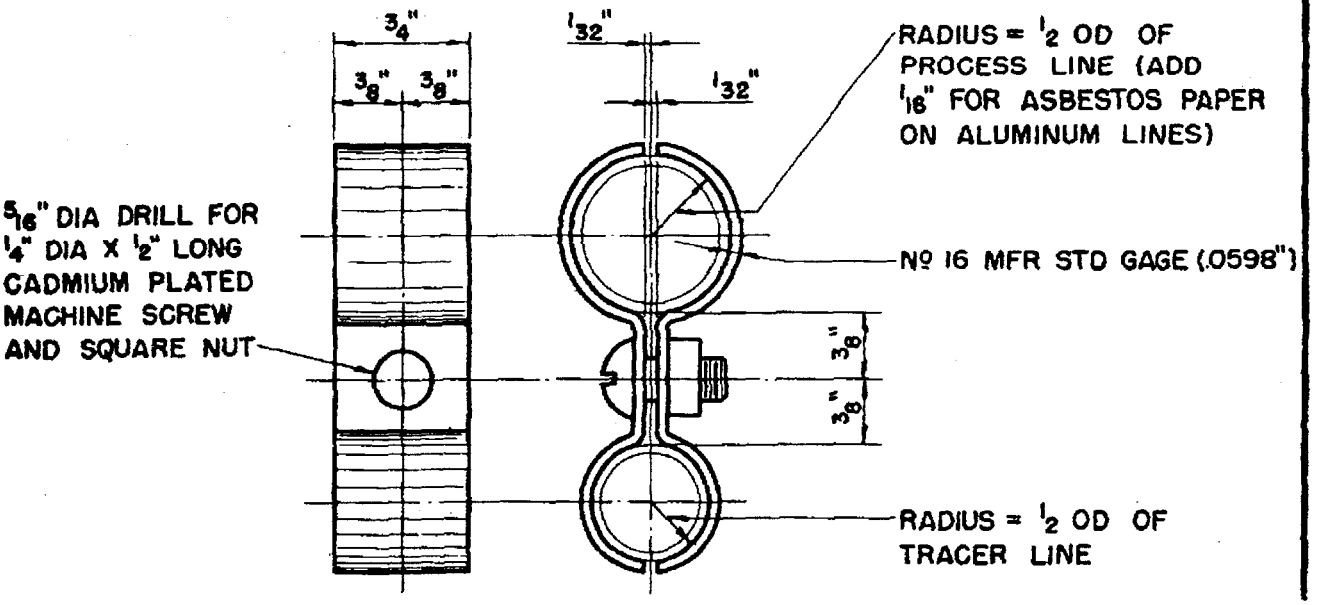
CLASSIFICATION: DETAIL

SPONSOR: 936 BY: R.J.S. DATE: 9-15-56

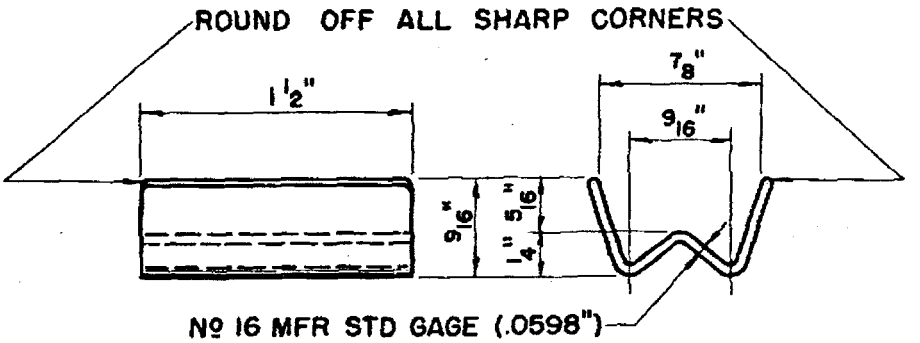
APPROVED: [signature] DATE: 9-26-56

IS-42
STANDARD
INSULATION SUPPORTS
INSIDE OF
VESSEL SKIRT
DETAIL
UNION CARBIDE AND CARBON CORPORATION
UNION CARBIDE CHEMICALS COMPANY
DETAIL "A"
BOTTOM VIEW
DETAIL "B"
DETAIL "C"
INSULATION SUPPORT ANGLES INSIDE OF VESSEL SKIRT
SEE DETAIL "B"
SEE DETAIL "C"
NOTE:

UCC 021863



PRESSED STEEL CLAMP FOR PROCESS LINES 7/8" OD AND SMALLER



PRESSED STEEL SPACER

THIS STANDARD IS MANDATORY ONLY WHEN INCORPORATED, WHOLLY OR WITH EXCEPTIONS, INTO DESIGN REPORTS, DESIGN DRAWINGS OR OTHER DESIGN DATA, OR INTO BILLS-OF-MATERIAL OR PURCHASE ORDERS.

NOTE:

MATERIAL SHALL BE ASTM A7 CARBON STEEL.

ENGINEERING DEPARTMENT
CARBIDE AND CARBON CHEMICALS COMPANY
A DIVISION OF
UNION CARBIDE AND CARBON CORPORATION
SOUTH CHARLESTON, WEST VIRGINIA

STANDARD CLAMPS AND SPACERS FOR STEAM TRACED LINES	Nº P-84A
CLASSIFICATION: DETAIL	
SPONSOR: H2B BY: OTE	DATE: 8/7/53
APPROVED: [signature]	DATE: 4-17-47

REVISED: 8-3-53

UCC 021864

UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 10-B — Cellular Glass

Scope

This specification describes the essential requirements for the purchase and application of preformed cellular glass insulation, for use in building roofs, side walls and floors.

Procedures outlined in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this specification.

A. MATERIAL

1. Composition

Material shall be composed of glass, complete inorganic, processed and molded at temperatures sufficient to produce a rigid, cellular thermal insulation.

2. Properties

Cellular glass insulation shall have the following properties:

Acid Resistance	Impervious to common acids and acid fumes.
Alkalinity	pH = 7.5
Capillarity	0
Coefficient of Expansion . .	0.0000040 per °F
Combustibility	Incombustible
Composition	A true glass; completely inorganic.
Compressive Strength . . .	100 lbs. per sq. in.

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II. SPECIFICATION 10-B

A. MATERIAL - contd

2. Properties - contd

Density	9 to 11 lbs. per cu. ft.
Flexural Strength	100 lbs. per sq. in.
Hygroscopicity	No increase in weight in 246 days in air at 90% relative humidity.
Modulus of Elasticity	200,000 lbs. per sq. in.
Shear Strength	64 lbs. per sq. in.
Specific Gravity	0.16
Specific Heat	0.20 BTU per lb.
Tensile Strength	84 lbs. per sq. in.
Thermal Conductivity	Shall not exceed values at the following mean temperatures:

Mean Temp. °F	Conductivity Btu/hr., sq. ft. °F, inch thick
50	0.40
300	0.55

Thermal Diffusivity	.0.40 sq. ft. per day
Water Absorption	.0.2% by volume on 2" x 12" x 18" block (all on surface only.)
Temperature Limits	Minus 350F to plus 600F

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II. SPECIFICATION 10-B

A. MATERIAL - contd

3. Accessory Materials

a. Cellular glass insulation

b. Asphalt - 180° Hot Asphalt

c. Asphaltic Cement - Pittsburgh-Corning Asphaltic cement, or approved alternate.

d. Felt - 15 lb. asphalt saturated

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II. SPECIFICATION 10-B

B. APPLICATION

1. Roof Decks (General)

   a. Unless otherwise specified, insulation in access of 2-1/2 inches total thickness shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, Part I.B.1.

   b. Roof Decks shall be plane, dry, clean and free from holes through which bitumens might drip. All materials used shall be dry before and during application.

   c. Insulation shall be adhered to the prepared surface by firmly embedding in molten hot asphalt. Mop only edges of block and area on which insulation can be immediately laid.

   d. Each layer of insulation shall be applied with all joints tightly butted and sealed with hot asphalt. Insulation shall be applied in parallel courses and all joints between blocks staggered. Asphalt shall be heated not more than 360°F.

   e. After insulation is installed as specified, entire surface shall be flood mopped with 1/16" inch thick (minimum) coat of hot asphalt and allowed to set. Any cracks or voids present after first mopping shall receive second mopping to insure complete seal prior to application of built-up-roof.

2. Flat Roofs

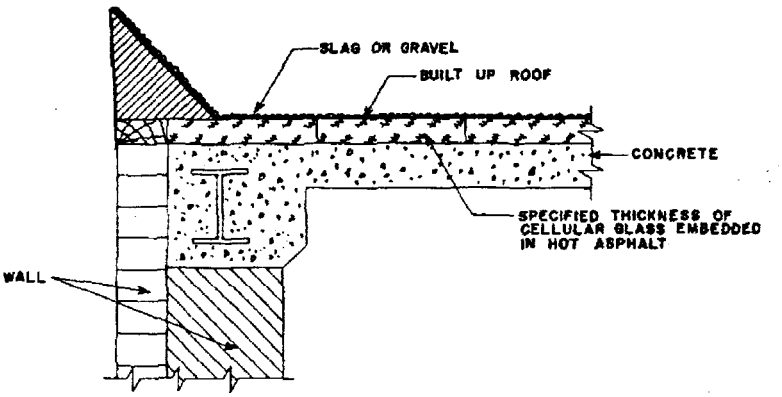
   Figures 10-B-1, 10-B-2, and 10-B-3 show typical insulation details of roofs having slopes that do not exceed two inches per foot.

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II. SPECIFICATION 10-B

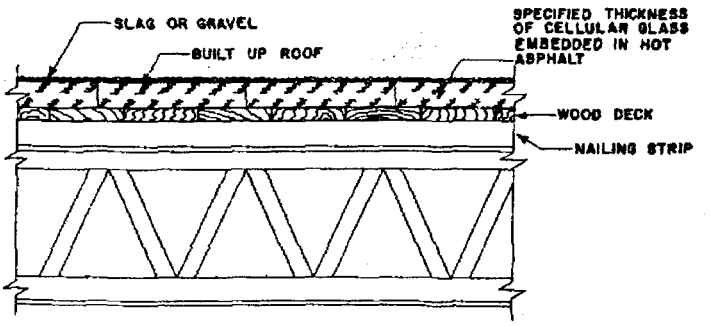
B. APPLICATION

2. Flat Roofs



CONCRETE ROOF DECK

FIGURE 10-B-1



WOOD ROOF DECK

FIGURE 10-B-2

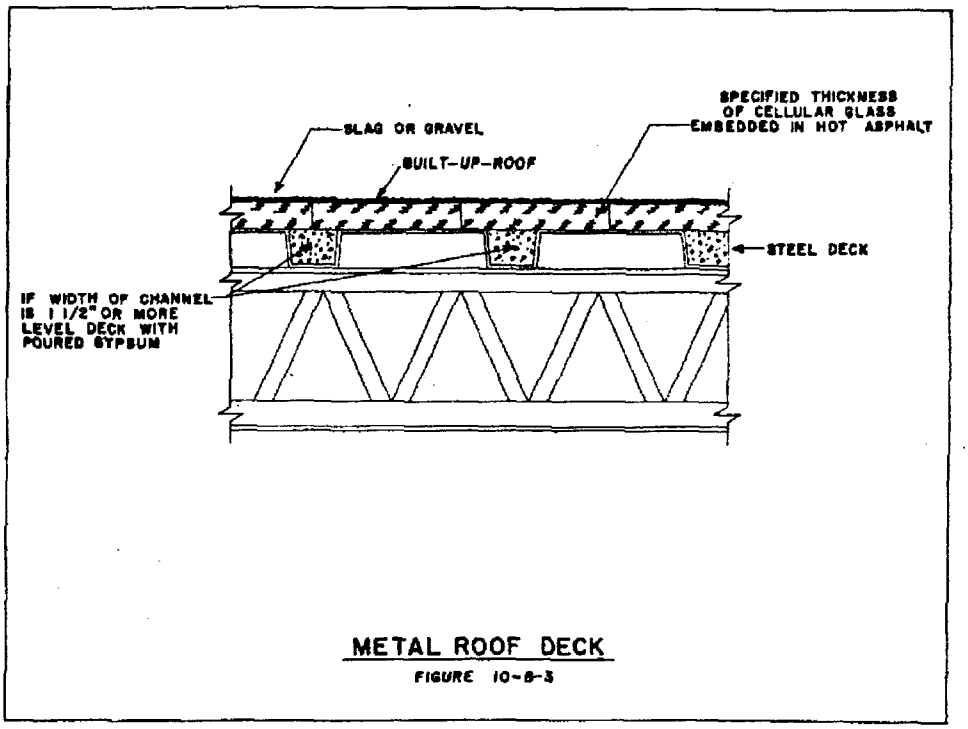
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II. SPECIFICATION 10-B

B. APPLICATION

2. Flat Roofs



METAL ROOF DECK

FIGURE 10-B-3

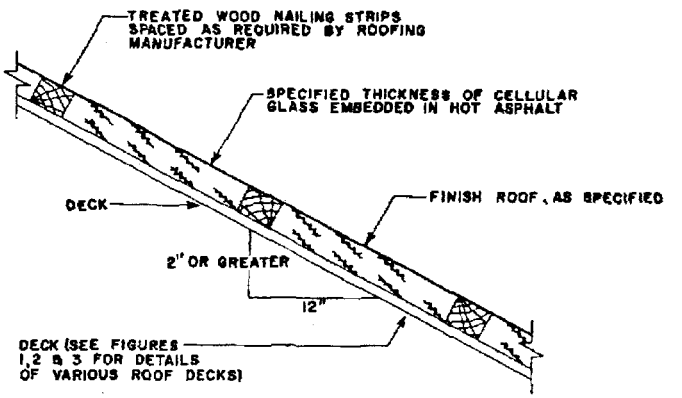
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II. SPECIFICATION 10-B

B. APPLICATION

3. Pitched Roofs

Where insulation is specified for roofs, having a slope in excess of two inches per foot, they shall be insulated as shown in Figure 10-B-4.



PITCHED ROOF DETAILS

FIGURE 10-B-4

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II. SPECIFICATION 10-B

B. APPLICATION - contd

4. Walls and Ceilings

a. Where cellular glass is specified for smooth surfaced interior walls or ceilings, it shall be applied in the following manner.

(1) Surfaces requiring insulation shall be dry, clean, smooth, and primed with a brush coat of hot asphalt.

(2) Cellular glass shall be applied using hot asphalt as an adhesive. Back of block and two adjacent edges shall be dipped in hot asphalt and applied to the primed surfaces while asphalt is still molten. Asphalt shall be heated not more than 360°F.

(3) Block shall be applied with all joints tightly butted, and fully sealed with asphalt. Thickness of asphalt joint shall not exceed 1/16 inch. Insulation shall be applied in parallel courses with all joints between blocks staggered.

b. Where cellular glass is specified for interior walls and ceilings, and surfaces are irregular, it shall be applied in the following manner.

(1) Surface requiring insulation shall be dry and clean.

(2) Cellular glass shall be applied with asphaltic cement gobs. Cement shall be applied near the four corners of the backface of the block, and a trowel coat of the same cement on two adjacent edges. Apply block with sufficient manual pressure to assure tight joints and good contact with the masonry wall. Thickness of asphalt joints shall not exceed 1/16 inch.

(3) All finish surfaces of insulation shall be true, plumb and flush.

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II. SPECIFICATION 10-B

B. APPLICATION - contd

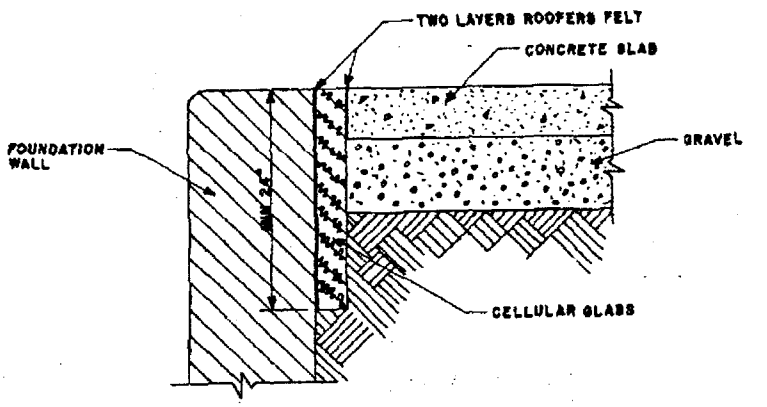
5. Concrete Floor Slabs

a. Foundation Wall Method

(1) Where specified, insulation shall be applied to foundation walls as shown in Figure 10-B-5.

(2) Insulation surfaces adjacent to foundation wall and floor slab shall be separated from the concrete with a layer of roofers felt cemented to the insulation block with hot asphalt.

(3) Blocks shall be installed with adjacent edges and back surfaces dipped in hot asphalt and applied while asphalt is still molten. All joints shall be tightly butted.



INSULATED FOUNDATION WALL

FIGURE 10-B-5

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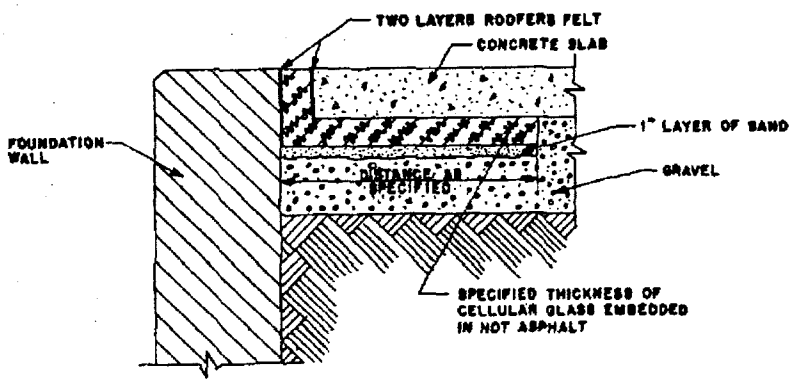
II. SPECIFICATION 10-B

B. APPLICATION - contd

5. Concrete Floor Slabs - contd

b. Slab-Border Method

(1) Where specified, insulation shall be applied to foundation walls as shown in Figure 10-B-6.



INSULATED FLOOR SLAB

FIGURE 10-B-6

(2) Insulation surfaces around the perimeter shall be separated from the slab edge and foundation with a layer of roofers felt cemented to the insulation block with hot asphalt.

(3) A layer of sand, approximately one inch in thickness, shall be applied over gravel before applying insulation.

(4) Blocks shall be installed with all joints tightly butted.

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II. SPECIFICATION 10-B

B. APPLICATION - contd

5. Concrete Floor Slabs - contd

b. Slab-Border Method

(5) After insulation is installed as specified, entire surface shall be flood mopped with a 1/16 inch thick (minimum) coat of hot asphalt prior to pouring of floor slab. Asphalt shall be heated to a temperature not exceeding 360°F.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 10-H — Cellular-Glass

Scope

This specification describes the essential requirements for the purchase and application of preformed cellular-glass insulation, for use on equipment and piping normally operating at temperatures above 70°F. and up to 600°F. It is applicable to both indoor and outdoor service.

Procedures outlined in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this specification.

A. MATERIAL

1. Composition

Material shall be composed of glass, completely inorganic, processed and molded at temperatures sufficient to produce a rigid, cellular thermal insulation.

2. Properties

Cellular glass insulation shall have the following properties:

Acid Resistance	Impervious to common acids and acid fumes.
Alkalinity	pH = 7.5
Capillarity	0
Coefficient of Expansion . .	0.0000040 per °F
Combustibility	Incombustible
Composition	A true glass; completely inorganic.

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II. SPECIFICATION 10-H

A. MATERIAL - contd

2. Properties - contd

Compressive Strength	100 lbs. per sq. in.
Density	9 to 11 lbs. per cu. ft.
Flexural Strength	100 lbs. per sq. in.
Hygroscopicity	No increase in weight in 246 days in air at 90% relative humidity.
Modulus of Elasticity	200,000 lbs. per sq. in.
Shear Strength	64 lbs. per sq. in.
Specific Gravity	0.16
Specific Heat	0.20 Btu per lb.
Tensile Strength	84 lbs. per sq. in.
Thermal Conductivity	Shall not exceed values at the following mean temperatures:

Mean Temp. °F	Conductivity Btu/hr., sq. ft., °F, inch thick
50	0.40
300	0.55

Thermal Diffusivity	0.40 sq. ft. per day
Water Absorption	0.2% by volume on 2" x 12" x 18" block (all on surface only.
Temperature Limits	Minus 350F to plus 600F.

3. Accessory Materials

a. Cellular glass insulation

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II. SPECIFICATION 10-H

A. MATERIAL - contd

3. Accessory Materials - contd

b. Cushioning material
Equipment - 1-1/2 lb. density, Aerowrap P-308, Fine Fyber Felt.
Piping - Piping 350F and under, Ultrafine, Superfine, Mono-Kover. Piping above 350F, Aerowrap P-308.

c. Stainless Steel Wire - .0475 inch dia., type 304, cold drawn, bright annealed, 18 gage.

d. Stainless Steel Insulation Strap - 1/2 inch x .020 inch, type 304 or approved alternate.

e. Stainless Steel Die Cut Strap - 3/4 inch x .023 inch, 2-inch fingers on 9-inch centers, A. J. Gerrard or approved alternate.

f. Stainless Steel Clips - Double pronged, type 304, A. J. Gerrard or approved alternate.

g. Strap Anchor Clip - A. J. Gerrard's strap hanger.

h. Anti-Abrasion Coating - Keen Cement or approved alternate.

i. Weather-Barrier Coating - (color as specified) - Vimasco WC-1, Benjamin Foster Sealfas "C", or approved alternate.

j. Reinforcing Cloth - Glass fiber, 10 x 10 thread count, Perma Glas Mesh, or approved alternate.

k. Staples - 5/8 inch x 1/2 inch, stainless steel, A. J. Gerrard or approved alternate.

l. Adhesive Cement - Miracle Adhesive Type H or approved alternate.

m. Fabricating Cement - Miracle Adhesive RT-1000 P or approved alternate.

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II. SPECIFICATION 10-H

A. MATERIAL - contd

3. Accessory Materials - contd

n. Heat Resistant Sealer - Benjamin Foster No. 30-43 or approved alternate.

o. Glass Wool Blanket - White glass wool, Hex Netting one side, expanded metal lath on other side - Fiber-glas Metal Mesh Blanket.

p. Insulating Cement - Hydraulic setting - Baldwin-Hill Powerhouse, Eagle Picher one coat or approved alternate.

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II. SPECIFICATION 10-H

B. APPLICATION

1. Equipment

a. Insulation Supports

Equipment shall be provided with insulation supports as called for in the GENERAL SPECIFICATIONS, Part I.B.4.

b. Thickness Schedule

Unless otherwise specified, insulation in excess of 2-1/2 inches total thickness shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, Part I.B.1.

c. Cushioning Blanket

(1) On horizontal equipment, a one-half inch thick blanket shall be applied over the entire surface, as a cushioning material, prior to the application of the cellular glass insulation.

(2) On vertical equipment, two layers of one-half inch thick cushioning material shall be applied over the top head, and one layer of one-half inch thick cushioning material over the sides and bottom head. Blanket shall be secured in place with a minimum amount of No. 18 gage stainless steel wire. Cellular glass insulation shall then be applied over blanket in manner described in this specification. Cushioning material will not be considered as part of the specified insulation thickness.

d. Curved Surfaces

Cellular glass block insulation (curved segments or shaped head segments) shall be shop fabricated and fitted to a one-inch greater diameter than that of the

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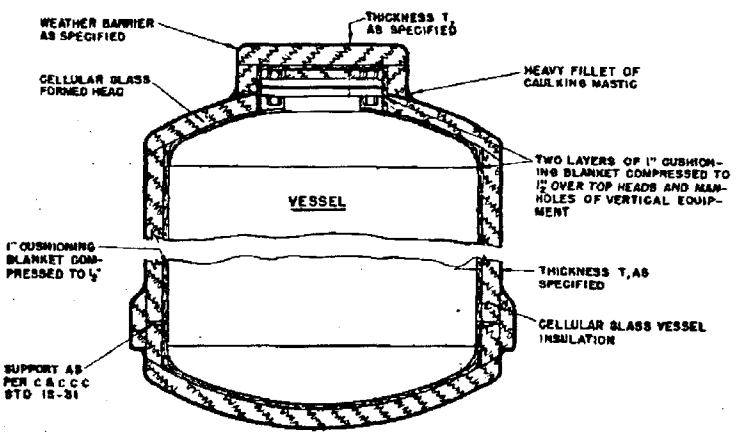
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

d. Curved Surfaces - contd

vessel to which it is applied. Block insulation shall be applied to equipment with all joints tightly butted. Multiple layers of insulation shall be so applied that the butt joints of one layer do not coincide with those of any other layer. Typical installation is shown on Figure 10-H-1.



APPLICATION OF CELLULAR GLASS INSULATION TO VESSEL HEAD & NOZZLE

FIG. 10-H-1

e. Flat Surfaces

Flat block shall be applied to flat surfaces in the same manner as previously specified for curved surfaces when operating temperature of equipment is in excess of 150 F. When operating temperature of equipment is 150 F or below, cushioning material will be omitted and block applied directly to metal surfaces. Securement shall be as specified in the Insulation Design Schedule and/or Line List.

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II. SPECIFICATION 10-H

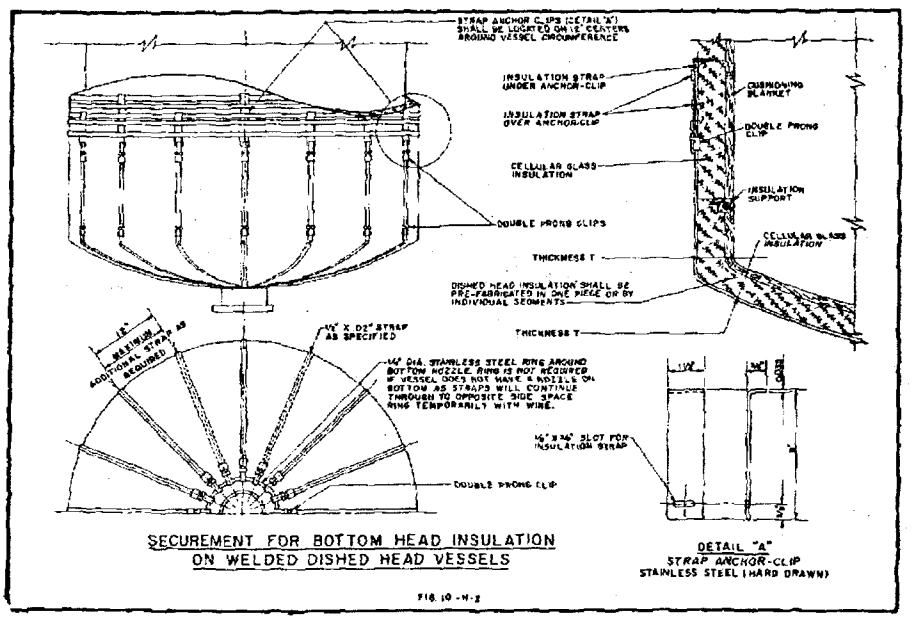
B. APPLICATION - contd

1. Equipment - contd

f. Securement

(1) Where contour of vessel permits firm and effective attachment, all layers of cellular glass insulation shall be secured in place with stainless steel insulation strap. Insulation applied to ir regular surfaces, where use of insulation strap is impracticable, shall be secured with No. 18 gage stainless steel wire.

(2) Inner layer or layers of cellular glass insulation on bottom heads of vertical equipment or heads of horizontal equipment shall be held in place with specified stainless steel wire secured to support as shown in UCCC Standards IS-21, IS-36, and IS-42. Outer layer of cellular glass insulation on bottom heads of vertical equipment, or heads of horizontal equipment shall be secured with insulation strap as shown in Figure 10-H-2.



SECUREMENT FOR BOTTOM HEAD INSULATION ON WELDED DISHED HEAD VESSELS

FIG. 10-H-2

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II. SPECIFICATION 10-H

B. APPLICATION - contd

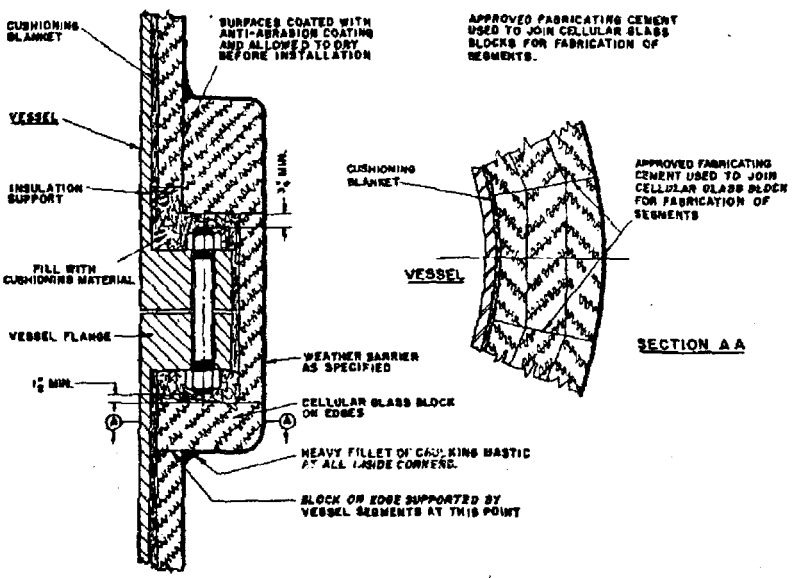
1. Equipment - contd

f. Securement - contd

(3) Where specified, block shall be applied directly to metal surfaces, such as duct work, with adhesive or other approved securement. Where block is specified to be secured with adhesive, it shall be embedded firmly into a surface coat.

g. Expansion joint

(1) Cellular glass applications shall be provided with expansion joints at vessel flanges constructed as shown in Figure 10-H-3.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT FLANGE

FIG. 10-H-3

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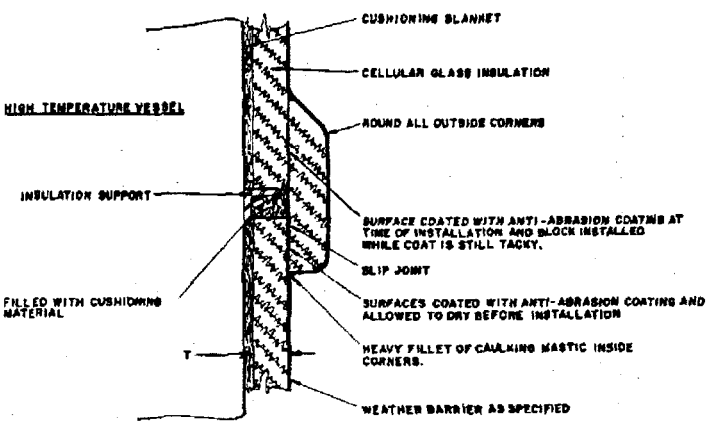
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

g. Expansion Joint - contd

(2) Longitudinal expansion of vessels shall be provided by installing expansion joints at the insulation supports as shown in Figure 10-H-4. When more than one thickness is specified for a vessel, an insulation support shall be provided at the junction of two different thicknesses and insulated in similar manner as shown in Figure 10-H-4.



APPLICATION OF CELLULAR GLASS INSULATION TO EXPANSION JOINT

FIG. 10-H-4

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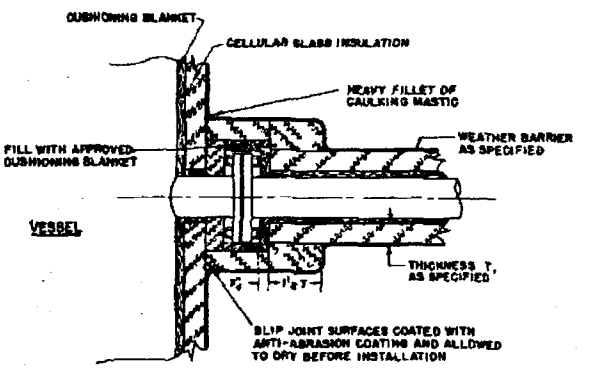
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

g. Expansion Joint - contd

(3) One inch of cushioning material shall be packed around nozzles and projections where they extend through the insulation, to prevent crushing of the insulation by contraction and expansion of the vessel. Typical application is shown in Figure 10-H-5.



APPLICATION OF CELLULAR GLASS INSULATION TO NOZZLE

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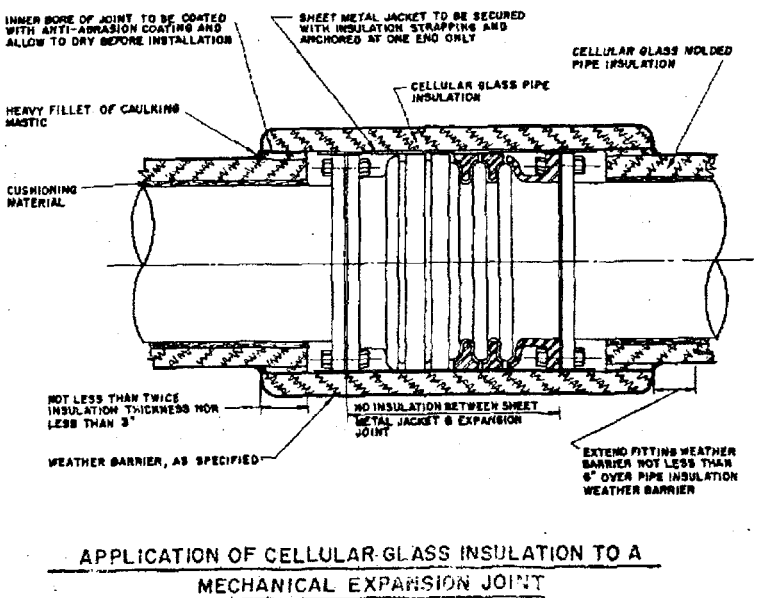
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

g. Expansion Joints - contd

(4) Corrugated mechanical expansion joints on piping (usually listed as equipment item) where cellular glass products are specified shall be as shown in Figure 10-H-6.



APPLICATION OF CELLULAR GLASS INSULATION TO A MECHANICAL EXPANSION JOINT

FIG. 10-H-6

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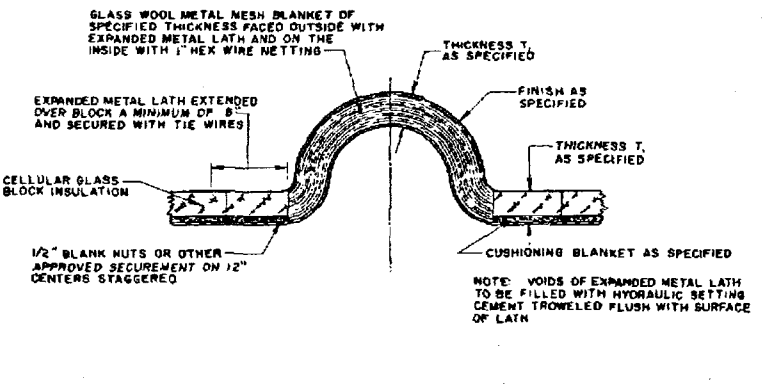
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

g. Expansion Joints - contd

(5) Expansion joints in flat surfaces or cylindrical vessels shall be insulated with flexible blanket insulation to permit movement of the expansion joint. Typical installation is shown in Figure 10-H-7.



APPLICATION OF BLANKET INSULATION TO EXPANSION JOINTS ON FLAT SURFACE

FIG. 10-H-7

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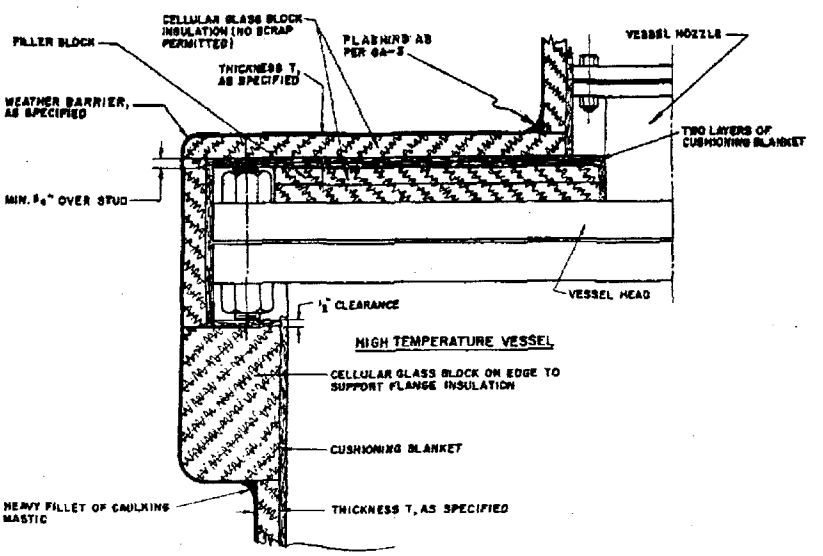
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

i. Flat Heads

(1) Insulation on top flat heads of vertical equipment shall be applied in the same manner as previously described in this specification. Water pockets shall be eliminated and proper drainage provided as shown in Figure 10-H-8.



APPLICATION OF CELLULAR GLASS INSULATION TO FLAT EQUIPMENT HEAD

Fig. 10-H-8

(2) All nozzles on top of insulated equipment shall be provided with flashing as shown in Figure GA-3, of GENERAL SPECIFICATIONS.

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II. SPECIFICATION 10-H

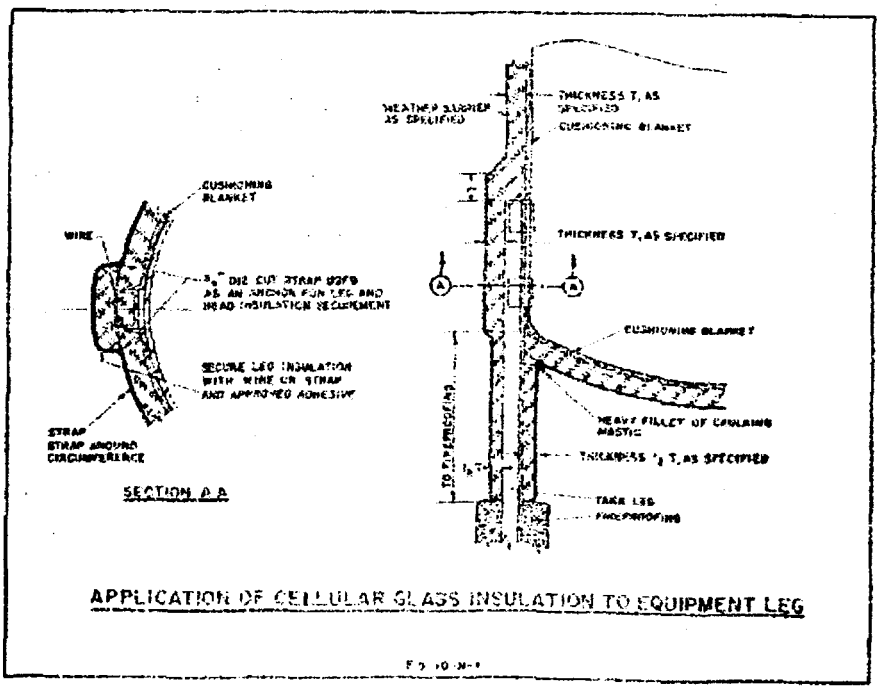
B. APPLICATION - contd

1. Equipment - contd

j. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down channel legs to junction with any fire resistant material. Thickness shall be one-half that specified for body of vessel. Body insulation shall be brought up to and butted firmly against tank leg flange.

(2) Re-entrant space between channel flanges and over channel flanges between body insulation shall be filled with block cemented in place with an approved adhesive. Surface of fireproofing material abutting tank leg insulation shall be coated with specified weathercoating. Installation shall be as shown in Figure 10-H-9.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT LEG

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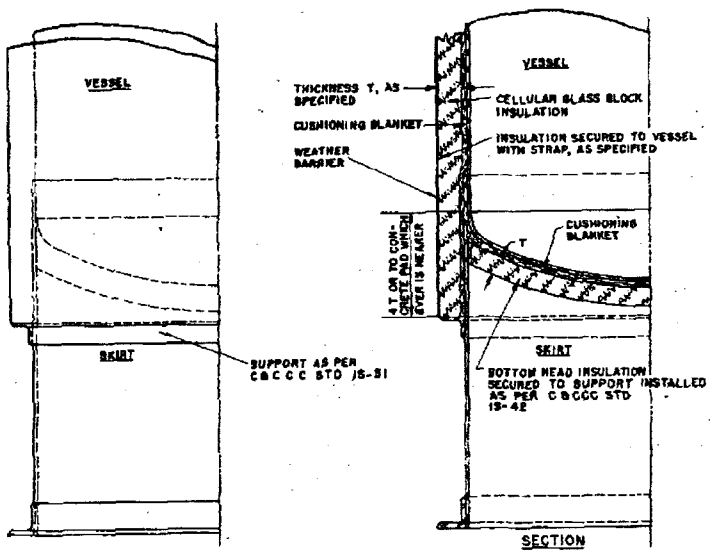
II. SPECIFICATION 10-H

B. APPLICATION - contd

1. Equipment - contd

k. Vessel Skirts

Skirts supporting vertical equipment shall be insulated outside. Insulation shall extend downward, from junction of skirt with bottom head, a distance of not less than four times the specified thickness or to concrete pad, whichever is nearer. Where specified, entire surface of skirt shall be insulated. Thickness shall be as specified for body of vessel. An insulation support shall be provided for securement of bottom head insulation in accordance with UCCC Standard IS-42. Installation shall be as shown in Figure 10-H-10.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT SKIRT

FIG. 10-H-10

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II. SPECIFICATION 10-H

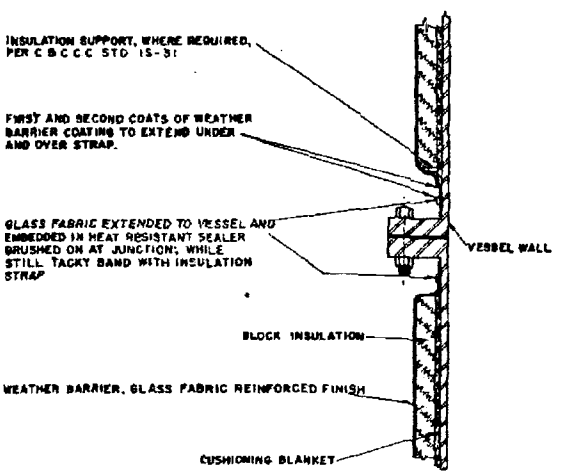
B. APPLICATION - contd

1. Equipment - contd

1. Weather-Barrier

(1) Weather-barrier shall be applied in accordance with GENERAL SPECIFICATION I. B. 9 and 16.

(2) Weather-barrier membrane shall be carried out 3 inches onto any metal, beyond termination of insulation. Where operating temperatures are above 300 F, the portion of the weather-barrier in contact with metal shall consist of reinforcing cloth embedded in heat resistant sealer instead of the weather-coating. A second application of the heat resistant sealer shall then be applied over the reinforcing cloth and, while still tacky, the weather membrane shall be secured with strap where practical. Securement shall then be coated with heat resistant sealer. Typical installation is shown in Figure 10-H-11.



APPLICATION OF CELLULAR GLASS INSULATION AROUND UNINSULATED FLANGES

FIG. 10-H-11

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II. SPECIFICATION 10-H

B. APPLICATION - contd

2. Piping

a. Pipe Insulation

(1) Insulation thicknesses in excess of 2-1/2 inches shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, I.B.4.

(2) Pipe insulation shall be applied to piping in a staggered position in accordance with Figures GA-1 and GA-2 of the GENERAL SPECIFICATION.

(3) Piping, operating at temperatures 350 F and below, shall have one-half inch thick preformed cushioning material applied prior to application of cellular glass insulation and secured with a minimum of four (4) staples per three foot section. Piping operating at temperatures above 350 F, or where preformed cushioning material is not available, shall have one-half inch thick cushioning blanket secured with glass tying cord, applied prior to application of insulation. Cushioning material shall not be considered as part of insulation thickness.

(4) Insulation shall be applied with all joints tightly butted and fitted, to eliminate voids. Large voids shall not be filled with weather-barrier coating, but eliminated either by refitting or replacing insulation. Any rounded corners on the insulation surfaces to be butted shall be trued before application.

(5) Butt edges and ends of all inner layers shall be given a smooth brush or spray coat of anti-abrasion coating and allowed to dry for a minimum of one-half hour, but preferably two hours, before application. Care shall be exercised to obtain a thin even coat of sufficient thickness only to cover and fill the cut cells of the insulation.

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II. SPECIFICATION 10-H

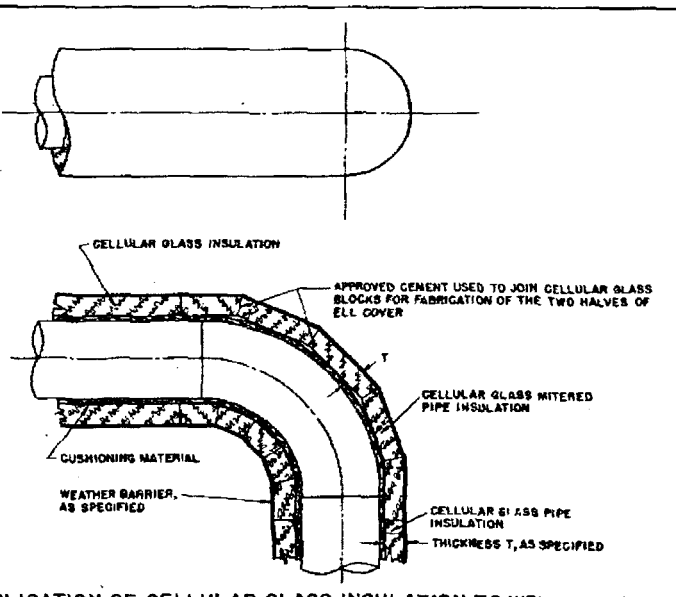
B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers

(1) Welded fitting covers shall be fabricated to an inside diameter one-inch greater than the outside diameter of the welded fitting to allow for cushioning material.

(2) Fitting, flange and valve covers shall be shop fabricated in accordance with the *UCCC Dimensional Standards Fabrication Manual*. Installation of typical fittings and valves are shown in Figures 10-H-12, 10-H-13, 10-H-14, 10-H-15, 10-H-16.



APPLICATION OF CELLULAR GLASS INSULATION TO WELDED ELL

FIG. 10-H-12

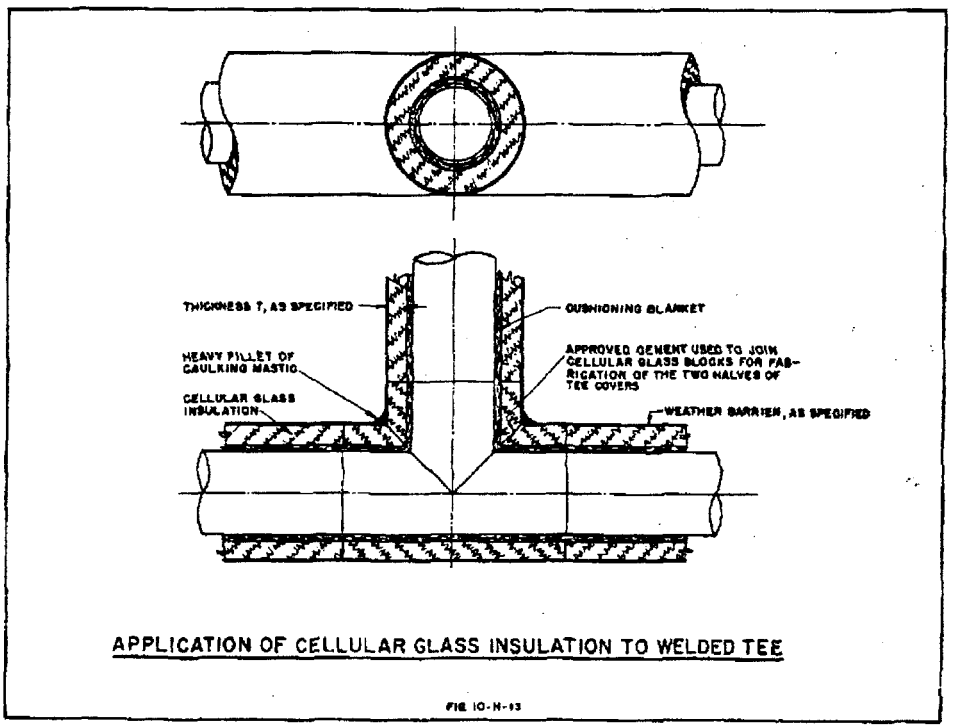
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II. SPECIFICATION 10-H

B. APPLICATION - contd

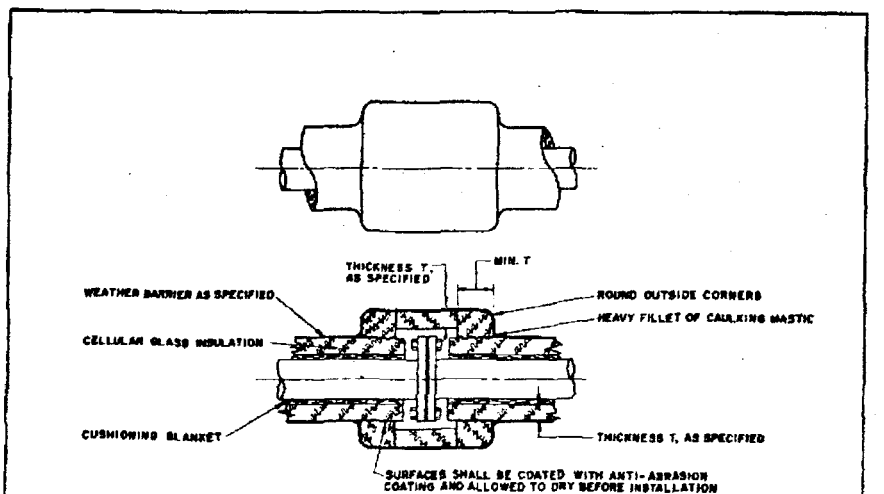
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO WELDED TEE

FIG 10-H-13



APPLICATION OF CELLULAR GLASS INSULATION TO LINE FLANGE

FIG 10-H-14

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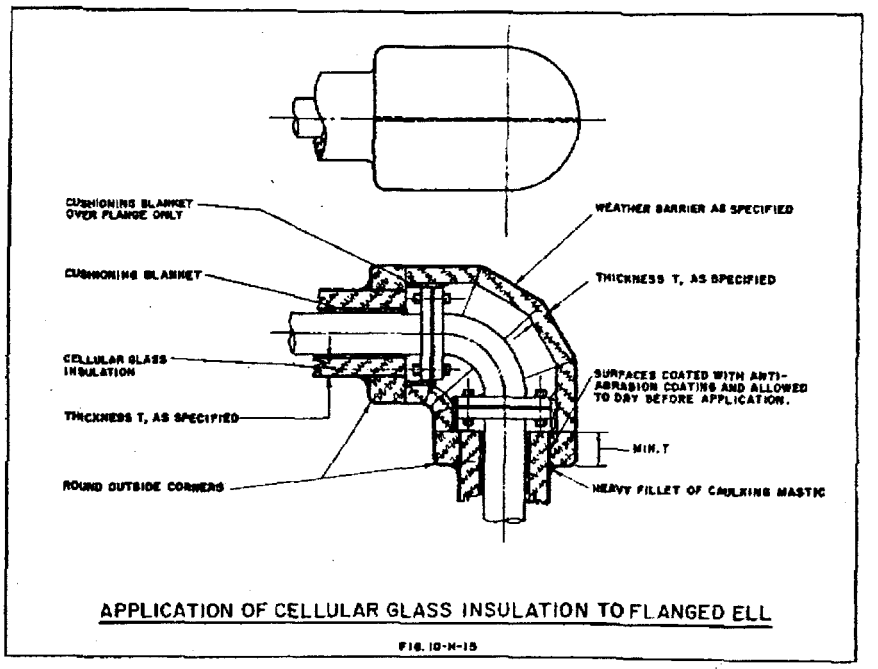
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II. SPECIFICATION 10-H

B. APPLICATION - contd

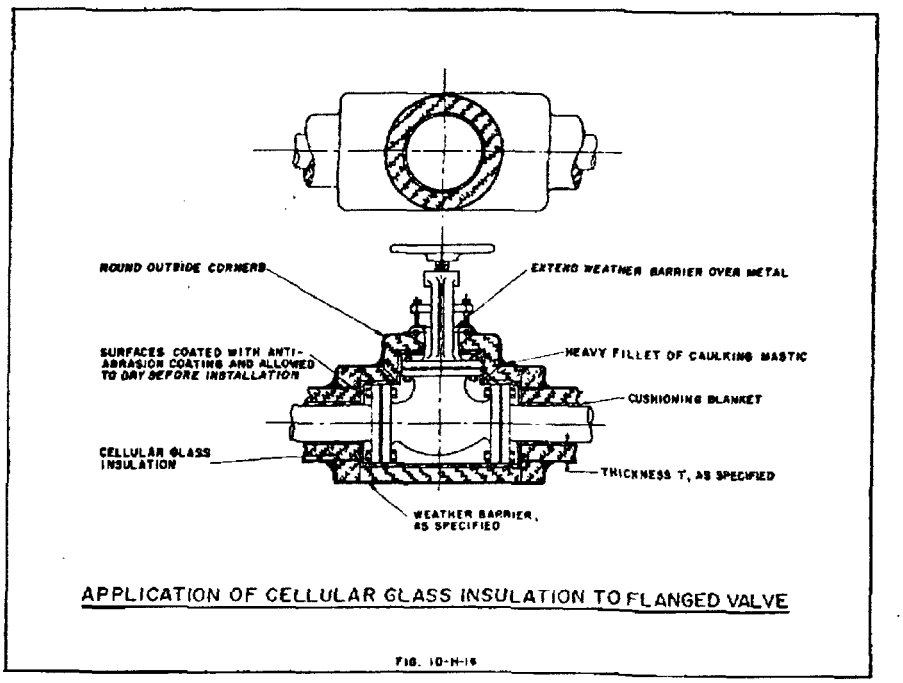
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO FLANGED ELL

FIG. 10-H-15



APPLICATION OF CELLULAR GLASS INSULATION TO FLANGED VALVE

FIG. 10-H-16

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II. SPECIFICATION 10-H

B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers - contd

(3) All valves shall be packed and filled around valve stem and packing gland assembly with heat resistant sealer to avoid water pocket.

(2) Cementing of shop assemblies shall be done with specified fabricating cement. In all cases the joints shall be as thin as possible with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids and holes plugged with cement, be permitted.

c. Securement

(1) All layers of cellular glass pipe insulation shall be secured with insulation strap.

(2) Location of strap shall be as described in the GENERAL SPECIFICATION, I.B. 5, 6, & 7.

d. Weather Barrier Coating

Weather barrier shall be installed in accordance with the GENERAL SPECIFICATION, I.B. 16.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 10-J — Cellular-Glass

Scope

This specification describes the essential requirements for the purchase and application of preformed cellular-glass insulation, for use on equipment and piping normally operating at temperatures above 70°F and up to 500°F. It is applicable to both indoor and outdoor service.

A. MATERIAL

1. Composition

Material shall be composed of glass, completely inorganic, processed and molded at temperatures sufficient to produce a rigid, cellular thermal insulation.

2. Properties

Cellular glass insulation shall have the following properties:

Acid Resistance	Impervious to common acids and acid fumes.
Alkalinity	pH = 7.5
Capillarity	0
Combustibility	Incombustible
Composition	A true glass; completely inorganic.
Compressive Strength . . .	100 lbs. per sq. in.
Density	9 to 11 lbs. per cu. ft.

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II. SPECIFICATION 10-J

A. MATERIAL - contd

2. Properties - contd

Flexural Strength.	100 lbs. per sq. in.
Hygroscopicity.	No increase in weight in 246 days in air at 90% relative humidity.
Modulus of Elasticity . . .	200,000 lbs. per sq. in.
Shear Strength.	64 lbs. per sq. in.
Specific Gravity	0.16
Specific Heat	0.20 Btu per lb.
Tensile Strength	84 lbs. per sq. in.
Thermal Conductivity	Shall not exceed values at the following mean temperatures:

Mean Temp. °F	Conductivity Btu/hr., sq.ft., °F, inch thk.
50	0.40
300	0.55

Thermal Diffusivity	0.40 sq. ft. per day
Water Absorption.	0.2% by volume on 2" x 12" x 18" block (all on surface only.
Temperature Limits. . . .	Minus 350F to plus 600F.

3. Accessory Materials

a. Cellular glass insulation

b. Stainless Steel Wire - .0475 inch dia., type 304, cold drawn, bright annealed, 18 gage.

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II. SPECIFICATION 10-J

A. MATERIAL - contd

3. Accessory Materials - contd

c. Stainless Steel Insulation Strap - 1/2 inch x .020 inch type 304 or approved alternate.

d. Stainless Steel Die Cut Strap - 3/4 inch x .023 inch, 2-inch fingers on 9-inch centers, A. J. Gerrard or approved alternate.

e. Stainless Steel Clips - Double pronged, type 304, A. J. Gerrard or approved alternate.

f. Strap Anchor Clip - A. J. Gerrard's strap hanger.

g. Anti-Abrasion Coating - Carlon No. 500-H or approved alternate.

h. Weather-Barrier Coating - (color as specified) - Vimasco WC-1, Benjamin Foster Sealfas "C", or approved alternate.

i. Reinforcing Cloth - Glass fiber, 10 x 10 thread count, Perma Glas Mesh, or approved alternate.

j. Adhesive Cement - Miracle Adhesive Type H or approved alternate.

k. Fabricating Cement - Miracle Adhesive RT-1000P or approved alternate.

l. Heat Resistant Sealer - Benjamin Foster No. 30-43 or approved alternate.

m. Glass Wool Blanket - White glass wool, Hex Netting one side, expanded metal lath on other side - Fiber-glas Metal Mesh Blanket.

n. Insulating Cement - Hydraulic setting - Baldwin - Hill Powerhouse, Eagle Picher one coat or approved alternate.

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II. SPECIFICATION 10-J

B. APPLICATION

1. Equipment

a. Insulation Supports

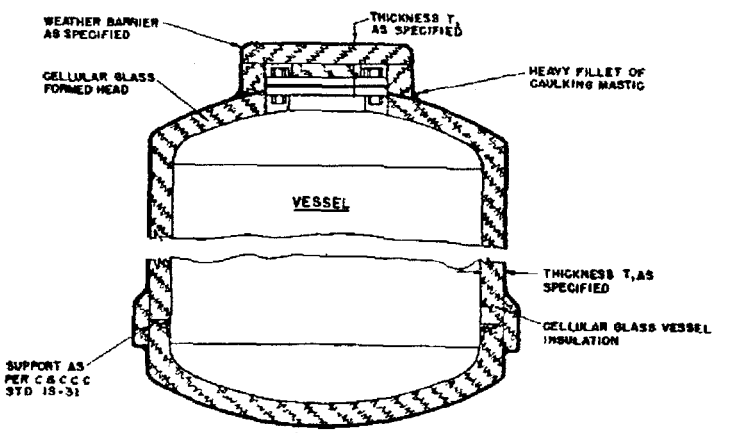
Equipment shall be provided with insulation supports as called for in the GENERAL SPECIFICATIONS, Part I.B.4.

b. Thickness Schedule

Unless otherwise specified, insulation in excess of 2-1/2 inches total thickness shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, Part I.B.1.

c. Curved Surfaces

(1) Cellular glass block insulation (curved segments or shaped head segments) shall be shop fabricated to fit the diameter of the vessel to which it is applied. Block insulation shall be applied to equipment with all joints tightly butted. Multiple layers of insulation shall be so applied that the butt joints of one layer do not coincide with those of any other layer. Typical installation is shown in Figure 10-J-1.



APPLICATION OF CELLULAR GLASS INSULATION TO VESSEL HEAD & NOZZLE

FIG. 10-J-1

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II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

c. Curved Surfaces - contd

(2) Inner surface of vessel insulation shall be coated with anti-abrasion coating, of just sufficient thickness to fill half cells, and allowed to dry before installation.

d. Flat Surfaces

Flat block shall be applied to flat surfaces in the same manner as previously specified for curved surfaces.

e. Securement

(1) Where contour of vessel permits firm and effective attachment, all layers of cellular glass insulation shall be secured in place with stainless steel insulation strap. Insulation applied to irregular surfaces, where use of insulation strap is impracticable, shall be secured with No. 18 gage stainless steel wire.

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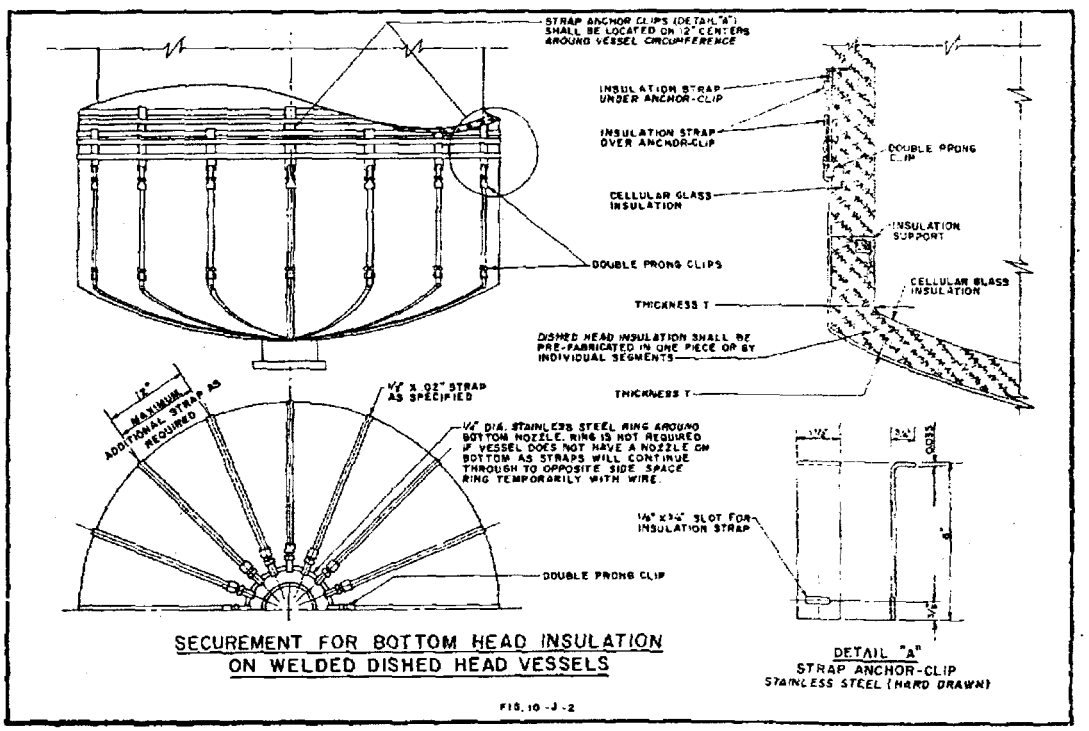
II. SPECIFICATION 10-J

B. APPLICATION - *contd*

1. Equipment - contd

e. Securement - contd

(2) Inner layer or layers of cellular glass insulation on bottom heads of vertical equipment or heads of horizontal equipment shall be held in place with specified stainless steel wire secured to support as shown in UCCC Standards IS-31, IS-36, and IS-42. Outer layer of cellular glass insulation on bottom heads of vertical equipment, or heads of horizontal equipment shall be secured with insulation strap as shown in Figure 10-J-2.



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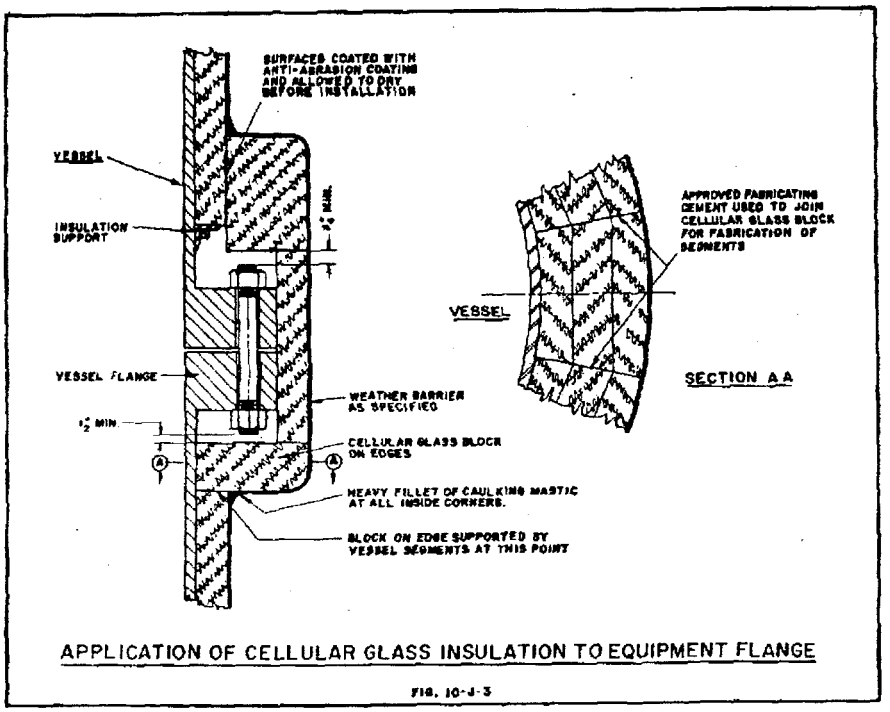
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joint

(1) Cellular glass applications shall be provided with expansion joints at vessel flanges constructed as shown in Figure 10-J-3.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT FLANGE

FIG. 10-J-3

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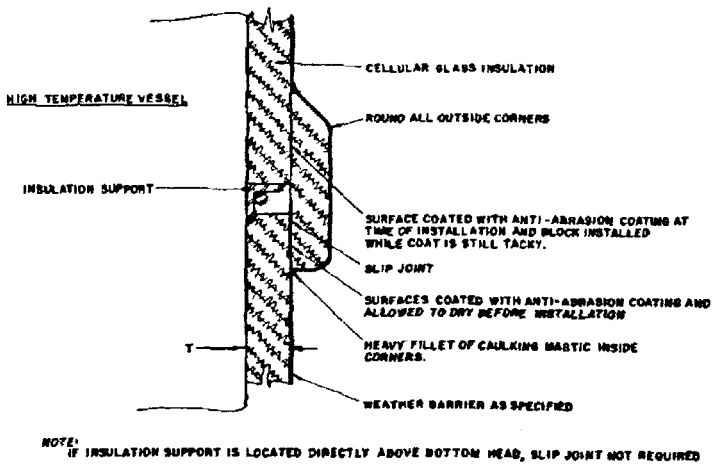
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joint

(2) Longitudinal expansion of vessels shall be provided by installing expansion joints at the insulation supports as shown in Figure 10-J-4. When more than one thickness is specified for a vessel, an insulation support shall be provided at the junction of two different thicknesses and insulated in a similar manner as shown in Figure 10-J-4.



APPLICATION OF CELLULAR GLASS INSULATION TO EXPANSION JOINT

FIG. 10-J-4

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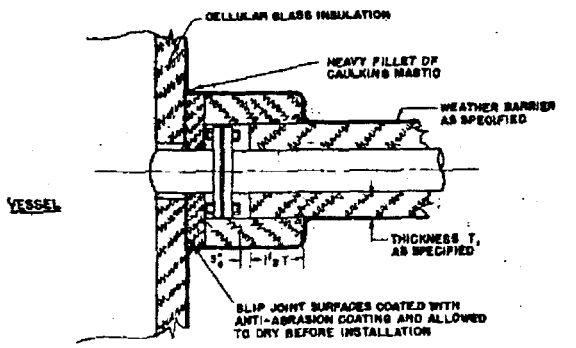
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joint - contd

(3) Where nozzles and projections extend through the insulation, they shall be insulated as shown in Figure 10-J-5.



APPLICATION OF CELLULAR GLASS INSULATION TO NOZZLE

FIG. 10-J-5

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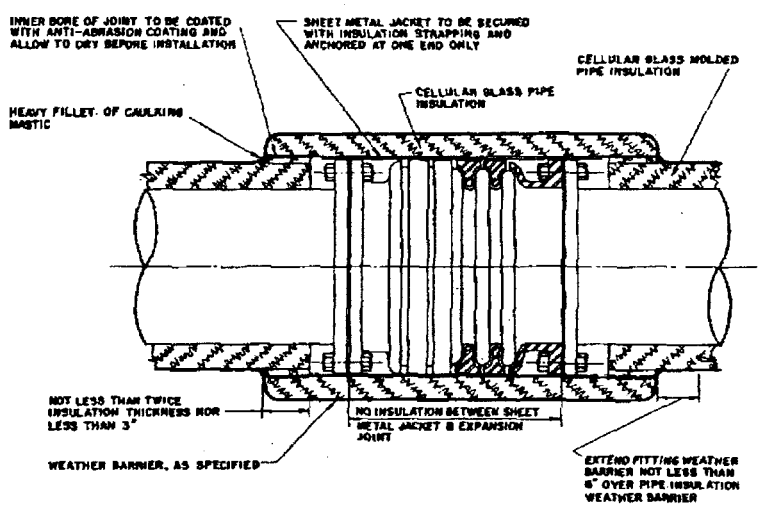
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joint - contd

(4) Corrugated mechanical expansion joints on piping (usually listed as equipment item) where cellular glass products are specified shall be as shown in Figure 10-J-6.



APPLICATION OF CELLULAR GLASS INSULATION TO A MECHANICAL EXPANSION JOINT

FIG. 10-J-6

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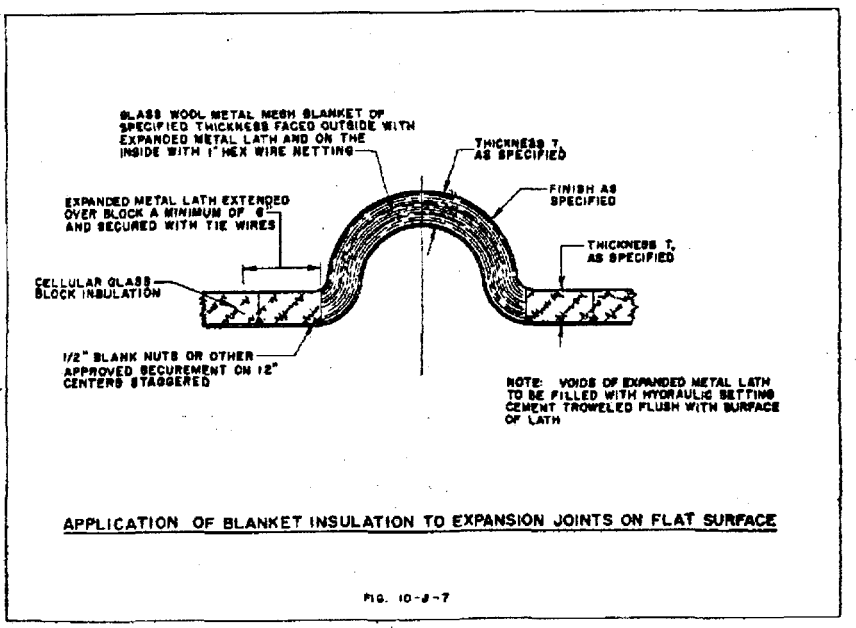
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joints - contd

(5) Expansion joints in flat surfaces or cylindrical vessels shall be insulated with flexible blanket insulation to permit movement of the expansion joint. Typical installation is shown in Figure 10-J-7.



APPLICATION OF BLANKET INSULATION TO EXPANSION JOINTS ON FLAT SURFACE

FIG. 10-J-7

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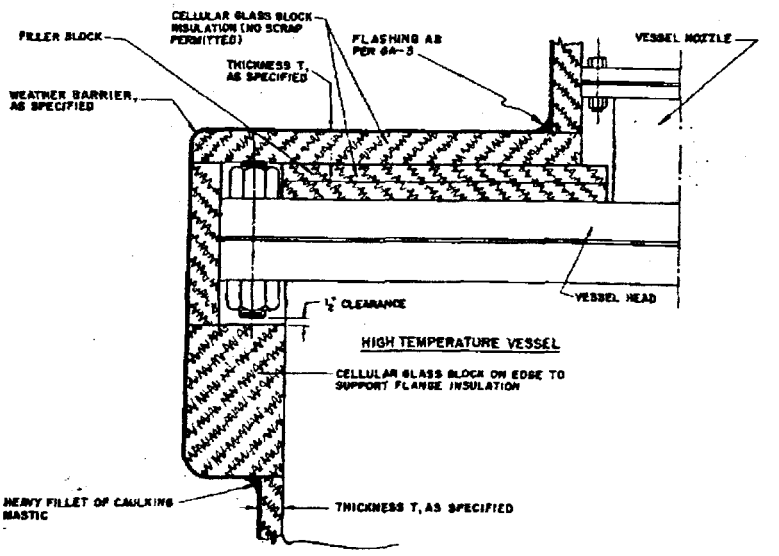
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

g. Flat Heads

(1) Insulation on top flat heads of vertical equipment shall be applied in the same manner as previously described in this Specification. Water pockets shall be eliminated and proper drainage provided as shown in Figure 10-J-8.



APPLICATION OF CELLULAR GLASS INSULATION TO FLAT EQUIPMENT HEAD

FIG. 10-J-8

(2) All nozzles on top of insulated equipment shall be provided with flashing as shown in Figure GA-3, of GENERAL SPECIFICATIONS, I.B.8.

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II. SPECIFICATION 10-J

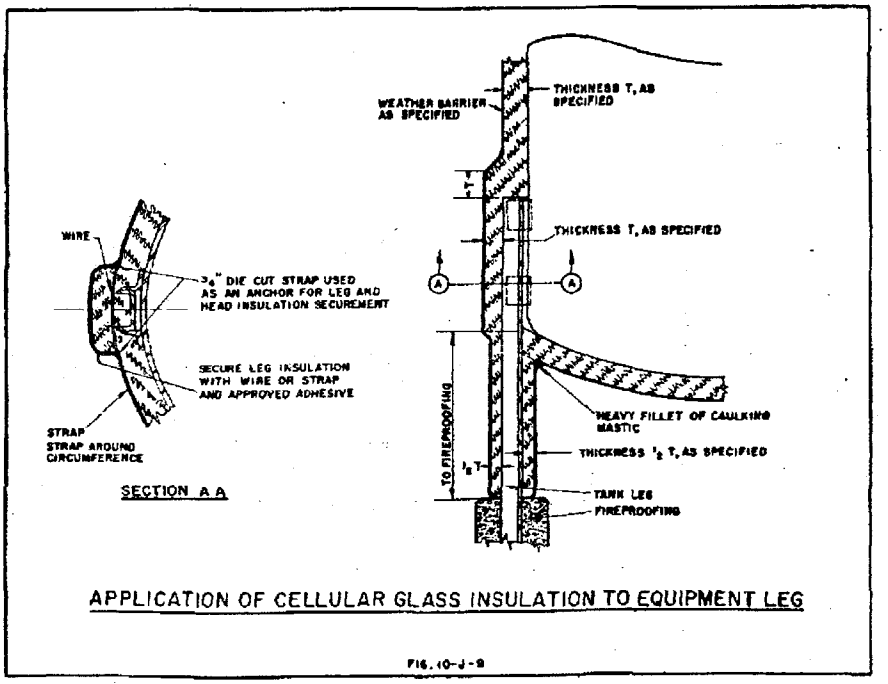
B. APPLICATION - contd

1. Equipment - contd

h. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down channel legs to junction with any fire resistant material. Thickness shall be one-half that specified for body of vessel. Body insulation shall be brought up to and butted firmly against tank leg flange.

(2) Re-entrant space between channel flanges and over channel flanges between body insulation shall be filled with block cemented in place with an approved adhesive. Surface of fireproofing material abutting tank leg insulation shall be coated with specified weathercoating. Installation shall be as shown in Figure 10-J-9.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT LEG

FIG. 10-J-9

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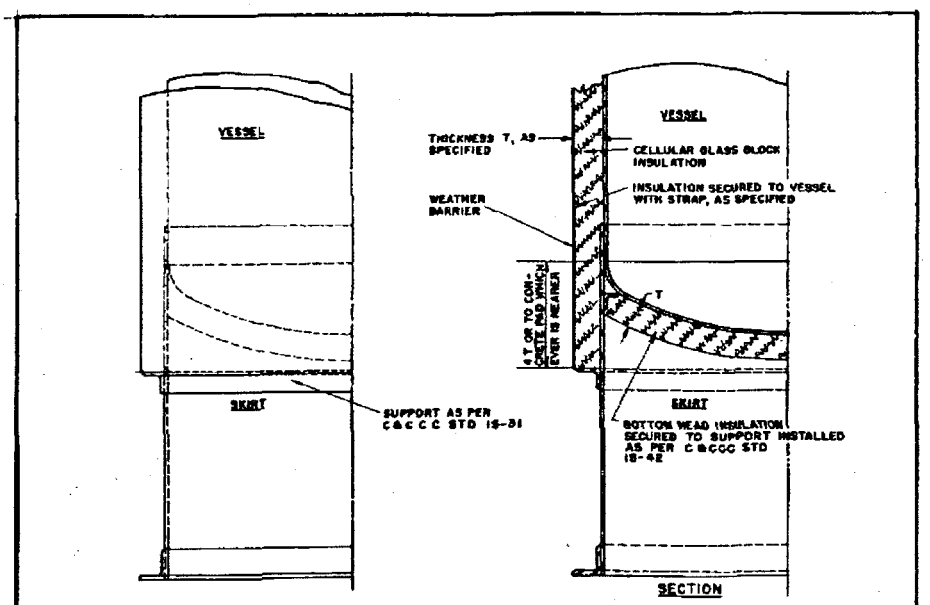
II. SPECIFICATION 10-J

B. APPLICATION - contd

1. Equipment - contd

i. Vessel Skirts

Skirts supporting vertical equipment shall be insulated outside. Insulation shall extend downward, from junction of skirt with bottom head, a distance of not less than four times the specified thickness or to concrete pad, whichever is nearer. Where specified, entire surface of skirt shall be insulated. Thickness shall be as specified for body of vessel. An insulation support shall be provided for securement of bottom head insulation in accordance with UCCC Standard IS-42. Installation shall be as shown in Figure 10-J-10.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT SKIRT

FIG. 10-J-10

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II. SPECIFICATION 10-J

B. APPLICATION - contd

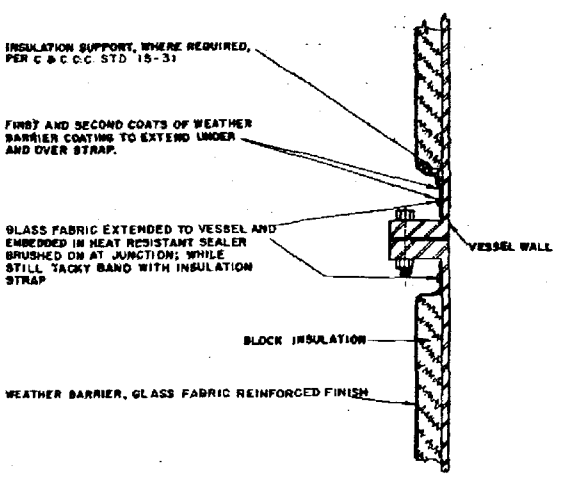
1. Equipment - contd

j. Weather-Barrier

(1) Insulation shall be coated with a weather-barrier before equipment is put in service.

(2) Weather-barrier shall be applied in accordance with GENERAL SPECIFICATION, I.B. 9 and 16.

(3) Weather-barrier membrane shall be carried out 3 inches onto any metal, beyond termination of insulation. Where operating temperatures are above 300 F, the portion of the weather-barrier in contact with metal shall consist of reinforcing cloth embedded in heat resistant sealer instead of the weather-coating. A second application of the heat resistant sealer shall then be applied over the reinforcing cloth and, while still tacky, the weather membrane shall be secured with strap where practical. Securement shall then be coated with heat resistant sealer. Typical installation is shown in Figure 10-J-11.



APPLICATION OF CELLULAR GLASS INSULATION AROUND UNINSULATED FLANGES

FIG. 10-J-11

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II. SPECIFICATION 10-J

B. APPLICATION - contd

2. Piping

a. Pipe Insulation

(1) Insulation thicknesses in excess of 2-1/2 inches shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, I.B.4.

(2) Pipe insulation shall be applied to piping in a staggered position in accordance with Figures GA-1 and GA-2 of the GENERAL SPECIFICATION.

(3) Insulation shall be applied with all joints tightly butted and fitted, to eliminate voids. Large voids shall not be filled with weather-barrier coating, but eliminated either by refitting or replacing insulation. Any rounded corners on the insulation surfaces to be butted shall be trued before application.

(4) Butt edges and ends of all inner layers shall be given a smooth brush or spray coat of anti-abrasion coating and allowed to dry for a minimum of one-half hour, but preferably two hours, before application. Care shall be exercised to obtain a thin even coat of sufficient thickness only to cover and fill the cut cells of the insulation.

b. Fitting, Flange and Valve Covers

(1) Fitting, flange and valve covers shall be shop fabricated in accordance with the UCCC Dimensional Standards Fabrication Manual. Installation of typical fittings and valves are shown in Figures 10-J-12, 10-J-13, 10-J-14, 10-J-15, and 10-J-16.

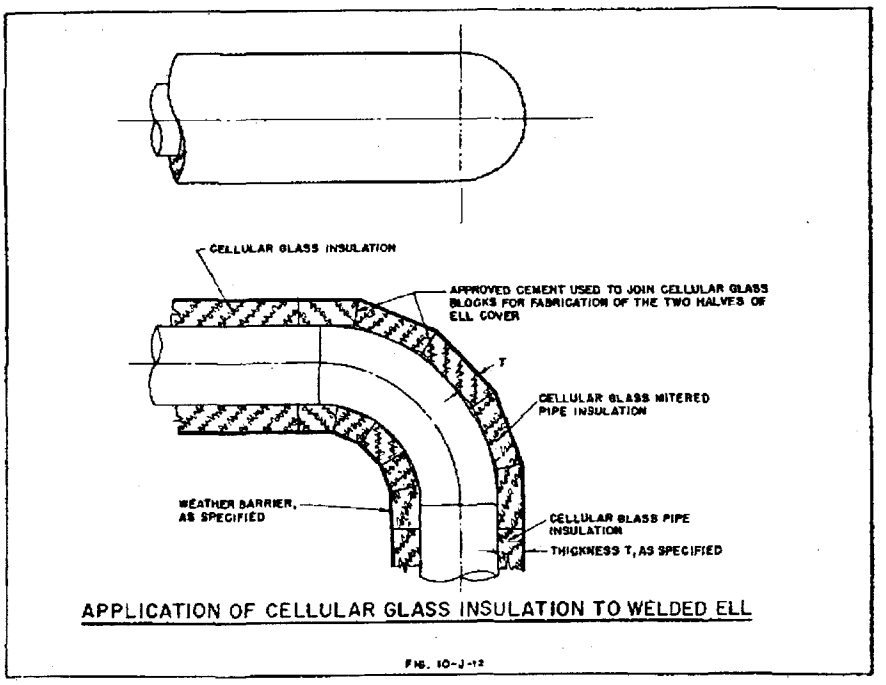
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II. SPECIFICATION 10-J

B. APPLICATION - contd

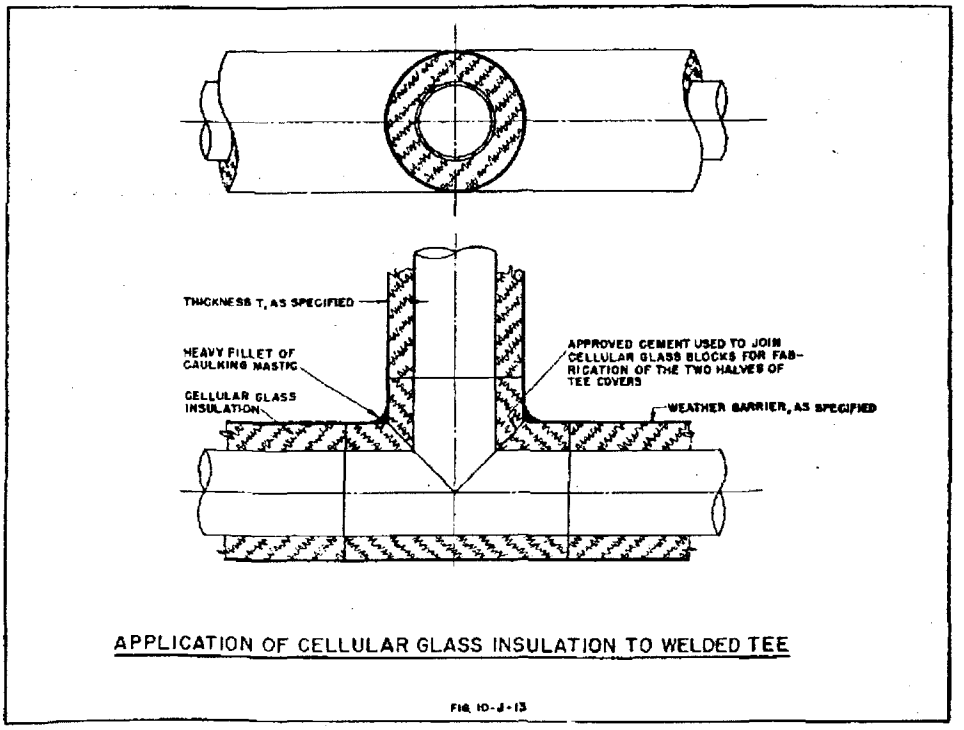
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO WELDED ELL

FIG. 10-J-12



APPLICATION OF CELLULAR GLASS INSULATION TO WELDED TEE

FIG. 10-J-13

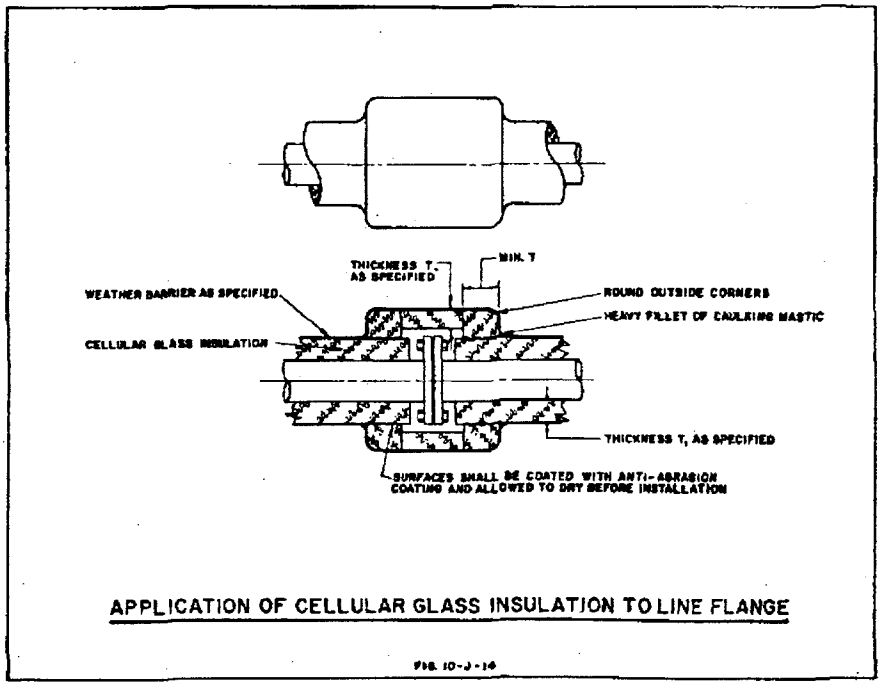
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II. SPECIFICATION 10-J

B. APPLICATION - contd

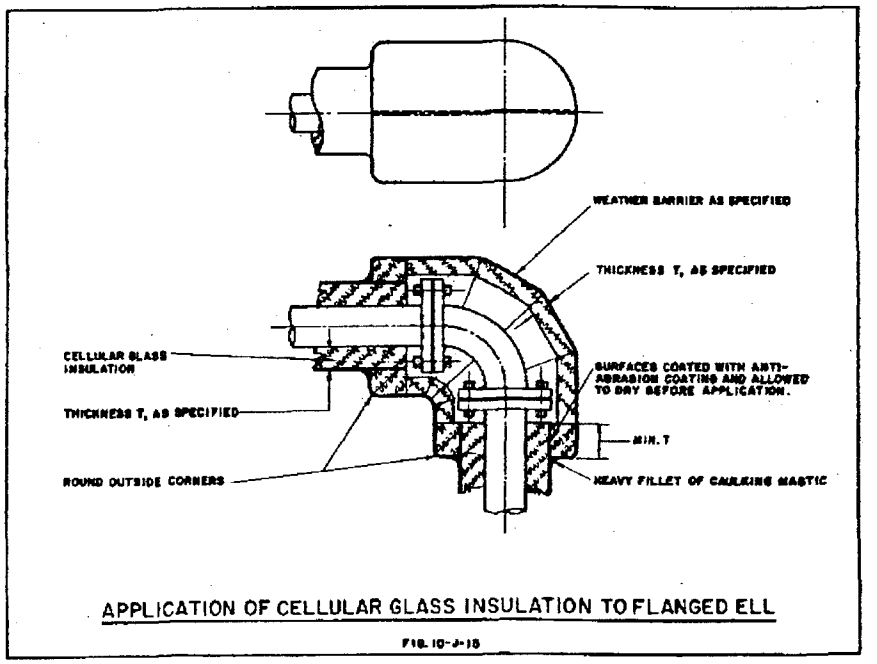
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO LINE FLANGE

FIG. 10-J-14



APPLICATION OF CELLULAR GLASS INSULATION TO FLANGED ELL

FIG. 10-J-15

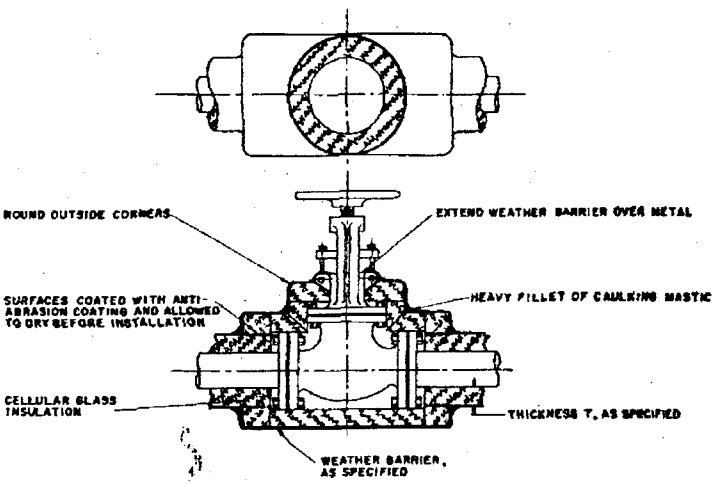
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II. SPECIFICATION 10-J

B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO FLANGED VALVE

FIG. 10-J-18

(3) All valves shall be packed and filled around valve stem and packing gland assembly with heat resistant sealer to avoid water pocket.

(4) Cementing of shop assemblies shall be done with specified fabricating cement. In all cases the joints shall be as thin as possible with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids and holes plugged with cement, be permitted.

c. Securement

(1) All layers of cellular glass pipe insulation shall be secured with insulation strap.

(2) Location of strap shall be as described in the GENERAL SPECIFICATION, I.B. 5.

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II. SPECIFICATION 10-J

B. APPLICATION - contd

2. Piping - contd

d. Steam Traced Installations

Steam-trace lines, where specified, shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

e. Weather-Barrier Coating

(1) Insulation shall be coated with weather-barrier before piping is put in service.

(2) Weather-barrier shall be installed in accordance with the GENERAL SPECIFICATION, I.B. 16.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 10-L — Cellular Glass

Scope

This specification describes the essential requirements for the purchase and application of preformed cellular glass thermal insulation, for use on equipment and piping normally operating at temperatures below 70 F, and including cycle operation and thawout service up to 400 F. It is applicable to both indoor and outdoor service.

Procedures outlined in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this Specification.

A. MATERIAL

1. Composition

Material shall be composed of glass, completely inorganic, processed and molded at temperatures sufficient to produce a rigid, cellular, thermal insulation.

2. Properties

Cellular glass insulation shall have the following properties:

Acid Resistance	Impervious to common acids and acid fumes.
Alkalinity	pH = 7.5
Capillarity	0
Coefficient of Expansion	0.0000040 per °F
Combustibility	Incombustible
Composition	A true glass; completely inorganic.
Compressive Strength	100 lb. per sq. in.
Density	9 lbs. per cu. ft.
Flexural Strength	100 lb. per sq. in.

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II. SPECIFICATION 10-L

A. MATERIAL - contd

2. Properties - contd

Hygroscopicity.	No increase in weight in 246 days in air at 90% relative humidity.
Modulus of Elasticity . . .	200,000 lb. per sq. in.
Shear Strength.	64 lb. per sq. in.
Specific Gravity	0.16
Specific Heat.	0.20 Btu per lb.
Tensile Strength	84 lb. per sq. in.
Thermal Conductivity . . .	Shall not exceed values at the following mean temperatures:

Mean Temp.F	Conductivity Btu/hr.,Sq.Ft., °F, inch Thick
50	0.40
300	0.55

Thermal Diffusivity . . .	0.40 sq. ft. per day
Water Absorption. . . .	0.2% by volume on 2" x 12" x 18" block (all on surface only)
Temperature Limits. . .	Minus 350F to plus 600F

3. Accessory Materials

a. Cellular Glass Insulation

b. Cushioning Blanket - 1-1/2 lb. density, Aerowrap P-308, Fine Fyber Felt, Ultralite, Superfine, or approved alternate.

c. Stainless Steel Wire - .0475 inch dia., 18 gauge, Type 304, cold-drawn bright-annealed, stainless steel wire, or approved alternate.

d. Stainless Steel Insulation Strap - 1/2 inch x .020 inch, Type 304, or approved alternate.

e. Stainless Steel Clips - Double pronged, Type 304; A. J. Gerrard, or approved alternate.

f. Strap Anchor Clip - A. J. Gerrard's strap hanger.

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II. SPECIFICATION 10-L

A. MATERIAL - contd

3. Accessory Materials - contd

i. Weather-Barrier Coating (Color as specified) - PVA- Vimasco No. WC-1, Benjamin Foster Seal-fas "C", or approved alternate.

j. Reinforcing Cloth - Glass fiber, 10 x 10 Perma-Glas, or approved alternate.

k. Adhesive Cement - Miracle Adhesive Type H, or approved alternate.

l. Caulking Mastic - Vimasco Caulking Compound, or approved alternate.

m. Fabricating Cement - Hot ('80°F) Asphalt or ap - proved alternate.

n. Vegetable Cork - 16 to 20 lb. cu. ft. - National Cork, Mundet or approved alternate.

o. Non-setting Sealer - Benjamin Foster 30-73, or approved alternate.

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II. SPECIFICATION 10-L

B. APPLICATION

1. Equipment

a. Insulation Supports

Equipment shall be provided with insulation supports as specified in GENERAL SPECIFICATIONS I.B.4.

b. Thickness Schedule

Unless otherwise specified, insulation in excess of 2-1/2 inches total thickness shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS I.B.1.

c. Cushioning Blanket

On all equipment, a one-half inch thick blanket shall be applied over the entire surface, as a cushioning material prior to the application of the cellular glass insulation. Blanket shall be held in place with a minimum amount of No. 18 gage, stainless-steel wire. Cellular glass insulation shall then be applied over blanket in manner described in this Specification. Cushioning material shall not be considered as part of the specified insulation thickness.

d. Curved Surfaces

(1) Block insulation (curved segments or shaped head segments) shall be shop fabricated and fitted to a one-inch greater diameter than that of the vessel to which it is applied. Block insulation shall be applied over cushioning material on all equipment, with all joints tightly butted. Multiple layers of insulation shall be applied so that the butt joints of one layer do not coincide with those of any other layer.

(2) All butt edges and ends of insulation fabricated for inner layer or layers shall be given a smooth brush or spray coat of anti-abrasion coating and allowed to dry for a minimum of one-half hour, but preferable two hours, before application of insulation to equipment.

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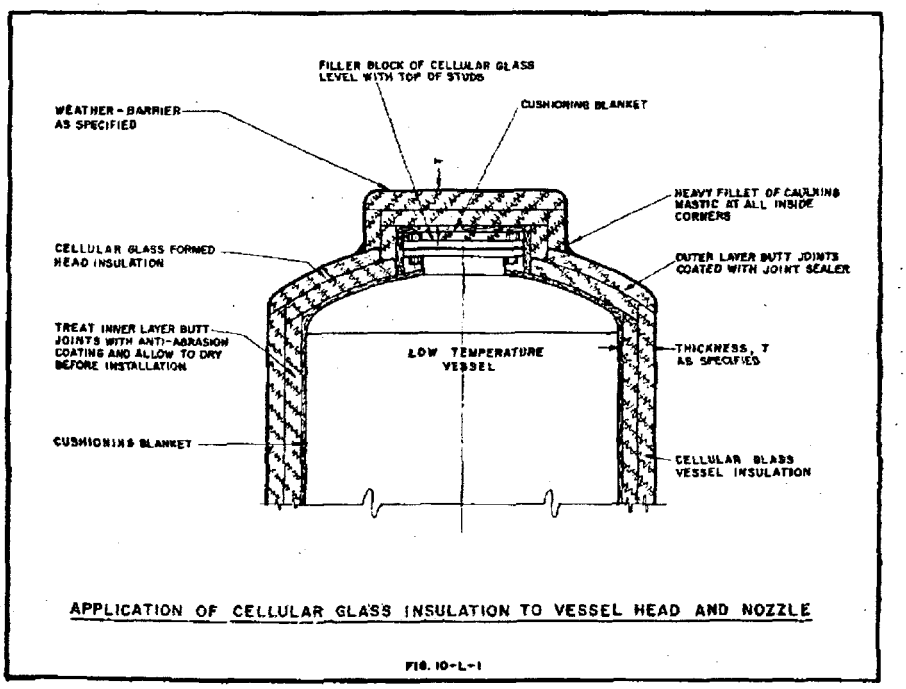
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

d. Curved Surfaces - contd

(3) All butt edges and ends of outermost layer (or single layer) of formed insulation shall be sealed with a buttered coat of Vinyl Asphalt Joint Sealer. This coating shall be of sufficient thickness to provide proper adhesion, seal and cushion, between the individual pieces of insulation. Typical installation is shown in Figure 10-L-1.



APPLICATION OF CELLULAR GLASS INSULATION TO VESSEL HEAD AND NOZZLE

FIG. 10-L-1

e. Flat Surfaces

Block shall be applied to flat surfaces, in the same manner as specified for curved surfaces, except where it is specified to be applied directly to metal surfaces with adhesive or other approved securement.

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II. SPECIFICATION 10-L

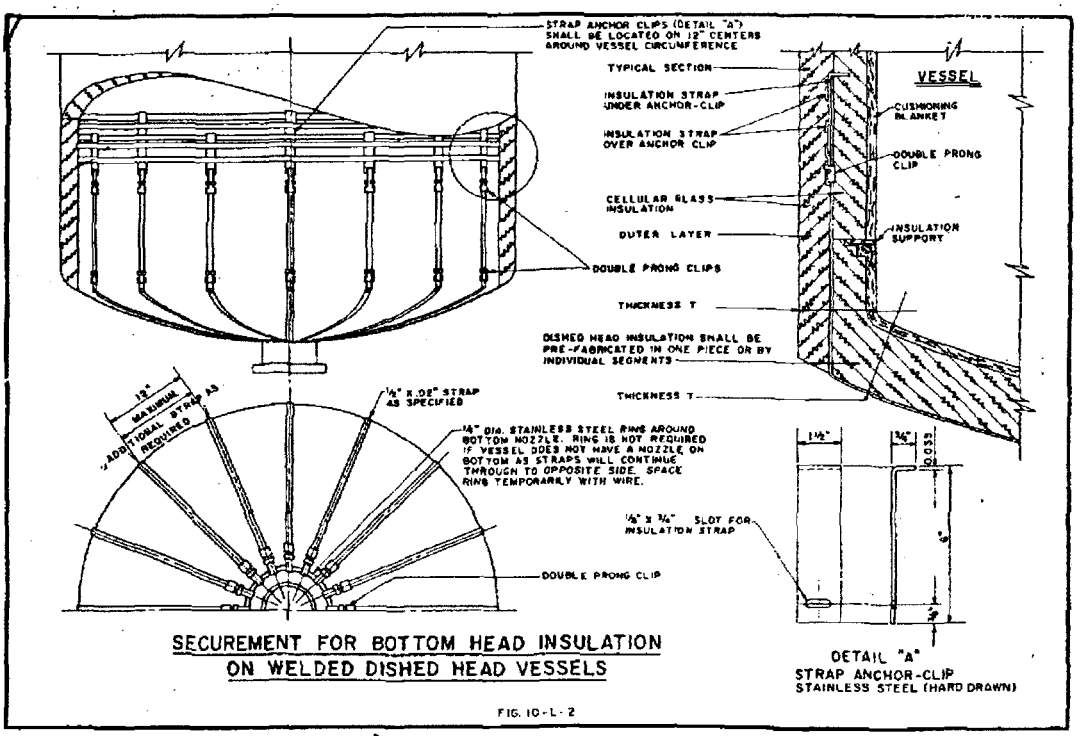
B. APPLICATION - contd

1. Equipment - contd

f. Securement

(1) Where contour of vessel permits firm and effective attachment, all layers of cellular glass insulation shall be secured in place with stainless steel insulation strap. Insulation shall be secured to irregular surfaces, with No. 18 gage stainless steel wire.

(2) Inner layer or layers of cellular glass insulation on bottom heads of vertical equipment, or heads of horizontal equipment, shall be held in place with specified stainless-steel wire secured to insulation supports, as shown in UCCC Standards IS-31, IS-36, and IS-42. Any slots cut in the cellular glass insulation resulting from tightening of the tie wires, shall be filled with specified joint sealer. Outer layer of cellular glass insulation on bottom heads of vertical equipment, or heads of horizontal equipment, shall be secured with insulation strap, as shown in Figure 10-L-2.



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II. SPECIFICATION 10-L

B. APPLICATION - contd

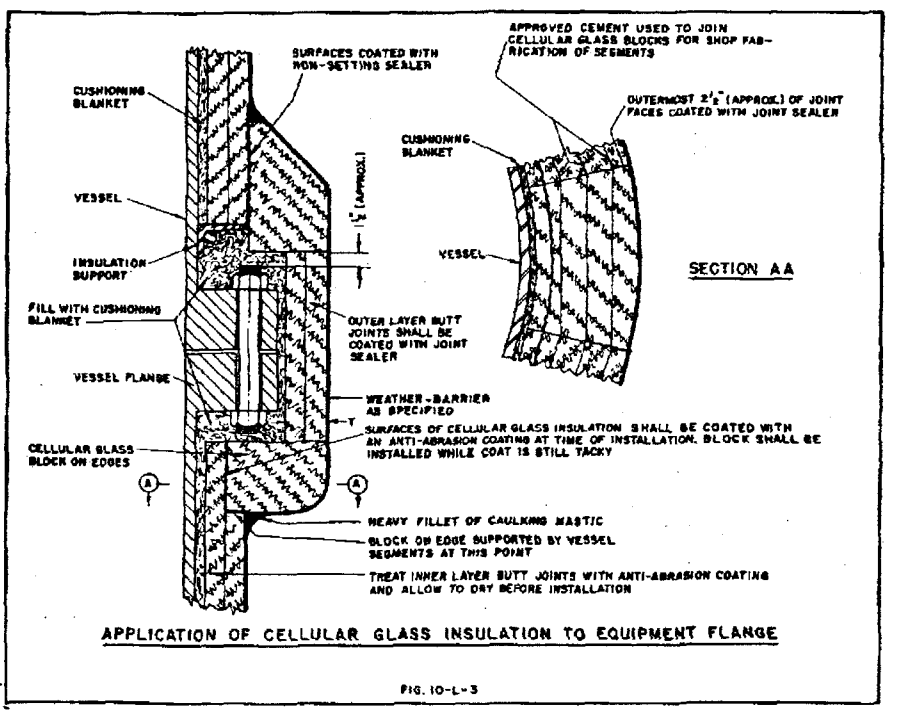
1. Equipment - contd

f. Securement - contd

(3) Where specified, block shall be applied directly to metal surfaces, such as duct work, with adhesive or other approved securement. Where block is specified to be secured with adhesive, it shall be embedded firmly into a surface coat.

g. Expansion Joint

(1) Cellular glass applications shall be provided with expansion-contraction joints at vessel flanges, constructed as shown in Figure 10-L-3. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation, as shown, to provide proper slip joint.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT FLANGE

FIG. 10-L-3

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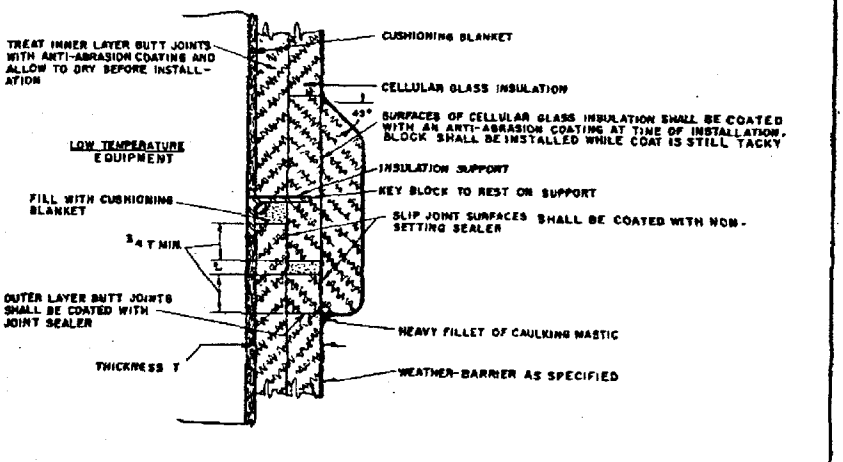
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

g. Expansion Joints - contd

(2) Longitudinal contraction of vessels shall be provided for by installing expansion-contraction joints at the insulation supports, as shown on Figure 10-L-4. Where more than one thickness of insulation is specified for a vessel, an insulation support shall be provided at the junction of two different thicknesses, and insulated in a manner similar to that shown in Figure 10-L-4. Non-setting sealer shall be applied to surfaces of insulation, to provide proper slip joint where movement is likely to occur.



APPLICATION OF CELLULAR GLASS INSULATION TO CONTRACTION JOINT

FIG. 10-L-4

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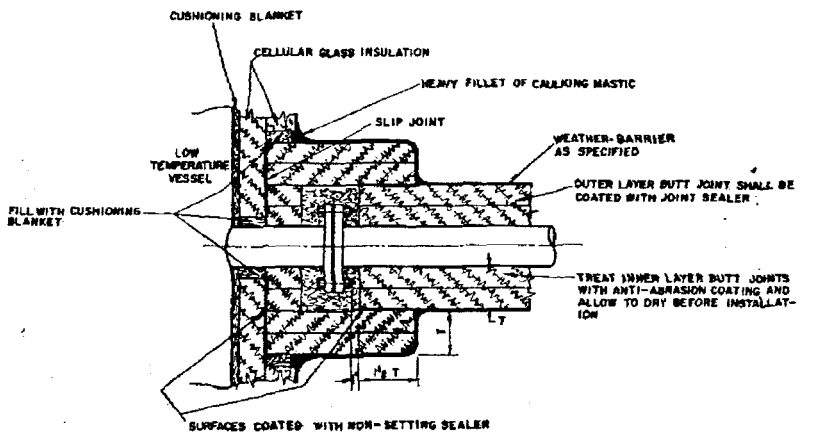
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

g. Expansion Joints - contd

(3) One-inch of cushioning blanket shall be packed around nozzles and projections where they extend through the insulation, as shown in Figure 10-L-5. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation to provide proper slip joint.



APPLICATION OF CELLULAR GLASS INSULATION TO NOZZLE

FIG. 10-L-5

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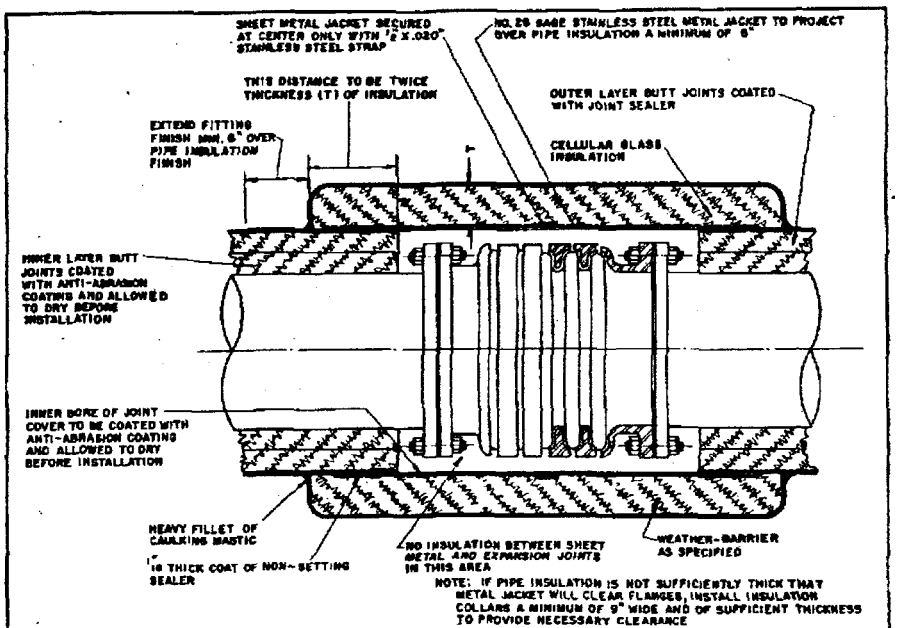
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

h. Mechanical Expansion Joints

Corrugated mechanical expansion joints in piping (usually listed as equipment items) shall be insulated as shown in Figure 10-L-6. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation to provide proper slip joint.



APPLICATION OF CELLULAR GLASS INSULATION TO A MECHANICAL EXPANSION JOINT

FIG. 10-L-6

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II. SPECIFICATION 10-L

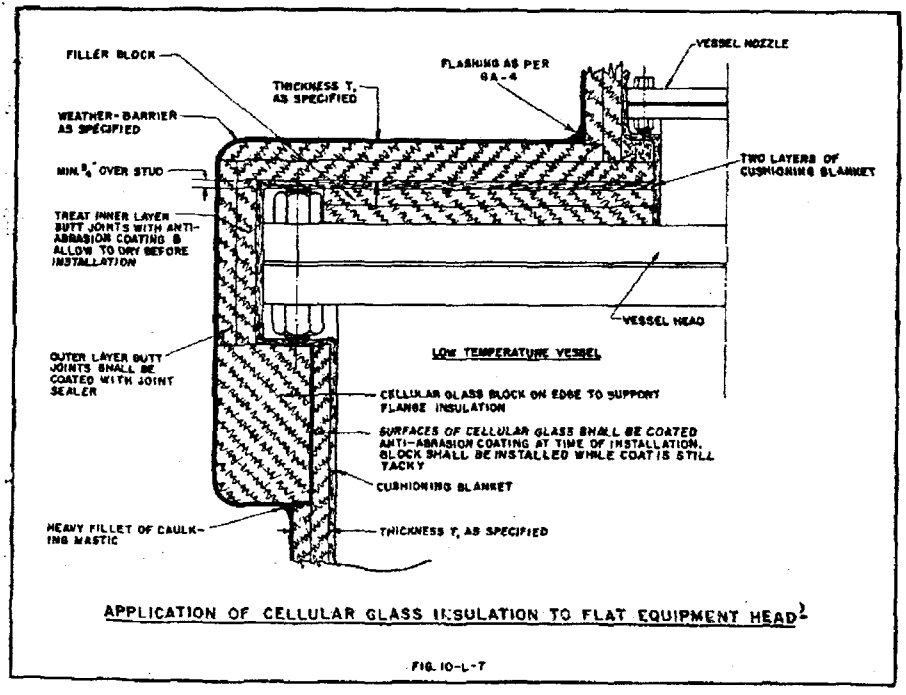
B. APPLICATION - contd

1. Equipment - contd

i. Flat Heads

(1) Insulation on top flat-heads of vertical equipment shall be applied in the same manner as previously described in this specification. Water pockets shall be eliminated and proper drainage provided as shown in Figure 10-L-7.

(2) All top nozzles on insulated equipment shall be provided with flashing as shown in Figure GA-3, of GENERAL SPECIFICATIONS.



APPLICATION OF CELLULAR GLASS INSULATION TO FLAT EQUIPMENT HEAD

FIG. 10-L-7

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II. SPECIFICATION 10-L

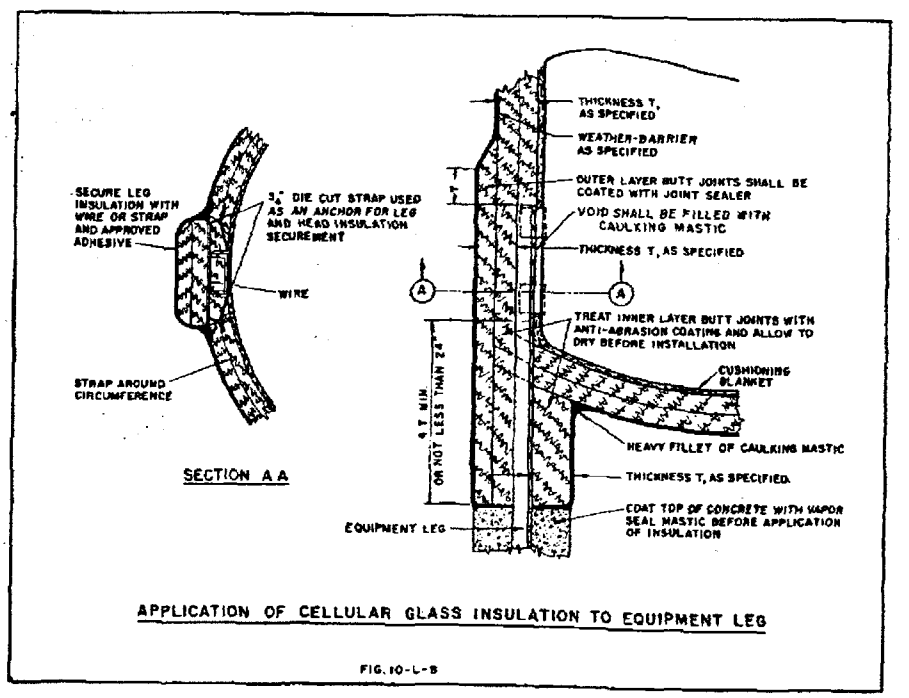
B. APPLICATION - contd

1. Equipment - contd

j. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down channel legs to the junction with any fire resistant material, or a distance of four times insulation thickness, but not less than 24 inches. Thickness shall be as specified for body of vessel but never less than two inches. Body insulation shall be butted firmly against tank leg flange.

(2) Re-entrant space between channel flanges shall be filled with block cemented in place with an approved adhesive. Surface of fire-resistant material abutting tank leg insulation shall be coated with weather-barrier coating. Installation shall be as shown on Figure 10-L-8.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT LEG

FIG. 10-L-8

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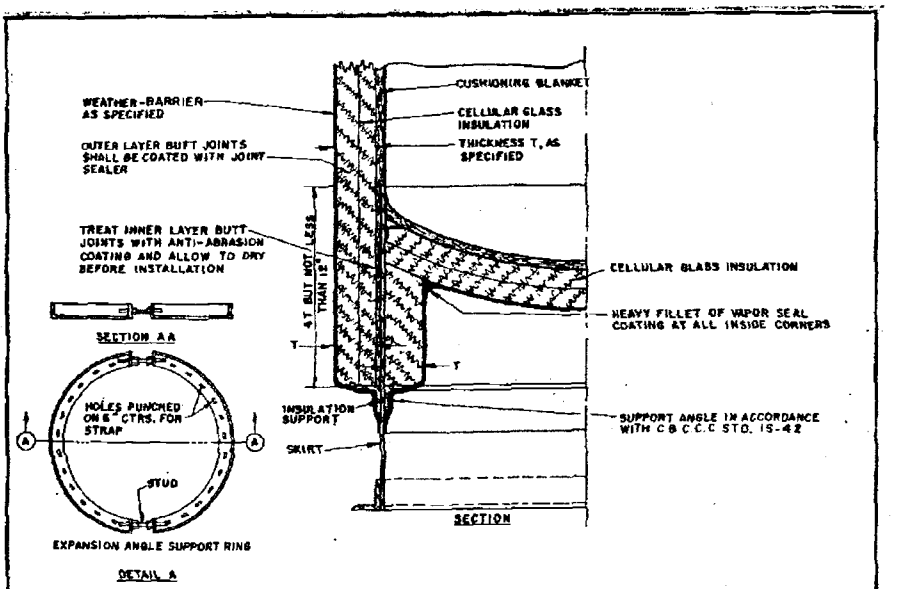
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

k. Vessel Skirts

Skirts supporting vertical equipment shall be insulated inside and outside. Insulation shall extend downward, from junction of inside of skirt with insulated bottom head, a distance of not less than four times the thickness of insulation, but never less than one foot. Thickness of insulation over skirts shall be as specified for body of vessel, but never less than two inches. Insulating material shall be secured to inside of skirt with adhesive cement. Support for inside skirt insulation, and bottom head insulation shall be in accordance with UCCC Standard IS-42. Installation shall be as shown in Figure 10-L-9.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT SKIRT

FIG. 10-L-9

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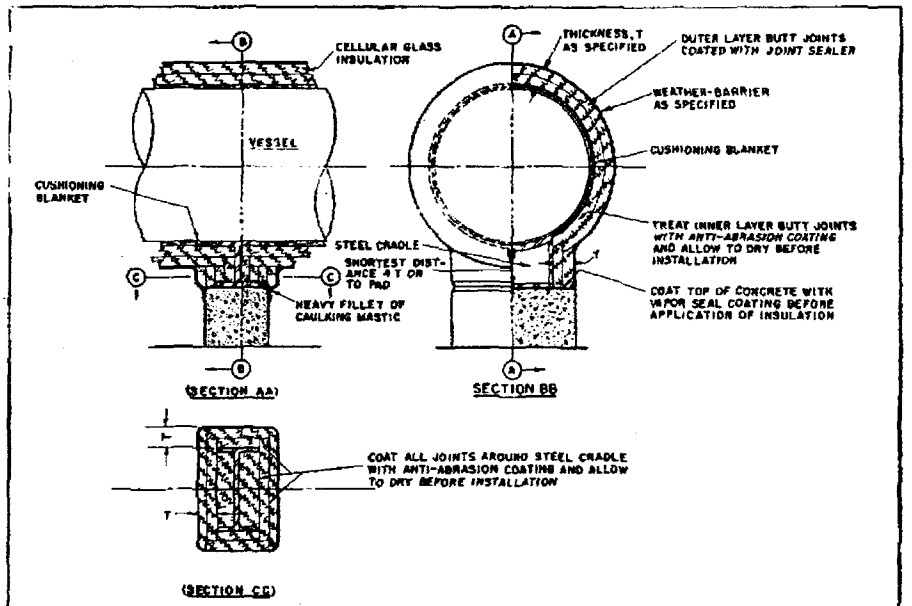
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

1. Equipment Supports.

(1) Where equipment is supported on cradles, vessel insulation shall extend over cradles as shown in Figure 10-L-10.



APPLICATION OF CELLULAR GLASS INSULATION TO CRADLES AND SUPPORTS FOR EQUIPMENT

FIG. 10-L-10

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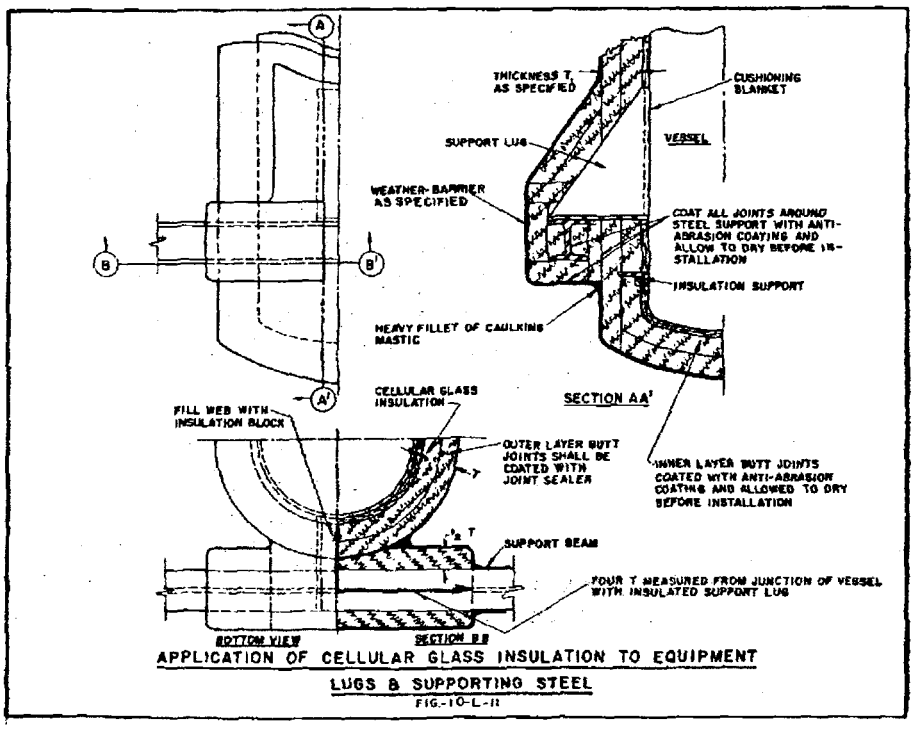
II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

1. Equipment Supports - contd

(2) Where equipment is supported by structural steel members, insulation shall extend not less than four times the specified insulation thickness in each direction, measured from junction of vessel with insulated support lug. Thickness of insulation over steel supports shall be not less than one-half that specified for body of vessel. Thickness of insulation over support lugs shall be the same as body insulation. Installation shall be as shown in Figure 10-L-11.



APPLICATION OF CELLULAR GLASS INSULATION TO EQUIPMENT LUGS & SUPPORTING STEEL

FIG.-10-L-11

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II. SPECIFICATION 10-L

B. APPLICATION - contd

1. Equipment - contd

m. Weather-Barrier

Weather-barrier shall be applied in accordance with GENERAL SPECIFICATION, I.B. 9 and 16.

2. Piping

a. Pipe Insulation

(1) Insulation thickness in excess of 2-1/2 inches shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, I.B.4.

(2) Pipe insulation shall be applied in staggered position, in accordance with figures GA-1 and GA-2 of the GENERAL SPECIFICATIONS, I.B.5.

(3) All butt edges and ends of single layer insulation, and outer layer of multiple layer applications, shall be buttered with joint sealer before application. The joints shall be drawn together, when insulation is applied, so that only a very thin, vapor-tight, vapor-seal coat separates the sections of insulation.

(4) Insulation shall be applied with all joints tightly butted and fitted, to eliminate voids. Large voids shall not be filled with vapor seal coating, but eliminated either by refitting or replacing insulation. Any rounded corners, on the insulation surfaces to be butted, shall be trued before application.

(5) Butt edges and ends, of all inner layers, shall be given a smooth brush or spray coat of anti-abrasion coating and allowed to dry for a minimum of one-half hour, but preferably two hours, before application. Care shall be exercised to obtain a thin even coat of sufficient thickness only to cover and fill the cut cells of the insulation.

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II. SPECIFICATION 10-L

B. APPLICATION - contd

2. Piping - contd

a. Pipe Insulation - contd

(6) When scheduled for installations where severe vibration is expected, entire surface area shall be coated with anti-abrasion coating.

(7) When scheduled for installations where thermal shock is expected, a cushioning material, as specified, shall be applied to bare pipe prior to application of cellular glass insulation.

b. Fitting, Flange and Valve Covers

(1) Fittings, flanges, and valve covers shall be shop fabricated, in accordance with the UCCC Dimensional Standards Fabrication Manual, using hot (180°F) Asphalt as a Fabricating Cement.

(2) Welded fitting covers shall be fabricated to fit snugly on the pipe. The two halves of the cover shall be cemented together, with joint sealer applied to the outermost 2-1/2 inches (approx.) of the faces of the joint. The adjacent pipe insulation shall be fitted tightly to the butt ends of the fitting cover and sealed as specified for piping. Typical fitting covers are shown in Figures 10-L-12 and 10-L-13.

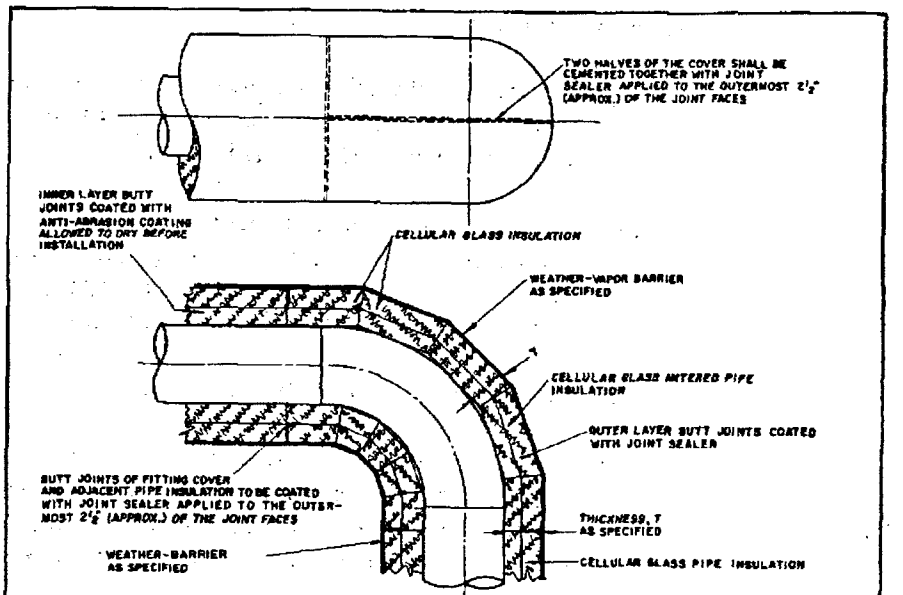
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II. SPECIFICATION 10-L

B. APPLICATION - contd

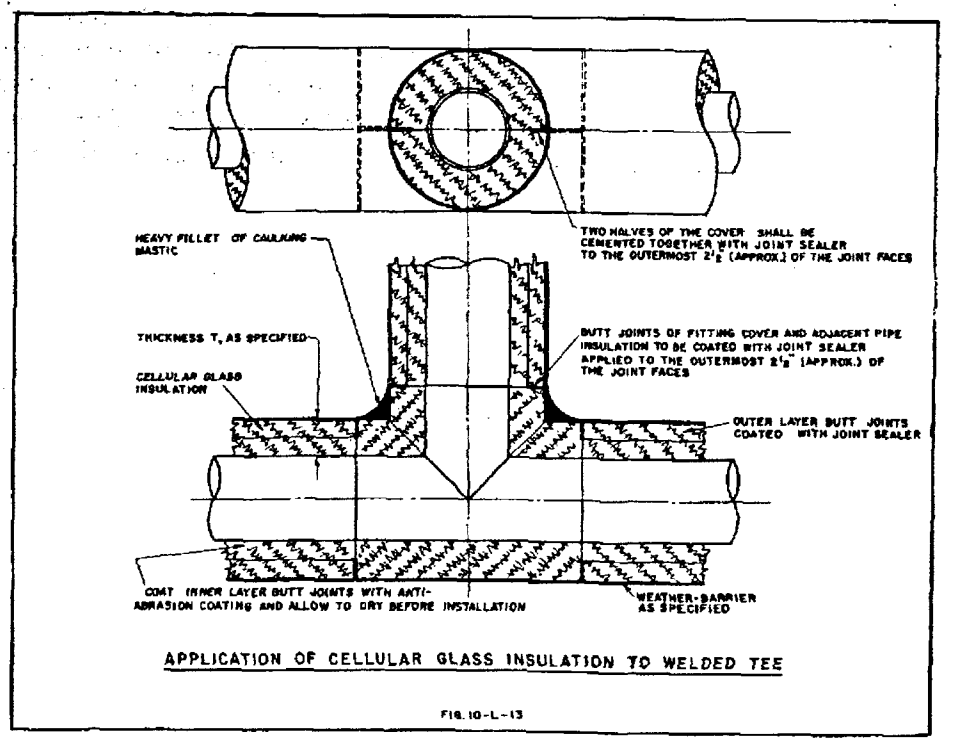
2. Piping - contd

b. Fittings, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO WELDED ELL

FIG. 10-L-12



APPLICATION OF CELLULAR GLASS INSULATION TO WELDED TEE

FIG. 10-L-13

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II. SPECIFICATION 10-L

B. APPLICATION - contd

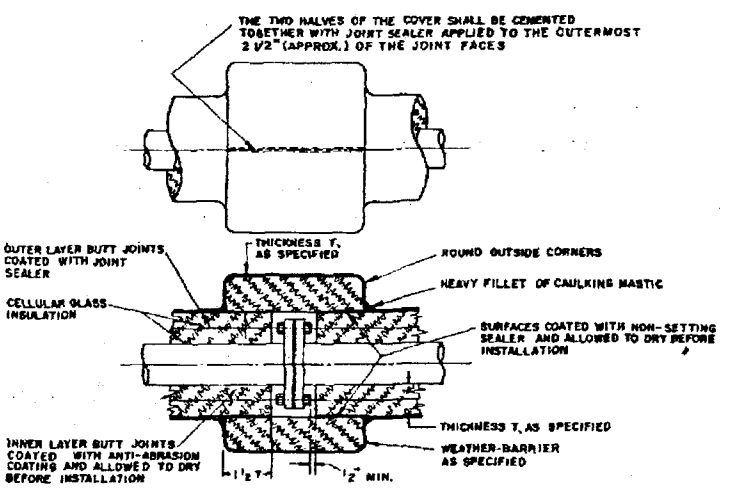
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd

(3) Flanges, flanged fittings and flanged valve covers shall be fabricated and fitted to extend over adjacent pipe insulation so as to provide a close fitting slip joint at each end. The two halves of the cover shall be cemented together with joint sealer, applied to the outermost 2-1/2 inches (approx.) of the faces of the joint.

(4) All valves shall be packed and filled around valve stem, and packing gland assembly, with valve sealer, to avoid water pockets.

(5) Installation of typical fittings and valve are shown in Figures 10-L-14, 10-L-15, and 10-L-16.



APPLICATION OF CELLULAR GLASS INSULATION TO LINE FLANGE

FIG.10-L-14

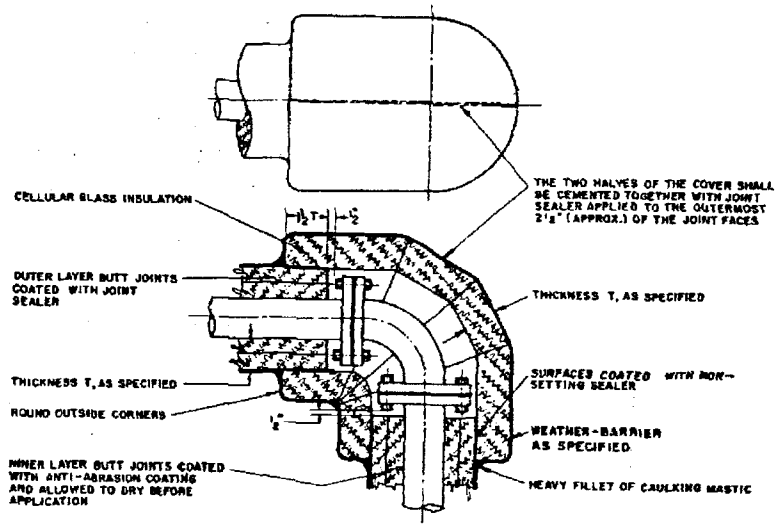
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II. SPECIFICATION 10-L

B. APPLICATION - contd

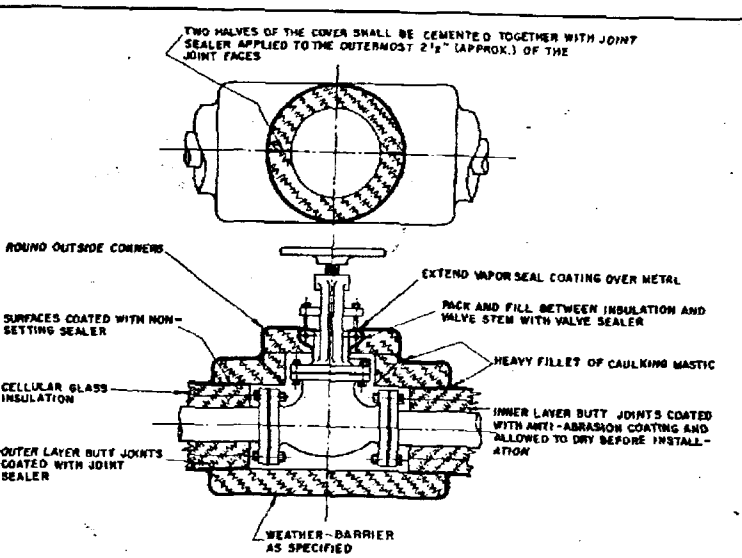
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



APPLICATION OF CELLULAR GLASS INSULATION TO FLANGED ELL

FIG. 10-L-15



APPLICATION OF CELLULAR GLASS INSULATION TO FLANGED VALVE

10-L-16

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II. SPECIFICATION

B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers - contd

(6) All fittings shall be fitted and assembled with very thin, tight joints. Cementing of shop assemblies shall be done with hot (180°) asphalt of approved quality. In all cases the joints shall be thin, with just sufficient asphalt to obtain good adhesion and complete closure. Wide asphalt joints, voids, or holes plugges with asphalt, will not be permitted.

c. Securement

(1) All layers of cellular glass pipe insulation shall be secured with insulation strap.

(2) Use and location of strap shall be as described in the GENERAL SPECIFICATIONS, I.B. 5,6, and 7.

d. Supports and Hangers

(1) Where horizontal, low temperature piping is supported on the outside of insulation surfaces, as per UCCC Std. IS-19, insulation shall be complete with weather-barrier applied before piping is placed in cradles. UCCC Std. IS-19 is a guide to the maximum horizontal span of pipe which may be supported on the outside of insulation.

(2) On all vertical piping, where the operating temperature does not exceed 250°F, and any additional piping specified on the insulation drawings or by a Field Representative of the Design and Construction Department, supported on the outside of insulated surfaces, as per UCCC Std. IS-19, the insulation between cradle and pipe shall be prefabricated heavy density vegetable cork. For piping in excess of 250°F, the insulation between cradle and pipe shall be cellular glass.

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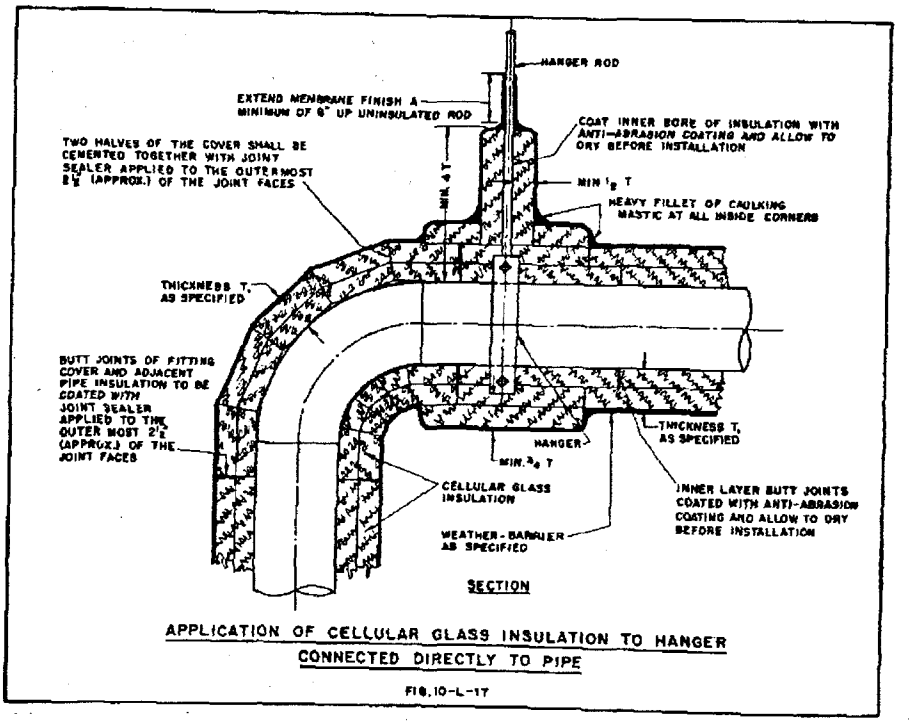
II. SPECIFICATION 10-L

B. APPLICATION - contd

2. Piping - contd

d. Supports and Hangers - contd

(3) Hangers attached directly to piping shall be insulated as shown in Figure 10-L-17.



APPLICATION OF CELLULAR GLASS INSULATION TO HANGER CONNECTED DIRECTLY TO PIPE

FIG. 10-L-17

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II. SPECIFICATION 10-L

B. APPLICATION - contd

2. Piping - contd

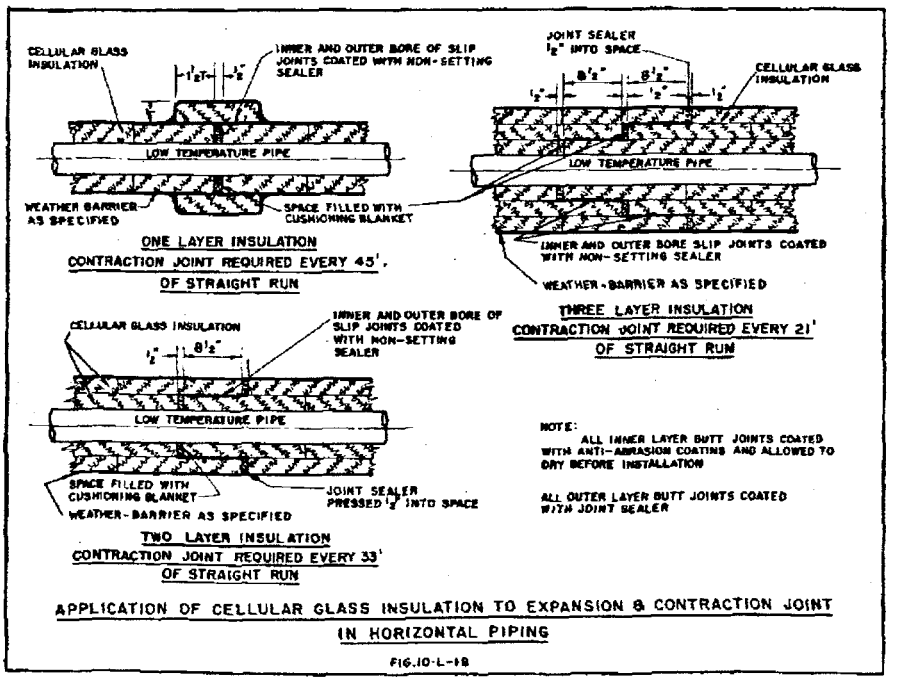
e. Expansion-Contraction Joints

(1) Expansion and contraction joints shall be installed, as per Figure 10-L-18, in both horizontal and vertical straight run piping, at intervals as follows:

Single layer - one for each 45 feet.
Double layer - one for each 33 feet.
Triple layer - one for each 21 feet.

(2) Where flanged joints occur within these limits, expansion and contraction shall be provided for in the flange cover and expansion-contraction joints in insulation will not be required.

(3) Joints shall be packed tightly with strips of cushioning blanket.



APPLICATION OF CELLULAR GLASS INSULATION TO EXPANSION & CONTRACTION JOINT IN HORIZONTAL PIPING

FIG.10-L-18

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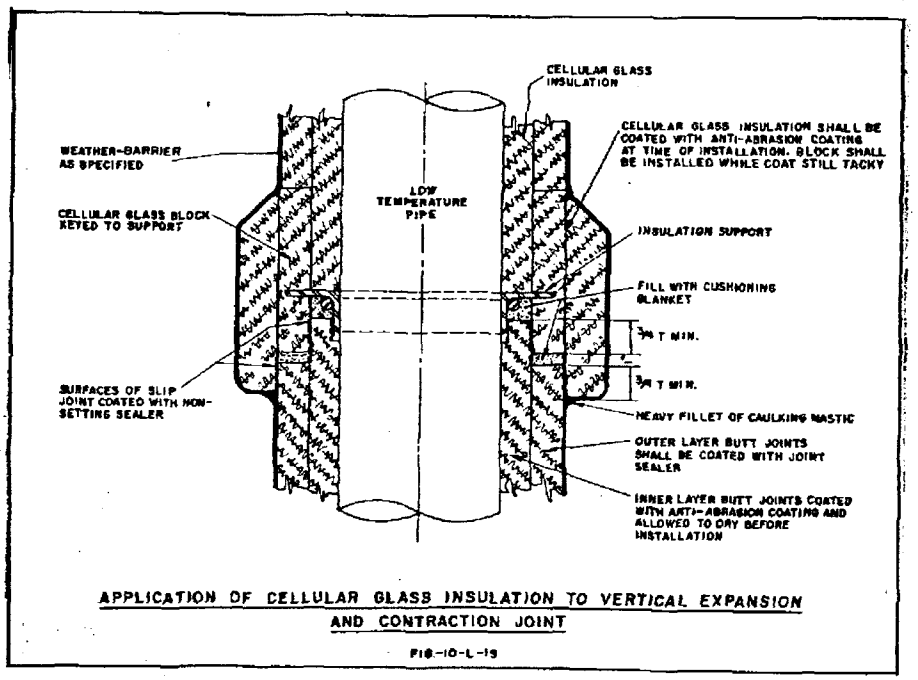
II. SPECIFICATION 10-L

B. APPLICATION - contd

2. Piping - contd

e. Expansion-Contraction Joints - contd

(5) Where it is necessary to install expansion-contraction joints in insulation on vertical piping, an insulation support shall be provided. Installation shall be as shown in Figure 10-L-19.



APPLICATION OF CELLULAR GLASS INSULATION TO VERTICAL EXPANSION AND CONTRACTION JOINT

FIG-10-L-19

f. Steam-Traced Installations

Steam-trace lines, where specified, shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

g. Weather-Barrier Coating

Weather-barrier shall be installed in accordance with the GENERAL SPECIFICATION, I.B. 16.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 16-H — Preformed Glass Fiber

Scope

This specification described the essential requirements for the purchase and application of preformed glass fiber thermal insulation for use on piping and equipment normally operating between 71°F up to and including 350°F. It is applicable to both indoor and outdoor service.

Procedures outlined in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this specification.

A. MATERIAL

1. Composition

Material shall be composed of fiberous glass, with phenol-formaldehyde binder formed into moulded block and pipe insulation with a factory applied canvas jacket.

2. Properties

Glass fiber insulation shall have the following properties:

Acid Resistance . . . . Good resistance except to Hydrofluoric and Phosphoric.

Alkalinity . . . . . pH = 6 to 7

Capillarity . . . . . Negligible after 24 hours

Combustibility . . . . . Will not support combustion.

Compressive Strength . . Shall be not less than

Percent Deflection	Load, psi
5	0.24
10	0.49

Density . . . . . 3 lbs. /cu. ft. (minimum)

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II. SPECIFICATION 16-H

A. MATERIAL - contd

2. Properties - contd

Hygroscopicity.	1.13% by wt. after 72 hours.
Specific Gravity	Shall be not less than Apparent 0.047 True 2.572
Temperature Limits	350°F (min.)
Thermal Conductivity . . .	Shall not exceed values at the following mean temperatures: Mean Temp.°F — Conductivity Btu/hr., sq.ft. °F, inch thick 70 — 0.30
Thermal Diffusivity	0.32 sq. ft. per day
Water Absorption.	90 - 93% by volume

3. Accessory Materials

a. Glass Fiber Insulation (with 6 ounce (minimum) canvas jacket) - Fiberglas Standard Pipe Insulation, Guston-Bacon snap-on, or approved alternate.

b. Stainless Steel Wire - 0.0475 inch diameter, type 304, cold drawn, bright annealed, 18 gage.

c. Stainless Steel Insulation Strap - 1/2 inch x 0.020 inch, type 304, or approved alternate.

d. Stainless Steel Clips - Double pronged, type 304, A. J. Gerrard, or approved alternate.

e. Weather-Barrier Coating (color as specified) PVA-Vimasco No. WC-1, Benjamin Foster Sealfas "C", or approved alternate.

f. Paste - Benjamin Foster 81-42 W Lagfas, or approved alternate.

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II. SPECIFICATION 16-H

B. APPLICATION

1. Equipment

a. Insulation Support

Equipment shall be provided with insulation supports as specified in GENERAL SPECIFICATION I. B. 4.

b. Thickness Schedule

Unless otherwise specified, insulation shall be applied in a single layer.

c. Curved Surfaces

(1) Insulation for equipment, having diameter less than four feet, shall be factory formed to specified radius. Insulation for larger equipment shall be bent, and kerfed where necessary, to fit vessel contour.

(2) Insulation shall be installed with all joints tightly butted and circumferencial butt joints staggered.

d. Flat Surfaces

Block insulation shall be applied to flat surfaces in the same manner as specified for curved surfaces.

e. Securement

(1) Insulation shall be secured with insulation strap where contour of vessel permits firm and effective attachment. Insulation applied to irregular surfaces, where strap is impracticable, shall be secured with wire, drawn taut, ends twisted and embedded in insulation.

(2) Insulation on bottom heads of vertical equipment shall be secured in place with insulation strap attached to insulation support as shown in UCCC Standard IS-31.

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II. SPECIFICATION 16-H

B. APPLICATION - contd

1. Equipment - contd

f. Surface Finish

(1) Cracks and depressions in insulation shall be pointed and leveled smooth with insulation surface prior to application of weather-barrier coating finish.

(2) Weather-barrier coating shall be applied over insulation in accordance with GENERAL SPECIFICATION I.B.16, where curved block is not furnished with canvas jacket. When canvas is attached to block, from factory, glass fiber reinforcing cloth in weather-barrier coating shall be omitted.

2. Piping

a. Pipe Insulation

(1) Thickness Schedule

Unless otherwise specified, insulation shall be applied in a single layer with attached canvas jacket lapped and sealed with specified paste.

(2) Securement

(a) Insulation shall be applied to piping in accordance with GENERAL SPECIFICATIONS I.B. 4,5,6, and 7.

(b) All sectional pipe insulation having outside diameters of 6.625 inches or less shall be secured with stainless steel wire.

(c) All pipe insulation having outside diameters greater than 6.625 inches shall be secured with stainless steel insulation strap.

b. Fitting, Flange and Valve Covers

(1) Fittings, flanges and valve covers shall be either factory moulded or prefabricated in accordance with UCCC Dimensional Standards Fabrication Manual.

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II. SPECIFICATION 16-H

B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers - contd

(2) Fittings, flanges and valve covers may be field fabricated, providing work is approved by the field representative of the Department of Design and Construction. Segments shall be carefully fitted to insure tight joints.

(3) Prefabricated covers shall be secured with wire or strap as required.

c. Steam Traced Installations

Steam trace-lines, where specified, shall be installed in accordance with GENERAL SPECIFICATIONS I.B.15.

d. Surface Finish

(1) Piping exposed to view or weather

(a) Where present, cracks and depressions in canvas jacket shall be filled with weather-barrier coating and trowelled smooth with adjacent surface prior to application of weather-barrier coating finish.

(b) Weather-barrier coating shall be applied over canvas jacket in accordance with GENERAL SPECIFICATION I.B.16, except glass fiber reinforcing cloth will be omitted.

(2) Piping concealed

Finish other than factory applied canvas will not be required.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 16-L — Preformed Glass Fiber

Scope

This specification describes the essential requirements for the purchase and application of preformed glass fiber thermal insulation for use on piping and equipment normally operating at temperatures between 35°F and 70°F. It is applicable to both indoor and outdoor service.

Procedures outlined in the GENERAL SPECIFICATIONS are applicable to and constitute an integral part of this specification.

A. MATERIAL

1. Composition

Material shall be composed of fiberous glass, with phenolformaldehyde binder, formed into moulded block and pipe insulation with a factory applied vapor barrier.

2. Properties

Glass fiber insulation shall have the following properties:

Acid	Good resistance except to Hydrofluoric and Phosphoric.
Alkalinity	pH = 6 to 7
Capillarity	Negligible after 24 hours.
Combustibility.	Will not support combustion.
Compressive Strength . .	Shall be not less than

Percent Deflection	Load, psi
5	.24
10	.49

Density	3 lbs./cu. ft. (minimum)

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II. SPECIFICATION 16-L

A. MATERIAL - contd

2. Properties - contd

Hygroscopicity.	1.13% by wt. after 72 hours.
Specific Gravity	Shall be not less than Apparent 0.047 True 2.572
Thermal Conductivity . . .	Shall not exceed values at the following mean temperatures: Mean Temp.°F — Conductivity Btu/hr., sq.ft. °F, inch thick 70 — 0.30
Thermal Diffusivity	0.32 sq. ft. per day
Water Absorption.	90 - 93% by volume.

3. Accessory Materials

a. Glass Fiber Insulation - Fiberglas white dual temp. Pipe Insulation, Gustin-Bacon Snap-on with Kraft foil laminate vapor barrier, or approved alternate.

b. Stainless Steel Wire - 0.0475 inch diameter, type 304, cold drawn, bright annealed, 18 gage.

c. Stainless Steel Insulation Strap - 1/2 inch x 0.020 inch, type 304, or approved alternate.

d. Stainless Steel Clips - Double pronged, type 304, A. J. Gerrard, or approved alternate.

e. Vapor-Barrier - Foil (0.001 min.) - Scrim-craft, or approved alternate. (May be factory attached.)

f. Reinforcing Cloth - Glass Fiber, approximately 10 x 10 mesh, with starch binder, Perma-Glas Mesh, Benjamin Foster, Open Weave, or approved alternate.

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II. SPECIFICATION 16-L

A. MATERIAL - contd

3. Accessory Materials - contd

g. Weather-Barrier Coating - (color as specified) - PVA - Vimasco No. WC-1, Benjamin Foster Sealfas "C", or approved alternate.

h. Joint Sealer Strips - Foil (.001" min.) with Kraft paper backing in three inch wide rolls.

i. Lap and Strip Adhesive - Benjamin Foster 81-71, Minnesota Mining #1128, St. Clair Rubber Adhesive No. 4815, or approved alternate.

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II. SPECIFICATION 16-L

B. APPLICATION

1. Equipment

a. Insulation Support

Equipment shall be provided with insulation supports as specified in GENERAL SPECIFICATION I. B. 4.

b. Thickness Schedule

Unless otherwise specified, insulation shall be applied in a single layer.

c. Curved Surfaces

(1) Insulation for equipment, having diameters less than four feet, shall be factory formed to specified radius. Insulation for larger equipment shall be bent, and kerfed where necessary to fit vessel contour.

(2) Insulation shall be installed with all joints tightly butted and circumferencial butt joints staggered.

d. Flat Surfaces

Block insulation shall be applied to flat surfaces in the same manner as specified for curved surfaces.

e. Vapor Barrier

All joints, cracks, and breaks in vapor barrier shall be sealed with three inch wide vapor barrier strips cemented to adjacent vapor barrier to form a continuous vapor tight envelope.

f. Securement

(1) Insulation shall be secured with insulation strap where contour of vessel permits firm and effective attachment. Insulation applied to irregular surfaces where strap is impracticable, shall be secured with wire, drawn taut, ends twisted and embedded in insulation.

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II. SPECIFICATION 16-L

B. APPLICATION - contd

1. Equipment - contd

f. Securement - contd

(2) Insulation on bottom heads of vertical equipment shall be secured in place with insulation strap attached to insulation support as shown in UCCC Standard IS-31.

g. Surface Finish

(1) Where present, cracks, holes and depressions in vapor barrier jacket shall be filled with weather coating and trowelled smooth with adjacent surface prior to application of weather-barrier coating finish.

(2) Weather coating shall be applied over vapor barrier jacket in accordance with GENERAL SPECIFICATION I. B. 16.

2. Piping

a. Pipe Insulation

(1) Thickness Schedule

Unless otherwise specified, insulation shall be applied in a single layer with attached vapor barrier tightly sealed to form a vapor tight envelope.

(2) Securement

(a) Insulation shall be applied to piping in accordance with GENERAL SPECIFICATIONS I. B. 4, 5, 6 and 7.

(b) All sectional pipe insulation having outside diameters of 6.625 inches or less shall be secured with stainless steel wire.

(c) All pipe insulation having outside diameters greater than 6.625 inches shall be secured with stainless steel insulation strap.

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II. SPECIFICATION 16-L

B. APPLICATION - contd

2. Piping - contd

b. Fittings, Flanges and Valve Covers

(1) Fittings, flanges and valve covers shall be either factory moulded or prefabricated in accordance with UCCC Dimensional Standards Fabrication Manual.

(2) Fittings, flanges and valve covers may be field fabricated, provided work is approved by the Field Representative of the Department of Design and Construction. Segments shall be carefully fitted to insure tight joints.

(3) Prefabricated covers shall be secured with wire or strap as required.

c. Steam Traced Installations

Steam trace-lines, where specified, shall be installed in accordance with the GENERAL SPECIFICATIONS I.B.15.

d. Surface Finish.

(1) Piping exposed to view or weather

(a) Where present, cracks and depressions in vapor barrier jacket shall be filled with weather-barrier coating and trowelled smooth with adjacent surface prior to application of weather-barrier coating finish.

(b) Weather-barrier coating shall be applied over vapor barrier jacket in accordance with GENERAL SPECIFICATIONS I.B.16.

(2) Piping concealed

Finish other than factory applied vapor barrier jackets will not be required.

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CARBIDE AND CARBON CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 17-H — Preformed Glass Fiber

Scope

This specification describes the essential requirements for the purchase and the application of glass fiber insulation for use on Heating, Ventilating and Air Conditioning Ducts.

Procedures outlined in the GENERAL SPECIFICATION are applicable to and constitute an integral part of this specification.

A. MATERIAL

1. Composition

Material shall be composed of fibrous glass with an inorganic resin binder formed into a rigid board and faced with a factory applied vapor barrier.

2. Properties

Glass fiber insulation board and duct liner shall have the following properties:

Alkalinity	pH = 6 to 7
Capillarity	Negligible after 24 hours.
Combustibility	Will not support combustion.
Compressive Strength . . .	Shall be not less than 0.07 @ 10 % deflection
Density	6 to 7 lbs. per sq. ft.
Hygroscopicity.	1.13% by wt. after 72 hours.
Resistance to Acids	Good resistance except to Hydrofluoric and Phosphoric.

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II. SPECIFICATION 17-H

A. MATERIAL - contd

2. Properties - contd

Specific Gravity . . . . . Apparent 0.012 to 0.016 true 2.6

Temperature Limits . . . . 250°F

Thermal Conductivity . . . Shall not exceed values at the following mean temperatures:

Mean Temp. °F.	Conductivity Btu/hr., sq. ft. °F, inch thick
0	0.21
100	0.25
150	0.28
250	0.35

Thermal Diffusivity . . . . 0.32 sq. ft. per day

3. Accessory Materials

a. Glass Fiber Insulation Board - Fiberglas FF Vapor-Seal Duct Insulation, Gustin-Bacon G-B Insulation Board with Foil-Scrim-Kraft Vapor Barrier, or approved alternate.

b. Glass Fiber Duct Liner - Fiberglas Coated Duct Insulation, or approved alternate.

c. Stainless Steel Wire - 0.0475 inch diameter, type 304 cold drawn, bright annealed, 18 gage.

d. Fasteners - 1-1/2 inches long, Stic-Klip Manufacturing Co., type N, Miracle Adhesives Anchor Nail, or approved alternate.

e. Washers - Stic-Klip Manufacturing Co. Speed Washers, Miracle Adhesives Lock Washers, or approved alternate.

f. Lap and Strip Adhesive - Benjamin Foster 81-71, Minnesota Mining #1128, St. Clair Rubber Adhesive No. 4815, or approved alternate.

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II. SPECIFICATION 17-H

A. MATERIAL - contd

3. Accessory Materials - contd

g. Fastener Adhesive - Stic-Klip, type S, Miracle's Anchor adhesive type AA, or approved alternate.

h. Joint Sealer Strips - Foil with Kraft paper backing in three inch wide rolls.

i. Reinforcing Cloth - Glass Fiber, approximately 10 x 10 thread count, with starch binder - Perma Glas Mesh, Benjamin Foster Open Weave, or approved alternate.

j. Weather Barrier Coating, color as specified - Vimasco WC-1, Benjamin Foster Sealfas "C", or approved alternate.

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II. SPECIFICATION 17-H

B. APPLICATION

1. External Surfaces of Ductwork

a. Thickness Schedule

Insulation thickness shall be one inch.

b. Duct Surfaces

Insulation board shall be applied to external duct surfaces with all joints tightly butted.

c. Securement

(1) Fasteners, as specified, shall be cemented to outside surfaces of duct on twelve inch staggered centers. On small ducts a minimum of two fasteners shall be cemented to each surface per linear foot.

(2) Insulation shall be impaled on fasteners and secured with washers that are installed so the insulation is held firmly in place.

(3) Fasteners shall be cut off 1/16 inch from outside of washer.

d. Vapor Barrier

All joints, cracks, and breaks, shall be sealed with three inch wide vapor barrier strips, cemented to existing vapor barrier to form a continuous vapor tight envelope. Where fastening devices project through insulation, holes shall be sealed with lap or strip adhesive.

e. Surface Finish

(1) Ductwork exposed to view or weather.

(a) Cracks and depressions shall be spotted with Weather Coating and trowelled smooth to form an even surface with insulation prior to application of Weather Coating.

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II. SPECIFICATION 17-H

B. APPLICATION - contd

1. External Surfaces of Ductwork - contd

e. Surface Finish - contd

(1) Ductwork exposed to view or weather - contd

(b) Weather Coating shall be applied over vapor barrier in accordance with GENERAL SPECIFICATION I.B.16.

(2) Ductwork concealed

Finish other than factory attached vapor barrier will not be required.

2. Internal Surfaces of Ductwork

Where specified, duct liner insulation shall be installed inside ducts in the following manner:

a. Thickness Schedule

Insulation thickness shall be one inch.

b. Duct Surfaces

Duct liner shall be applied to internal duct surfaces with all joints tightly butted.

c. Securement

(1) Fasteners shall be cemented to inside top surface of horizontal runs on twelve inch staggered centers. On small ducts a minimum of two fasteners per linear foot is required.

(2) Duct liner shall be secured to top surface of horizontal runs with mechanical fasteners. On all other surfaces duct liner shall be secured with adhesive.

d. Surface Finish

(1) All joints shall be pointed up with joint sealer.

(2) Finish other than factory applied coating will not be required.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 20-H — Calcium Silicate

Scope

This specification describes the essential requirements for the purchase and the application of preformed calcium silicate insulation for use on equipment and piping normally operating at temperatures from 70 F up to and including 750 F.

Procedures outlined in the GENERAL SPECIFICATION, are applicable to and constitute an integral part of this Specification.

A. MATERIAL

1. Composition

Material shall be composed of hydrous calcium silicate blended with asbestos fibers in suitable proportion, with or without inorganic filler added.

2. Properties

Calcium Silicate Insulation shall have the following properties:

Absorptivity	Not more than 93% of volume after 24 hours submersion in water.
Alkalinity	pH shall be not more than 11.0.
Capillarity	When placed on wet surface absorption after one-half hour shall be less than 100% and after 7 days less than 300% of its original weight.

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II. SPECIFICATION 20-H

A. MATERIAL - contd

2. Properties - contd

Combustibility	Shall be incombustible.
Compressive Strength	Percent of deformation shall be less than listed below:

Load lbs./sq. in.	Deformation per cent
20	2
60	6
100	10

Density	10 to 14 lbs./cu. ft.
Flexural Strength	Shall be not less than 40 psi.
Elasticity, Modulus of	Shall be not less than 35,000 psi.
Hygroscopicity	After oven dried at 200°F to 230°F, sample shall not gain over 10% by weight when exposed to air at 70 F, 90 RH for 14 days.
Resistance to Abrasion	When placed in Rotap on twenty mesh a 3 x 3 x 1-1/2 sample shall not have lost more than 25% after 10 minute run, nor more than 40% after 20 minute run.
Resistance to Acids or Caustics	It shall be resistant to most common caustics. (Not considered as an acid resistant material.)
Specific Gravity	0.15 to 1.28
Specific Heat	0.20 to 0.30 Btu/lb. °F.

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II. SPECIFICATION 20-H

A. MATERIAL - contd

2. Properties - contd

Coefficient of Expansion . After being heated to 1200 F then cooled, expansion upon reheating shall not exceed 0.000004 per °F.

Coefficient of Shrinkage. . When heated from 70 F to 1200 F (not reheated) linear shrinkage shall be less than 2%.

Temperature Limits. . . Shall be suitable for use from 0 F to 1200 F without mechanical, thermal, or chemical failure.

Tensile Strength . . . . Shall be above 6 lbs./sq. in.

Thermal Conductivity . . Shall not exceed values at the following mean temperatures:

Mean Temp. F	Conductivity Btu/hr., sq. ft. °F, inch Thick
100	0.43
200	0.46
300	0.49
400	0.52
500	0.58
600	0.64
700	0.69
800	0.75

Thermal Diffusivity . . . Shall not exceed 0.35 sq. ft. per day.

Thermal Shock Resistance. Material shall not spall, chip or crack, or otherwise fail when heated to 1200 F and then quenched with water.

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II. SPECIFICATION 20-H

A. MATERIAL - contd

3. Accessory Materials

a. Calcium Silicate Insulation

b. Wire - Stainless steel, .0475 inch diameter, type 304, cold drawn bright annealed, 18 gage.

c. Insulation Strap - Stainless steel, 1/2 inch x .020 inches type 304 or approved alternate.

d. Clips - Stainless steel, 1/2 inch double pronged, type 304, A. J. Gerrard or approved alternate.

e. Insulating Cement - Hydraulic setting, Baldwin-Hill Powerhouse, Eagle-Picher One Coat or approved alternate.

f. Finishing Cement - Hard surface, Eagle-Picher No. 106, Johns-Manville 678 or approved alternate.

g. Mineral Wool Blanket - Black, Spun Rock Wool, Hexagonal Wire Netting on both faces.

h. Mineral Wool Blanket - Black, Spun Rock Wool, Hex Netting one side, Expanded Metal Lath on the other side.

i. Heat Resistant Sealer - Benjamin Foster No. 30-43 or approved alternate.

j. Weather-Barrier Coating (Color as Specified) - Vimasco WC-1, Benjamin Foster Sealfas "C".

k. Reinforcing Cloth - Glass Fiber, 10 x 10 thread count, Perma Glass Mesh, Glasfab or approved alternate.

l. Fabricating Cement-A. P. Green "Insulation Adhesive" or approved alternate.

m. Wire Netting - One inch, Hexagonal Mesh, No. 20 gage, stainless steel, type 304, or approved alternate.

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II. SPECIFICATION 20-H

B. APPLICATION

1. Equipment

a. Insulation Supports

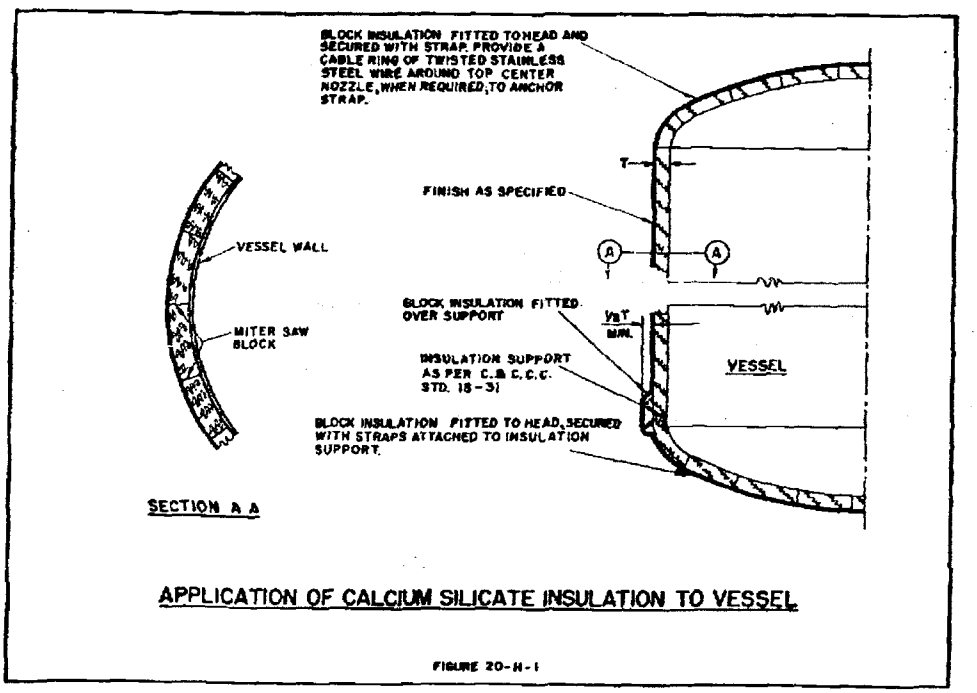
Equipment shall be provided with insulation supports as called for in the GENERAL SPECIFICATIONS, I.B.4.

b. Thickness Schedule

Unless otherwise specified, insulation in excess of two and one-half inches total thickness shall be applied in multi-layer construction as specified in GENERAL SPECIFICATION, I.B.1.

c. Curved Surfaces

On all equipment, insulation block shall be properly miter cut to fit vessel surface and applied to vessel sides and heads in staggered position, with all joints tightly butted. Block shall be applied to vessel sides with linear dimension paralleling axis of vessel. Typical installation is shown in Figure 20-H-1.



APPLICATION OF CALCIUM SILICATE INSULATION TO VESSEL

FIGURE 20-H-1

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II. SPECIFICATION 20-H

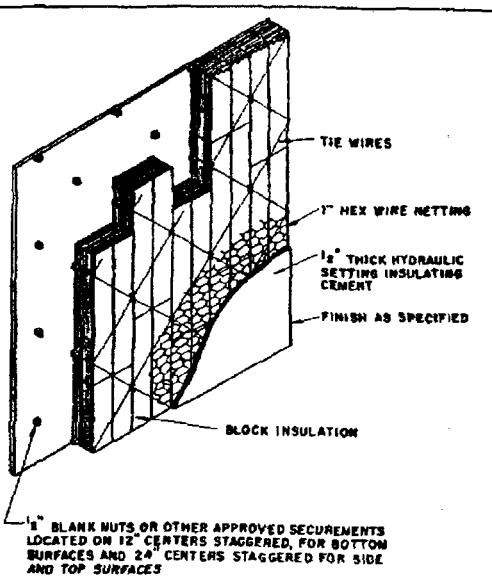
B. APPLICATION - contd

1. Equipment - contd

d. Flat Surfaces

(1) Block insulation shall be applied to flat surfaces in staggered position with all joints tightly butted. It shall be secured with wire attached to blank nuts or other approved securement. On rectangular equipment, the blank nuts, or other approved securements, shall be placed on 12-inch centers, staggered, for bottom surfaces and on 24-inch centers, staggered for side and top surfaces. Where specified in the Insulation Design Schedule, block may be applied to flat surfaces with an approved adhesive.

(2) When specified thickness of insulation has been applied, reinforcing netting shall be stretched tightly over block and secured with tie wires or other approved securement. Entire surface shall be given a 1/2 inch thick, smooth and uniformly applied trowel coat of hydraulic setting insulating cement. Typical installation is shown in Figure 20-H-2.



APPLICATION OF CALCIUM SILICATE INSULATION TO FLAT SURFACE

FIG. 20-H-2

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II. SPECIFICATION 20-H

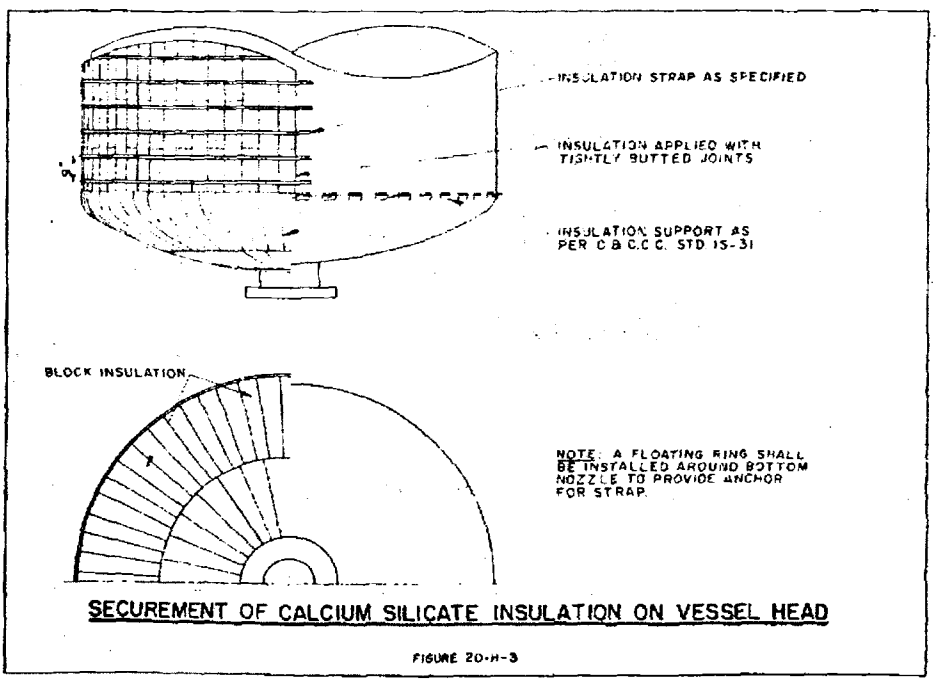
B. APPLICATION - contd

1. Equipment - contd

e. Securement

(1) All layers of insulation shall be secured with insulation strap where contour of vessel permits firm and effective attachment. Insulation applied to irregular surfaces, where strap is impracticable, shall be secured with wire, drawn taut, ends twisted and embedded in insulation.

(2) All layers of insulation on bottom heads of vertical equipment and heads of horizontal equipment shall be secured in place with wire attached to blank nuts, or with insulation strap attached to insulation support, as specified in UCCC Standard IS-31 and Figure 20-H-3.



SECUREMENT OF CALCIUM SILICATE INSULATION ON VESSEL HEAD

FIGURE 20-H-3

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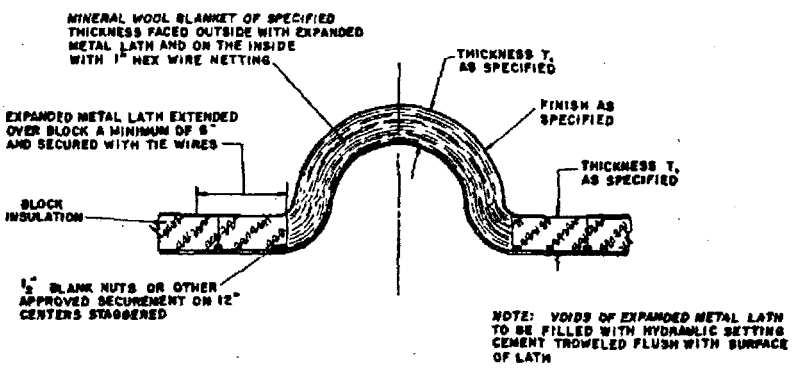
II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joints

Expansion joints in flat surfaces or cylindrical vessels shall be insulated with flexible blanket insulation. Typical installation is shown in Figure 20-H-4.



APPLICATION OF BLANKET INSULATION TO EXPANSION JOINTS ON FLAT SURFACE

FIG. 20-H-4

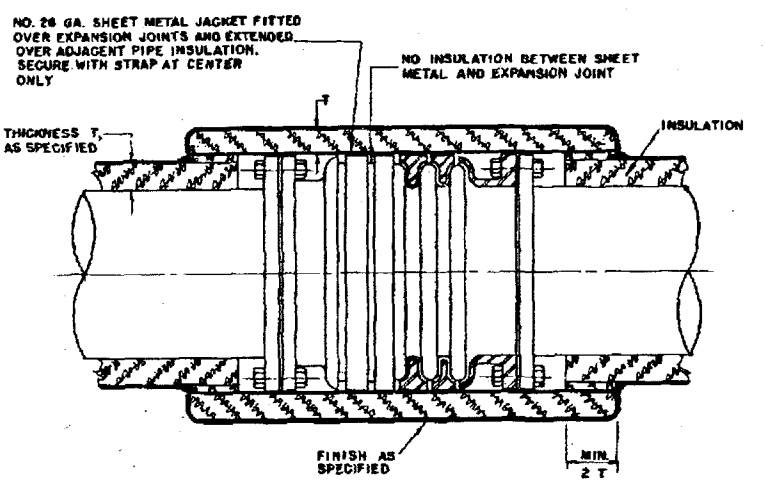
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II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

g. Corrugated mechanical expansion joints on piping (usually listed as equipment item) shall be insulated as shown in Figure 20-H-5.



APPLICATION OF CALCIUM SILICATE INSULATION TO EXPANSION JOINTS

FIG. 20-H-5

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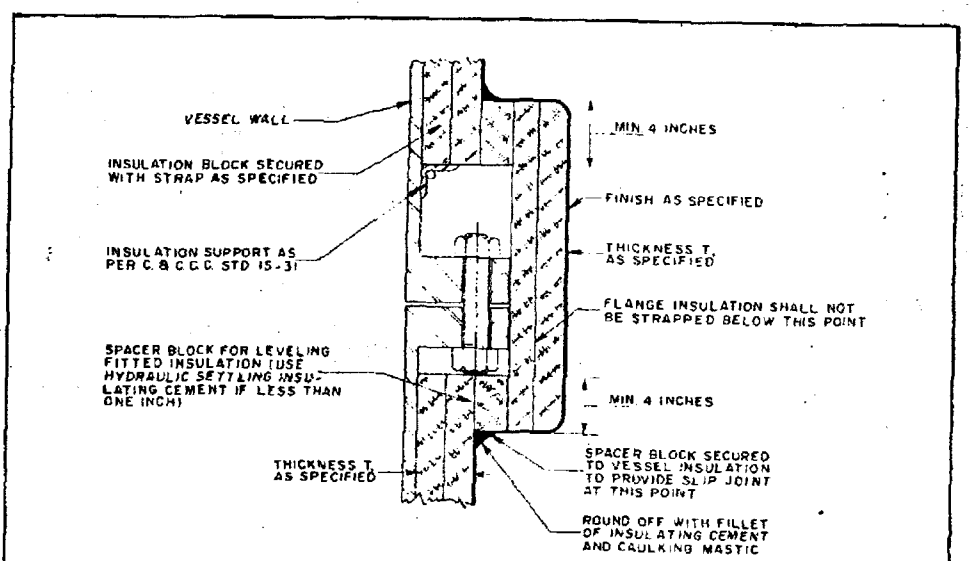
II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

h. Insulated Vessel Flanges

Vessel flanges shall be insulated with block in the same manner as specified for body of vessel. An insulation support shall be provided immediately above vessel flange. The top of projecting flange insulation shall be sloped to shed water. Typical installation is shown in Figure 20-H-6.



APPLICATION OF CALCIUM SILICATE TO VESSEL FLANGE

FIGURE 20-H-6

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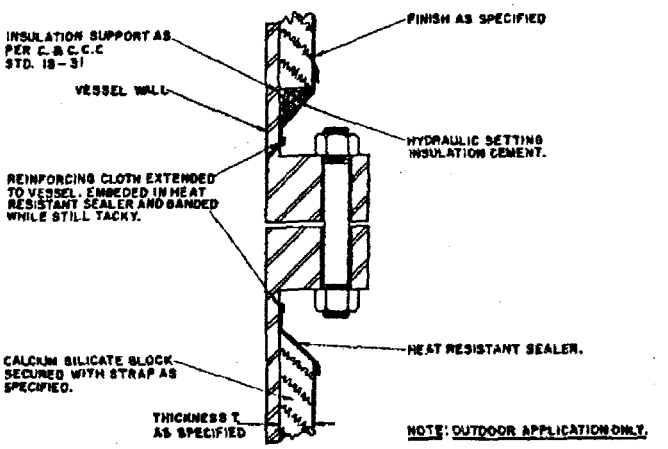
II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

i. Uninsulated Vessel Flanges

Where vessel flanges are located outdoors and specified to be left uninsulated, the reinforcing cloth of the weather-barrier, on the adjacent vessel insulation, shall be extended to metal of vessel body, embedded in heat resistant sealer, and banded while sealer is still tacky. A second application of heat resistant sealer shall then be applied over the reinforcing cloth and securement. Typical installation is shown in Figure 20-H-7.



WEATHER SEALING OF CALCIUM SILICATE VESSEL INSULATION AT UNINSULATED FLANGES

FIGURE 20-H-7

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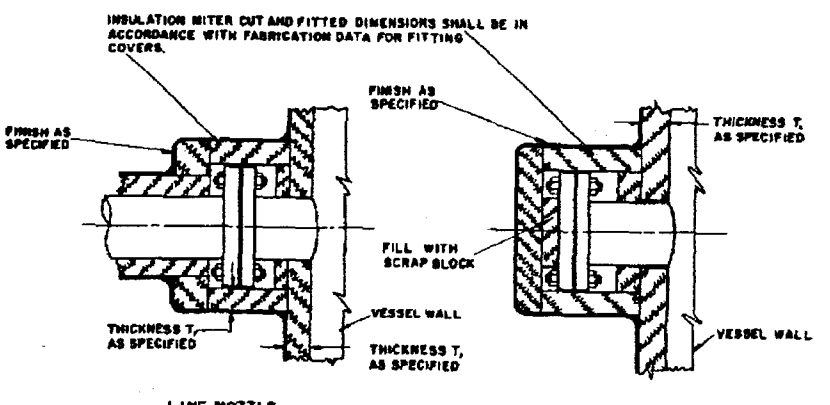
II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

j. Vessel Nozzles

Vessel nozzles shall be insulated as shown in Figure 20-H-8.



APPLICATION OF CALCIUM SILICATE TO VESSEL NOZZLES

FIGURE 20-H-8

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II. SPECIFICATION 20-H

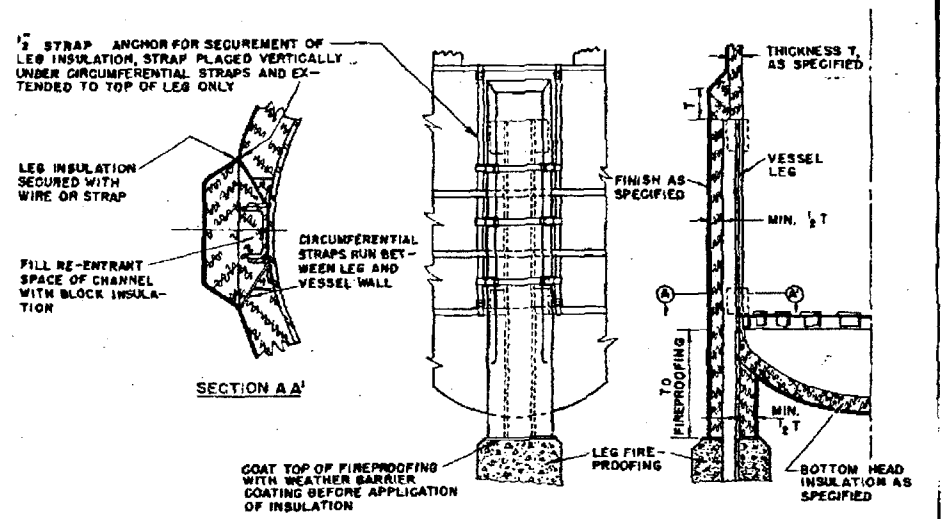
B. APPLICATION - contd

1. Equipment - contd

k. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down channel legs to fireproofing. Thickness shall be a minimum of one-half that specified for body of vessel.

(2) Vessel insulation shall be butted firmly against tank leg flange. Re-entrant space between channel flanges and over channel flanges between body insulation shall be filled with block. Installation shall be as shown in Figure 20-H-9.



APPLICATION OF CALCIUM SILICATE INSULATION TO VESSEL LEGS

FIG. 20-H-9

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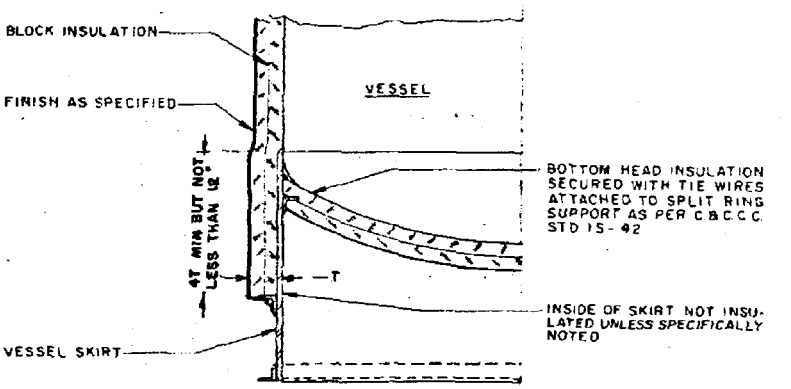
II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

1. Vessel Skirts

Skirts supporting vertical equipment shall have their outer surfaces insulated. Unless otherwise specified, insulation shall extend downward, from junction of skirt with bottom head, a minimum of four times the specified thickness, but not less than twelve inches, or to bottom of skirt if that distance is less than twelve inches. Thickness shall be as specified for body of vessel. The bottom head insulation shall be supported in accordance with UCCC Standard IS-42. Installation shall be as shown in *Figure 20-H-10*.



APPLICATION OF CALCIUM SILICATE INSULATION TO VESSEL SKIRT

FIGURE 20-H-10

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II. SPECIFICATION 20-H

B. APPLICATION - contd

1. Equipment - contd

m. Surface Finish

When specified thickness of insulation has been applied, any small cracks or depressions shall be pointed up with insulation cement trowelled flush with surface of insulation.

n. Weather-Barrier

Weather-barrier shall be installed in accordance with the GENERAL SPECIFICATIONS, I.B.16.

2. Piping

a. Pipe Insulation

(1) Thickness Schedule

Unless otherwise specified, insulation in excess of two and one-half inches total thickness shall be applied in multi-layer construction as specified in GENERAL SPECIFICATION, I.B.1.

(2) Securement

(a) Insulation shall be applied to piping in accordance with GENERAL SPECIFICATIONS, I.B. 4,5,6, and 7.

(b) All inner layers of sectional pipe insulation shall be secured with stainless steel wire.

(c) All sectional pipe insulation having outside diameters of 6.625 inches or less shall be secured with stainless steel wire.

(d) All pipe insulation having outside diameters greater than 6.625 inches shall be secured with stainless steel insulation strap.

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II. SPECIFICATION 20-H

B. APPLICATION - contd

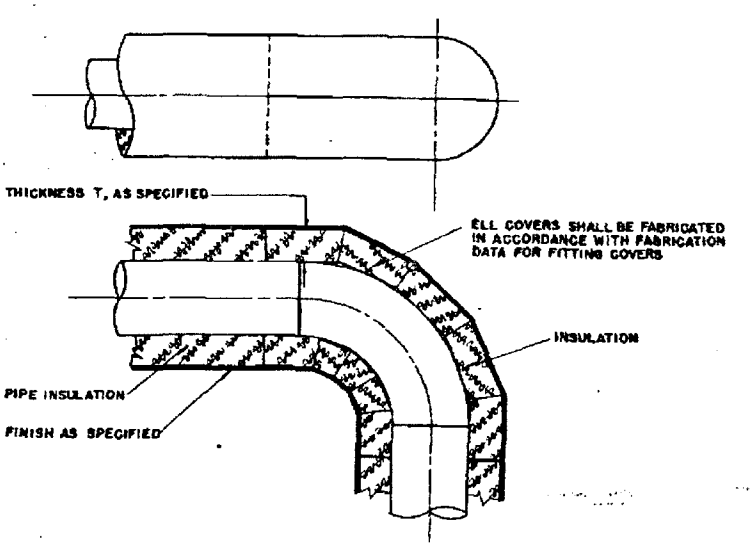
2. Piping - contd

b. Fittings, Flanges and Valves - contd

(3) Insulating cement may be applied as the insulating material where fittings are 2-1/2 inch IPS or smaller and the specified insulation thickness does not exceed 1-1/2 inches. Cement shall be of same thickness as specified for adjacent pipe insulation.

(4) Fitting insulation shall be secured with specified wire or strap as required.

(5) Insulation for all fittings shall be fitted and assembled with tight joints. Cementing of shop fabricated assemblies shall be done with specified fabricating cement. In all cases the joints shall be as thin as possible, with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids, and holes filled with fabricating cement, be permitted. Typical installations are shown in Figures 20-H-11, 20-H-12, and 20-H-13.



APPLICATION OF CALCIUM SILICATE INSULATION TO WELDING ELL

FIG. 20-H-11

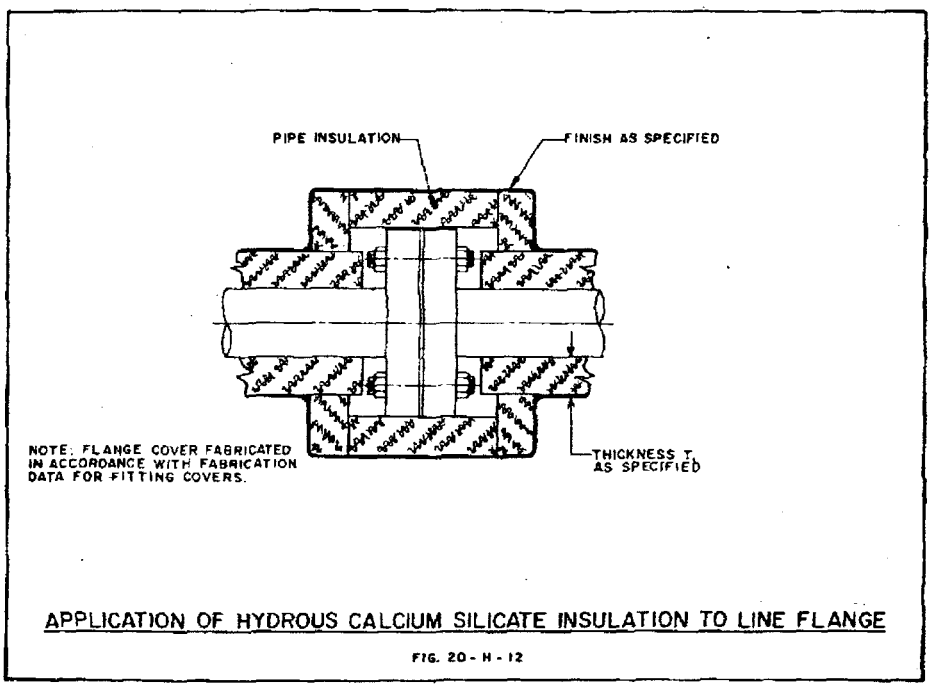
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II. SPECIFICATION 20-H

B. APPLICATION - contd

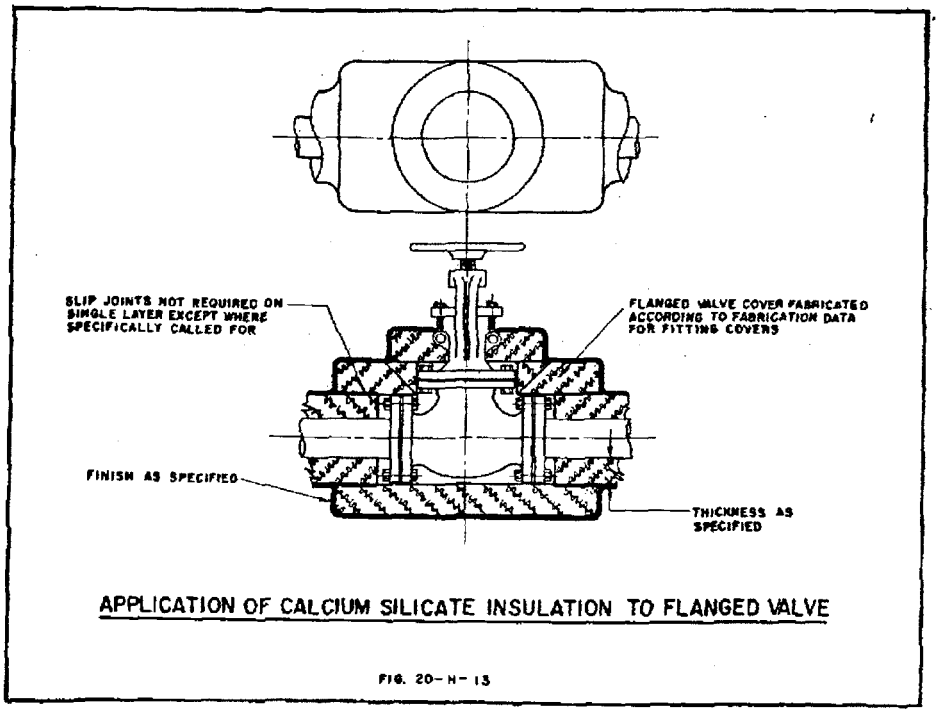
2. Piping - contd

b. Fittings, Flanges and Valves - contd



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO LINE FLANGE

FIG. 20-H-12



APPLICATION OF CALCIUM SILICATE INSULATION TO FLANGED VALVE

FIG. 20-H-13

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II. SPECIFICATION 20-H

B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers

(1) Fittings, flanges and valves shall be insulated with prefabricated fitting covers (preferred method) in accordance with UCCC Dimensional Standards Fabrication Manual.

(2) Fitting, flange and valve covers may be field fabricated provided work is in accordance with and/or approved by the Field Representative of the Department of Design and Construction. Segments shall be carefully fitted to insure tight joints.

c. Steam Traced Installations

Steam-trace lines, where specified, shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

d. Surface Finish

Where present, small cracks and depressions shall be filled and smoothed with insulating cement prior to application of weather-barrier.

e. Weather-Barrier

Weather-barrier shall be installed in accordance with GENERAL SPECIFICATIONS, I.B.16.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 21-H — Asbestos Fiber

Scope

This specification covers the application of preformed asbestos fiber insulation for use on piping normally operating at temperatures from 70 F up to and including 750 F.

Procedures outlined in the GENERAL SPECIFICATION, are applicable to and constitute an integral part of this specification.

A. MATERIAL

1. Composition

Material shall be composed of asbestos fibers blended with suitable inorganic binder, processed and molded at sufficient temperatures to produce a rigid, homogeneous thermal insulation.

2. Properties

Asbestos Fiber Insulation shall have the following properties:

Absorptivity	Not over 85% of volume after 24 hours submersion.
Alkalinity.	pH shall be not more than 10.7
Coefficient of Expansion . . . (or Volume and Linear Shrinkage)	Shrinkage shall be less than 0.7% when heated to 750 F
Combustibility	Shall be incombustible

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II. SPECIFICATION 21-H

A. MATERIAL - contd

2. Properties - contd

Compressive Strength . . . Compression of the 1 in. block shall be not more than the following:

Lbs./sq.in.	Compression
5	.07"
10	.15"
20	.30"
40	.55"

Density . . . . . Shall be not less than 12 but not more than 16 lbs. per cu. ft.

Flexural Strength . . . . . Shall be not less than 100 lbs. per sq. in.

Hygroscopicity. . . . . Weight gain of oven dried sample subjected to 70 F and 90 RH for the exposure times listed, shall be not more than the corresponding percentages.

Days	Percentages
1	4
7	15
14	19
30	23

Specific Gravity . . . . . Shall be approximately 0.228

Specific Heat . . . . . Shall be approximately 0.248 Btu/lb.

Thermal Conductivity . . . Mean Temp °F

Mean Temp °F	Btu/S.F. in. thk.
200	0.40
400	0.51
600	0.62

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II. SPECIFICATION 21-H

A. MATERIAL - contd

2. Properties - contd

Thermal Diffusivity	Shall be approx. 0.197 sq. ft./day
Thermal Shock Resistance . .	Material shall not spall, chip, or crack, or otherwise fail when heated to 750 F and then quenched with water.

3. Accessory Materials

a. Asbestos Fiber Insulation - Unibestos or approved alternate.

b. Wire - Stainless steel, .0475 inch dia., type 304, cold drawn bright annealed (18 gage).

c. Insulation Strap - Stainless steel, 1/2 inch double pronged, type 304 or approved alternate.

d. Clips - Stainless steel, 1/2 inch double pronged, type 304, A. J. Gerrard or approved alternate.

e. Insulating Cement - Hydraulic setting, Baldwin-Hill Powerhouse, Eagle-Picher One Coat or approved alternate.

f. Finishing Cement - Hard surface, Eagle Picher No. 106 Johns Manville 678 or approved alternate.

g. Heat Resistant Sealer - Benjamin Foster No. 30-43 or approved alternate.

h. Weather Barrier Coating (Color as specified) - Vimasco WC-1, Benjamin Foster Sealfas "C", or approved alternate.

i. Reinforcing Cloth - Glass fiber, 10 x 10 thread count, Perma Glas Mesh, Glasfab or approved alternate.

j. Fabricating Cement - A. P. Green "Insulation Adhesive", or approved alternate.

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II. SPECIFICATION 21-H

B. APPLICATION

1. Piping

a. Pipe Insulation

(1) Unless otherwise specified, insulation in excess of two and one-half inches total thickness shall be applied in multiple layers as specified in GENERAL SPECIFICATION, I.B.1.

(2) Insulation shall be applied to piping in staggered position in accordance with the GENERAL SPECIFICATION, I.B.4, 5, 6, and 7, with all joints tightly butted and factory attached sheeting jacket, where furnished, removed.

(3) Small cracks and depressions, where present, shall be pointed up with insulating cement troweled smooth with insulation surface.

b. Fittings, Flanges and Valves

(1) Fittings, flanges and valves shall be insulated with prefabricated insulation covers fabricated in accordance with the Dimensional Standard Fabrication Manual.

(2) Where impractical to shop fabricate fitting insulation, and with the approval of the representative of the Department of Design and Construction, fitting covers may be field fabricated, provided work is in accordance with Dimensional Standard Fabrication Data. Segments shall be carefully fitted to insure tight joints.

(3) Shop fabricated assemblies shall be cemented with specified fabricating cement. In all cases the joints shall be as thin as possible, with just sufficient cement to obtain good adhesion and complete closure. In no case will wide fabricating cement joints, or voids and holes filled with fabricating cement, be permitted. Typical installations are shown in Figures 21-H-1, 21-H-2, 21-H-3, and 21-H-4.

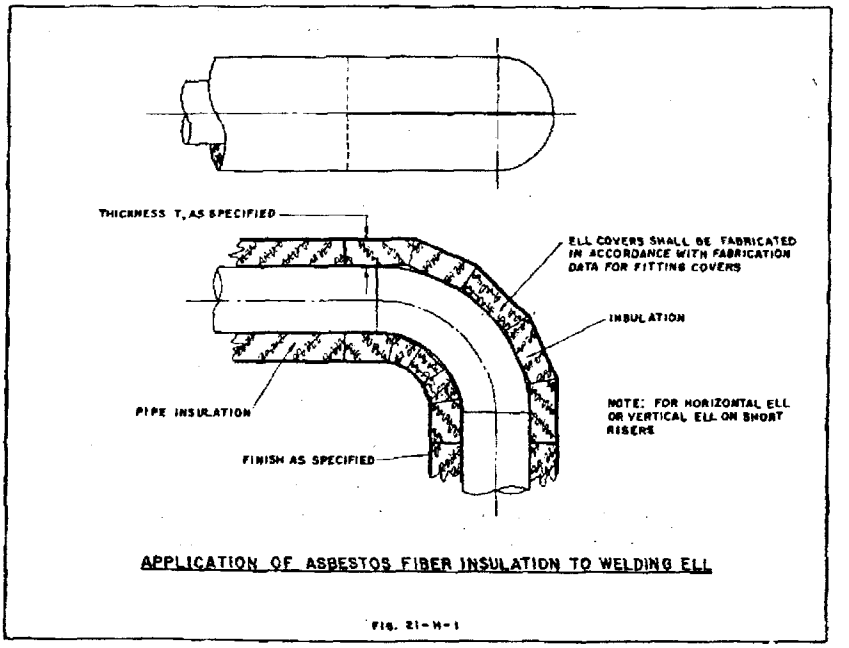
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II. SPECIFICATION 21-H

B. APPLICATION - contd

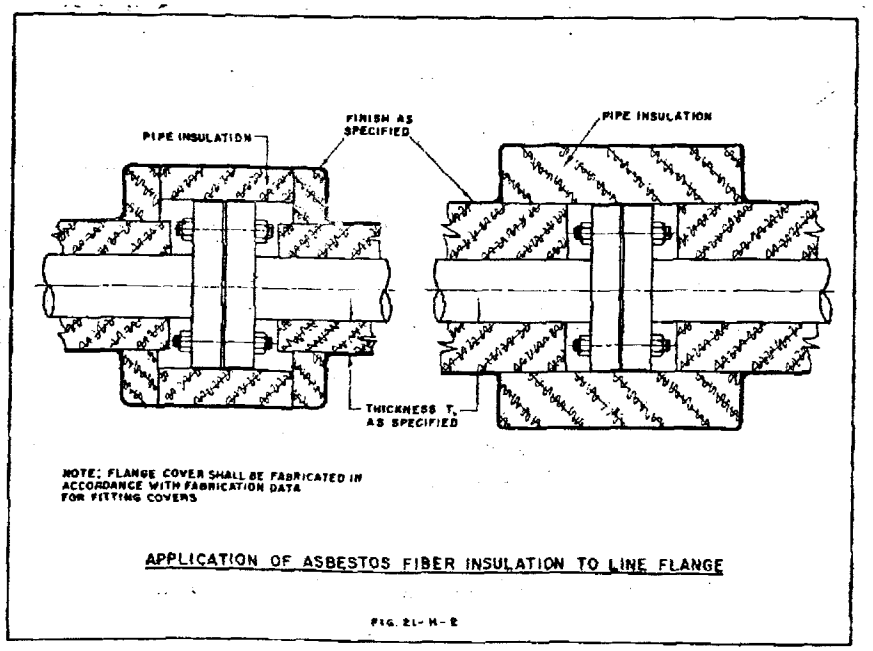
1. Piping - contd

b. Fittings, Flanges and Valves - contd



APPLICATION OF ASBESTOS FIBER INSULATION TO WELDING ELL

FIG. 21-H-1



APPLICATION OF ASBESTOS FIBER INSULATION TO LINE FLANGE

FIG. 21-H-2

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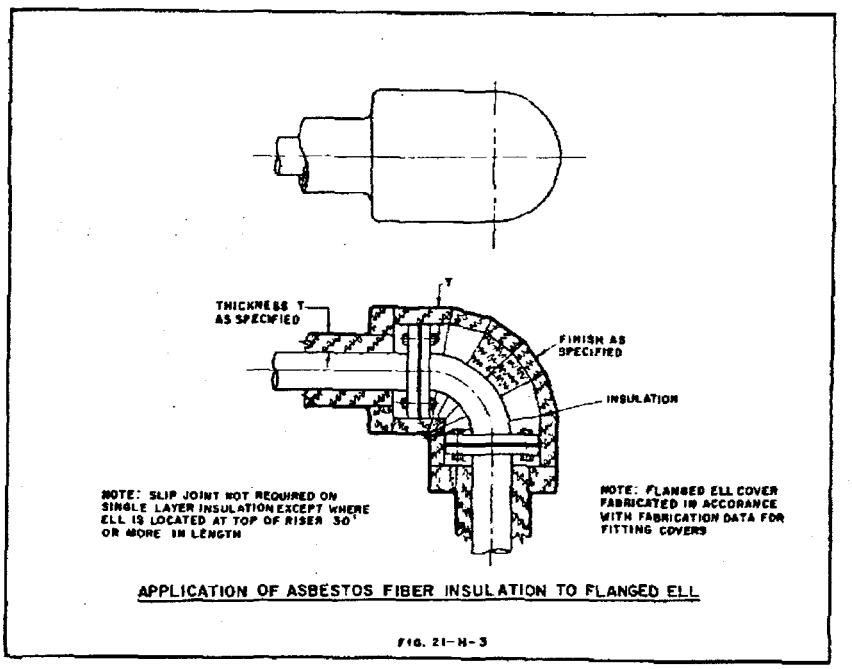
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II. SPECIFICATION 21-H

B. APPLICATION - contd

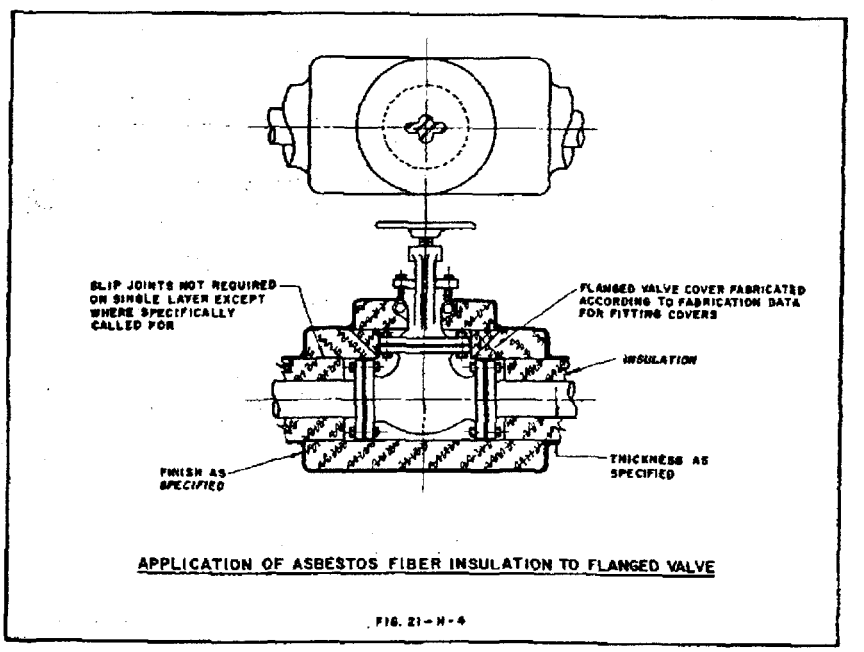
1. Piping - contd

b. Fittings, Flanges and Valves - contd



APPLICATION OF ASBESTOS FIBER INSULATION TO FLANGED ELL

FIG. 21-H-3



APPLICATION OF ASBESTOS FIBER INSULATION TO FLANGED VALVE

FIG. 21-H-4

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II. SPECIFICATION 21-H

B. APPLICATION - contd

1. Piping - contd

b. Fittings, Flanges and Valves - contd

(4) Insulating cement may be applied as the insulating material where fittings are 2-1/2 inch IPS or smaller and the specified insulation thickness does not exceed 1-1/2 inches. Cement shall be of same thickness as specified for adjacent pipe insulation.

c. Securement

(1) Application and securement of pipe insulation shall be as described (and shown in Figures GA-1 and GA-2) in the GENERAL SPECIFICATION.

(2) All inner layers of sectional pipe insulation shall be secured with stainless steel wire.

(3) All sectional pipe insulation having outside diameters of 6.625 inches or less shall be secured with stainless steel wire.

(4) All pipe insulation having outside diameters greater than 6.625 inches shall be secured with stainless steel insulation strap.

(5) Fitting, flange and valve covers shall be secured with specified insulation strap as required.

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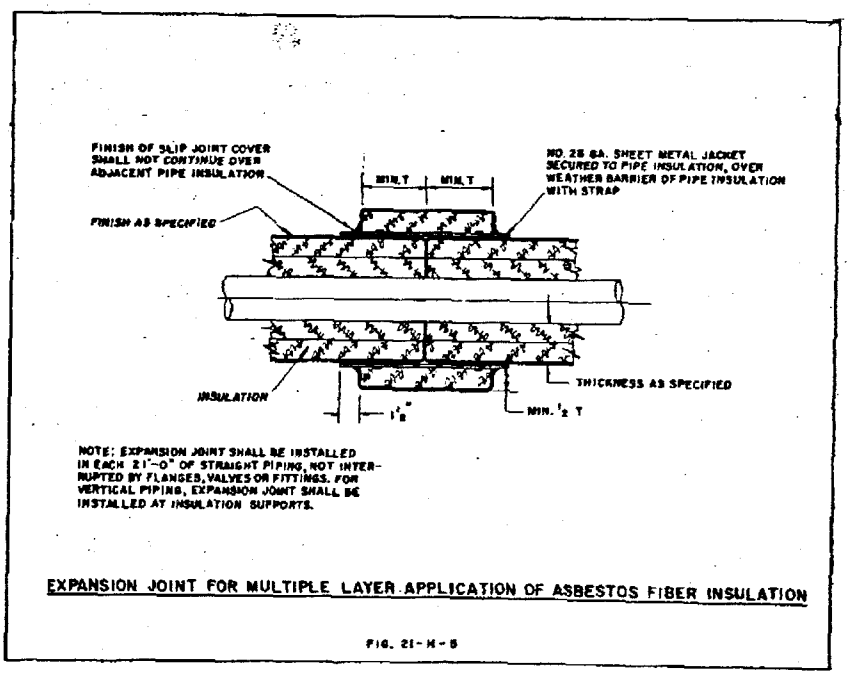
II. SPECIFICATION 21-H

B. APPLICATION - contd

1. Piping - contd

d. Expansion Joints

(1) Expansion slip joints shall be provided in the insulation for multiple layer applications. An expansion joint shall be installed in each 21'-0" of straight piping not interrupted by flanges, valves or fittings. Typical installation is shown in Figure 21-H-5.



EXPANSION JOINT FOR MULTIPLE LAYER APPLICATION OF ASBESTOS FIBER INSULATION

FIG. 21-H-5

(2) The expansion slip joints shall be installed at the insulation support in vertical piping. Care shall be exercised that slip joint is placed so movement occurs at the bottom in order to shed water.

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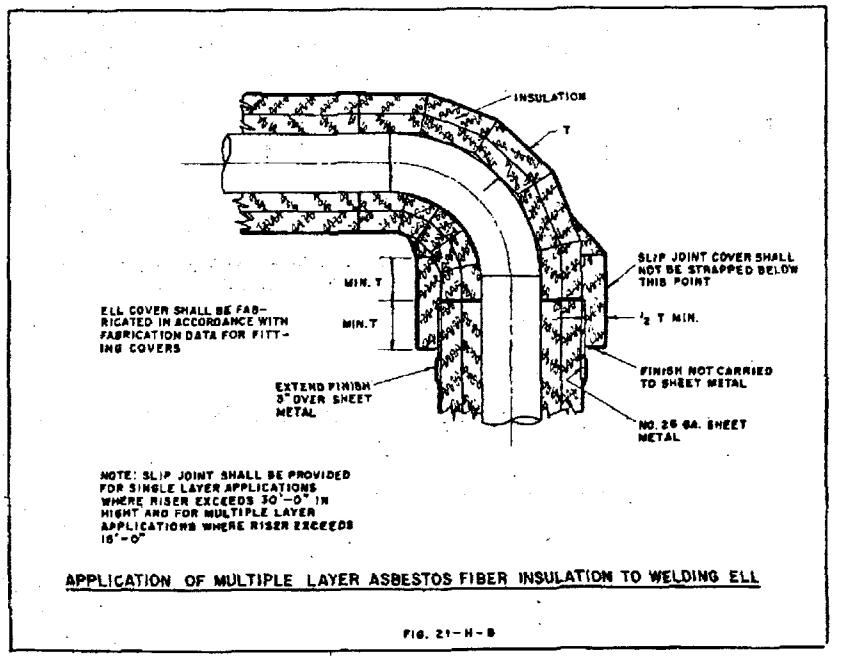
II. SPECIFICATION 21-H

B. APPLICATION - contd

1. Piping - contd

d. Expansion Joints - contd

(3) Expansion slip joints shall be provided at junction of fitting covers and pipe insulation located at the top of risers, where riser exceeds 30'-0" in height for single layer applications and where riser exceeds 15'-0" in height for multiple layer applications. Typical installation is shown in Figure 21-H-6.



APPLICATION OF MULTIPLE LAYER ASBESTOS FIBER INSULATION TO WELDING ELL

FIG. 21-H-6

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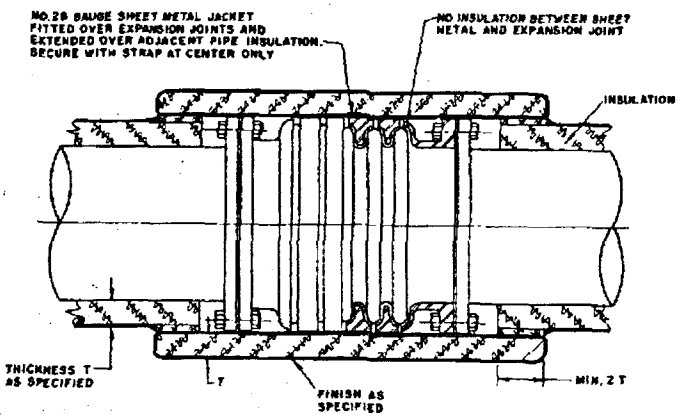
II. SPECIFICATION 21-H

B. APPLICATION - contd

1. Piping - contd

d. Expansion Joints - contd

(4) Corrugated mechanical expansion joints in piping (usually listed as equipment item) shall be insulated as shown in Figure 21-H-7.



APPLICATION OF ASBESTOS FIBER INSULATION TO EXPANSION JOINTS

FIG. 21-H-7

e. Steam Traced Installations

Steam-trace lines, where specified shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

f. Weather-Barrier

Weather-barrier shall be installed in accordance with GENERAL SPECIFICATION, I.B.16.

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CARBIDE AND CARBON CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 25-H — Hydrous Calcium Silicate

Scope

This specification describes the essential requirements for the purchase and the application of preformed calcium silicate insulation for use on equipment and piping normally operating at temperatures from 750 F up to and including 1200 F.

Procedures outlined in the GENERAL SPECIFICATION, are applicable to and constitute an integral part of this Specification.

A. MATERIAL

1. Composition

Material shall be composed of hydrous calcium silicate blended with asbestos fibers in suitable proportion, with or without inorganic filler added.

2. Properties

Calcium Silicate Insulation shall have the following properties:

Absorptivity	Not more than 93% of volume after 24 hours submersion in water.
Alkalinity	pH shall be not more than 10.0
Capillarity	When placed on wet surface absorption after one-half hour shall be less than 100% and after 7 days less than 300% of its original weight.

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II. SPECIFICATION 25-H

A. MATERIAL - contd

2. Properties - contd

Combustibility	Shall be incombustible.
Compressive Strength . . .	Percent of deformation shall be less than listed below:

Load lbs./sq. in.	Deformation per cent
20	2
60	6
100	10

Density	10 to 14 lbs./cu. ft.
Flexural Strength	Shall be not less than 40 psi.
Elasticity, Modulus of . . .	Shall be not less than 35,000 psi.
Hygroscopicity.	After oven dried at 200°F to 230°F, sample shall not gain over 10% by weight when exposed to air at 70 F, 90 RH for 14 days.
Resistance to Abrasion . . .	When placed in Rotap on twenty mesh a 3 x 3 x 1-1/2 sample shall not have lost more than 25% after 10 minute run, nor more than 40% after 20 minute run.
Resistance to Acids or Caustics . . .	It shall be resistant to most common caustics. (Not considered as an acid resistant material.)
Specific Gravity	0.15 to 0.28
Specific Heat	0.20 to 0.30 Btu/lb. °F.

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II. SPECIFICATION 25-H

A. MATERIAL - contd

2. Properties - contd

Coefficient of Expansion .	After being heated to 1800 F then cooled, expansion upon reheating shall not exceed 0.000004 per °F.
Coefficient of Shrinkage. .	When heated from 70 F to 1800 F (not reheated) linear shrinkage shall be less than 2%.
Temperature Limits. . .	Shall be suitable for use from 0 F to 1800 F without mechanical, thermal, or chemical failure.
Modulus of Rupture . . .	Shall be above 50 psi
Thermal Conductivity . .	Shall not exceed values at the following mean temperatures:

Mean Temp.F	Conductivity Btu/hr.,sq.ft., °F, inch thk.
100	0.43
400	0.58
800	0.78
1200	1.09

Thermal Diffusivity . . .	Shall not exceed 0.35 sq. ft.
Thermal Shock Resistance.	Material shall not spall, chip or crack, or otherwise fail when heated to 1800 F and then quenched with water.

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II. SPECIFICATION 25-H

A. MATERIAL - contd

3. Accessory Materials

a. Hydrous Calcium Silicate Insulation - Kaylo No. 20 or approved alternate.

b. Wire - Stainless steel, .0475 inch diameter, type 304, cold drawn bright annealed, 18 gage.

c. Insulation Strap - Stainless steel, 1/2 inch x .020 inches type 304 or approved alternate.

d. Clips - Stainless Steel, 1/2 inch double pronged, type 304, A. J. Gerrard *or approved alternate.*

e. Insulating Cement - Hydraulic setting, Baldwin-Hill Powerhouse, Eagle-Picher One Coat or approved alternate.

f. Mineral Wool Blanket - Black, Spun Rock Wool, Hex Netting one side, Expanded Metal Lath on the other side.

g. Mineral Wool Blanket - Black, Spun Rock Wool, Hexagonal Wire Netting on both faces.

h. Heat Resistant Sealer - Benjamin Foster No. 30-43 or approved alternate.

i. Weather-Barrier Coating (Color as Specified) - Vimasco WC-1, Benjamin Foster Sealfas "C".

j. Reinforcing Cloth - Glass Fiber, 10 x 10 thread count, Perma Glass Mesh, Glasfab or approved alternate.

k. Fabricating Cement - A. P. Green "Insulation Adhesive"

l. Wire Netting - One inch, Hexagonal Mesh, No. 20 gage, Stainless Steel, Type 304, or approved alternate.

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II. SPECIFICATION 25-H

B. APPLICATION

1. Equipment

a. Insulation Supports

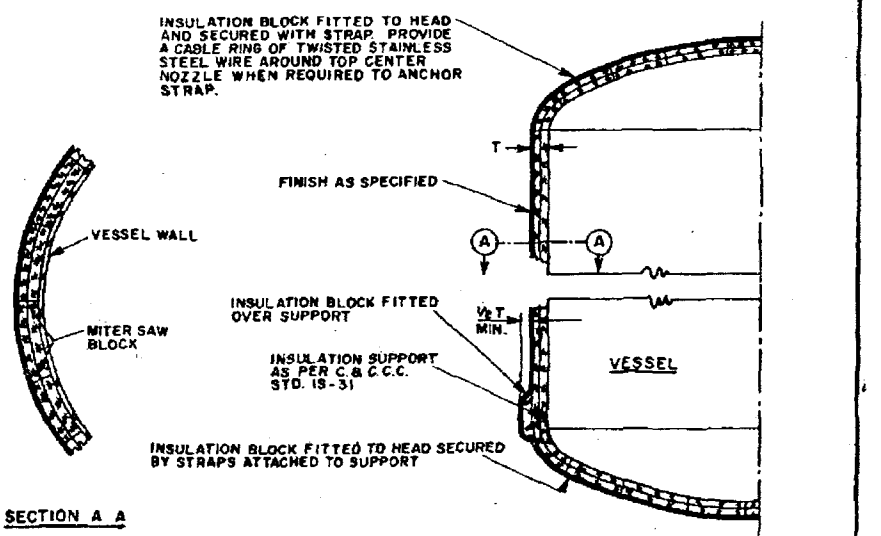
Equipment shall be provided with insulation supports as called for in the GENERAL SPECIFICATIONS, I.B.4.

b. Thickness Schedule

Unless otherwise specified, insulation in excess of two and one-half inches total thickness shall be applied in multi-layer construction as specified in GENERAL SPECIFICATION, I.B.1.

c. Curved Surfaces

On all equipment, insulation block shall be properly miter cut to fit vessel surface and applied to vessel sides and heads in staggered position, with all joints tightly butted. Block shall be applied to vessel sides with linear dimension paralleling axis of vessel. Typical installation is shown in Figure 25-H-1.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO VESSEL

FIG. 25-H-1

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II. SPECIFICATION 25-H

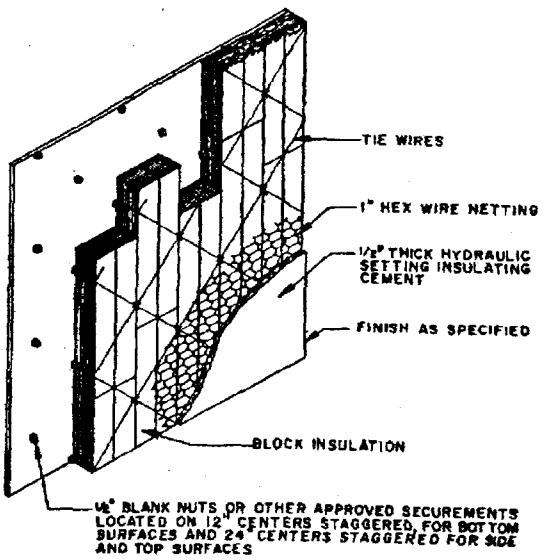
B. APPLICATION - contd

1. *Equipment - contd*

d. Flat Surfaces

(1) Block insulation shall be applied to flat surfaces in staggered position with all joints tightly butted. It shall be secured with wire attached to blank nuts or other approved securement. On rectangular equipment, the blank nuts, or other approved securements, shall be placed on 12-inch centers, staggered, for bottom surfaces and on 24-inch centers, staggered for side and top surfaces.

(2) When specified thickness of insulation has been applied, reinforcing netting shall be stretched tightly over block and secured with tie wires or other approved securement. Entire surface shall be given a 1/2 inch thick, smooth and uniformly applied trowel coat of hydraulic setting insulating cement. Typical installation is shown in Figure 25-H-2.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO FLAT SURFACE

FIG. 25-H-2

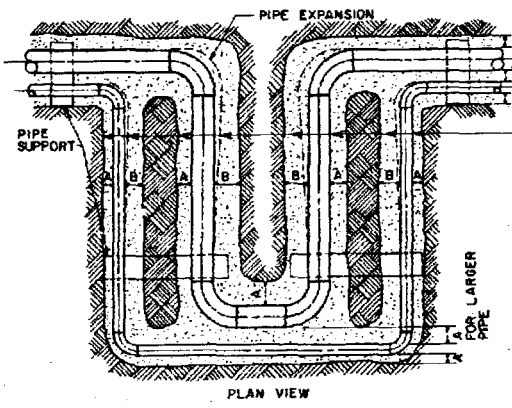
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II. SPECIFICATION 39-H

B. APPLICATION - contd

2. Expansion Loops

a. The insulation material shall be applied to expansion loops as shown in Fig. 39-H-2.



RECOMMENDED ENVELOPS

NOMINAL PIPE SIZE INCHES	DIMENSION "A" MIN. INCHES	DIMENSION "B" MIN INCHES
1 TO 4	4	9
5 AND 6	6	10
8	6	11
10 AND 12	8	15
16	11	16

APPLICATION OF BITIMINOUS FILL INSULATION TO UNDERGROUND EXPANSION LOOPS

FIG. 39-H-2

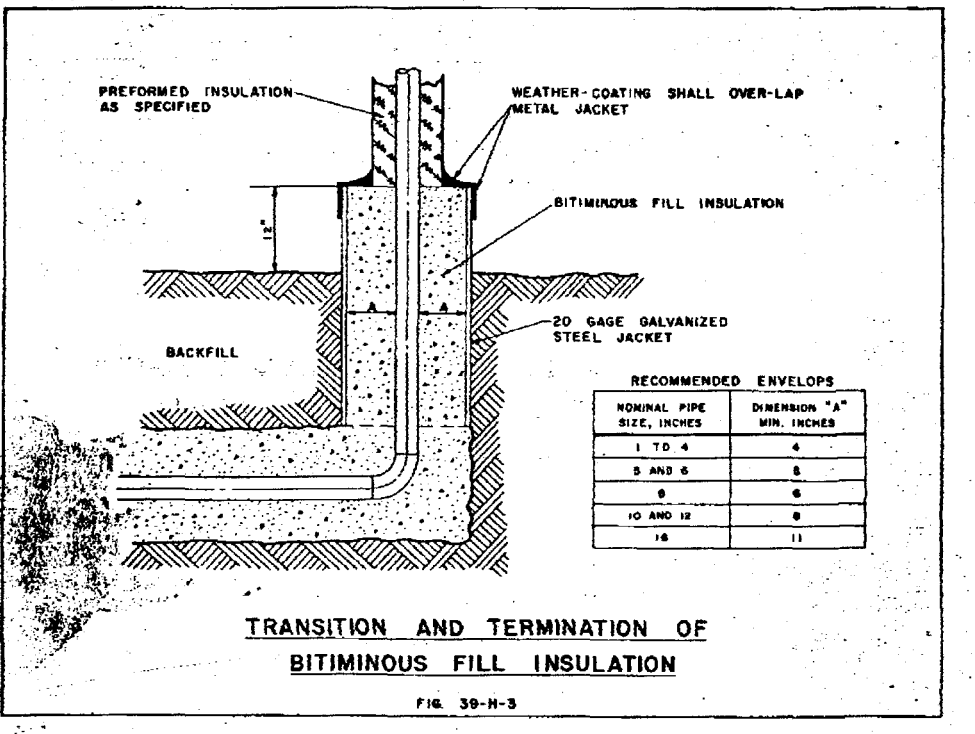
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B. APPLICATION - contd

3. Transition and Termination

a. Where the bituminous insulation system emerges above the surface, a transition shall be provided to the type of insulation specified for portion above surface. Details of the transition are shown on Fig. 39-H-3.

b. Where lines insulated with bituminous fill enter a manhole or building wall, an asbestos rope or lead packing shall be applied between the pipe and the sleeves.



RECOMMENDED ENVELOPS

NOMINAL PIPE SIZE, INCHES	DIMENSION "A" MIN. INCHES
1 TO 4	4
5 AND 6	5
8	6
10 AND 12	8
14	11

TRANSITION AND TERMINATION OF BITIMINOUS FILL INSULATION

FIG. 39-H-3

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II. SPECIFICATION 25-H

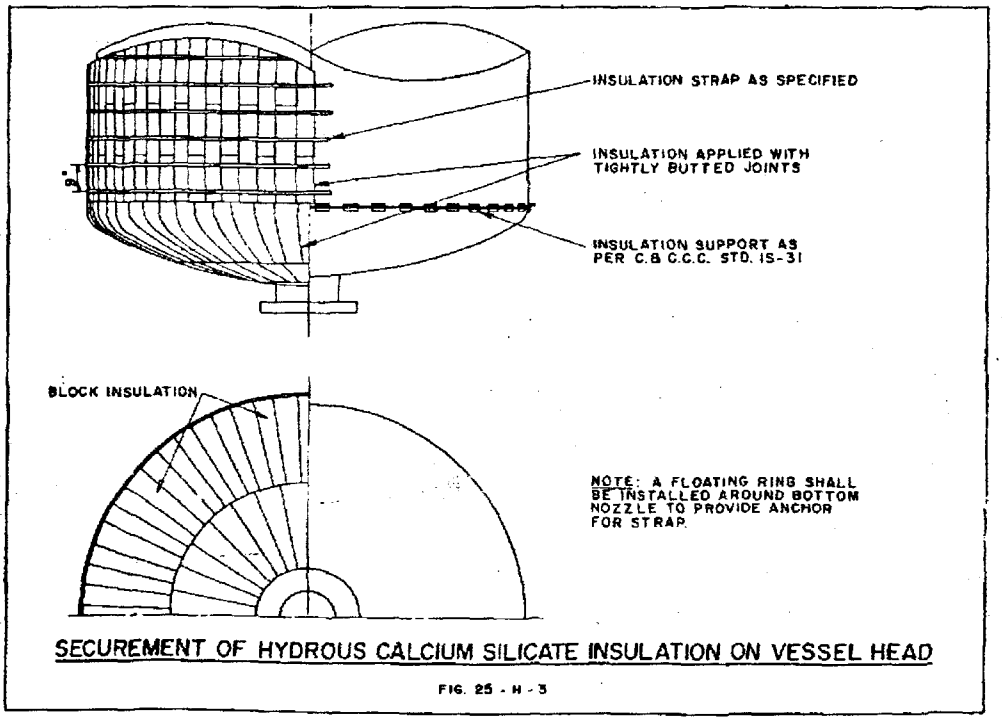
B. APPLICATION - contd

1. Equipment - contd

e. Securement

(1) All layers of insulation shall be secured with insulation strap where contour of vessel permits firm and effective attachment. Insulation applied to irregular surfaces, where strap is impracticable, shall be secured with wire, drawn taut, ends twisted and embedded in insulation.

(2) All layers of insulation on bottom heads of vertical equipment and heads of horizontal equipment shall be secured in place with wire attached to blank nuts, or with insulation strap attached to insulation support, as specified in C&CCC Standard IS-31 and Figure 25-H-3.



SECUREMENT OF HYDROUS CALCIUM SILICATE INSULATION ON VESSEL HEAD

FIG. 25 - H - 3

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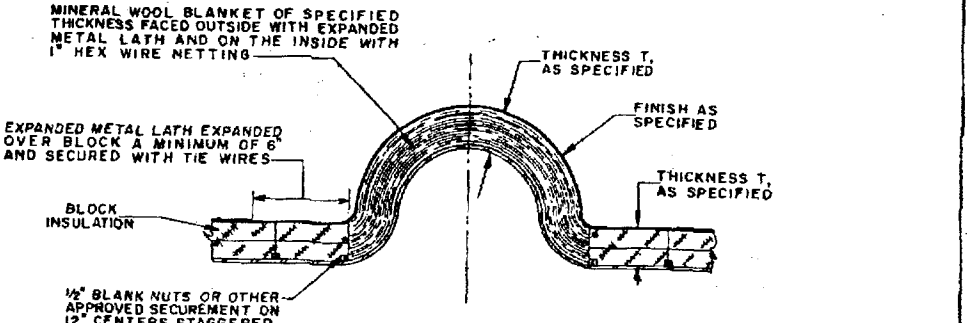
II. SPECIFICATION 25-H

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joints

(1) Expansion joints in flat surfaces or cylindrical vessels shall be insulated with flexible blanket insulation. Typical installation is shown in Figure 25-H-4.



APPLICATION OF BLANKET INSULATION TO EXPANSION JOINTS ON FLAT SURFACE

FIG. 25 - H - 4

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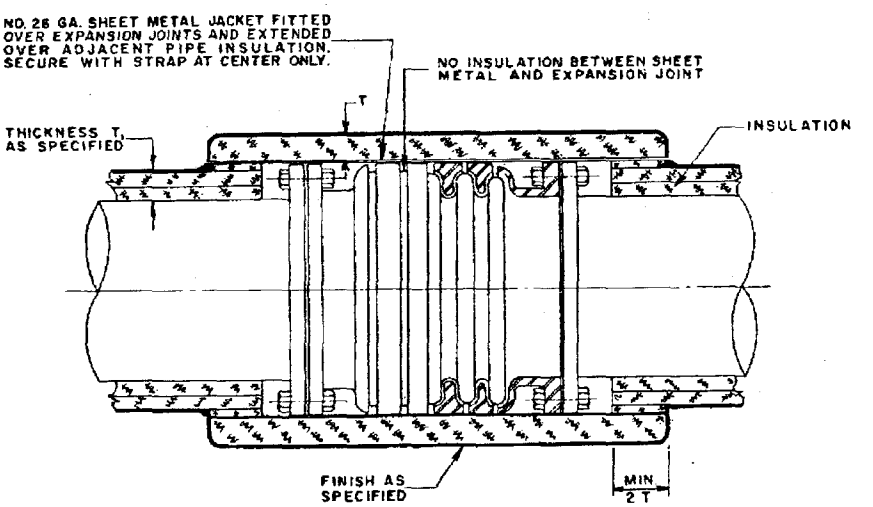
II. SPECIFICATION 25-H

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joints - contd

(2) Corrugated mechanical expansion joints on piping (usually listed as equipment item) shall be insulated as shown in Figure 25-H-5.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO EXPANSION JOINTS

FIG. 25 - H - 5

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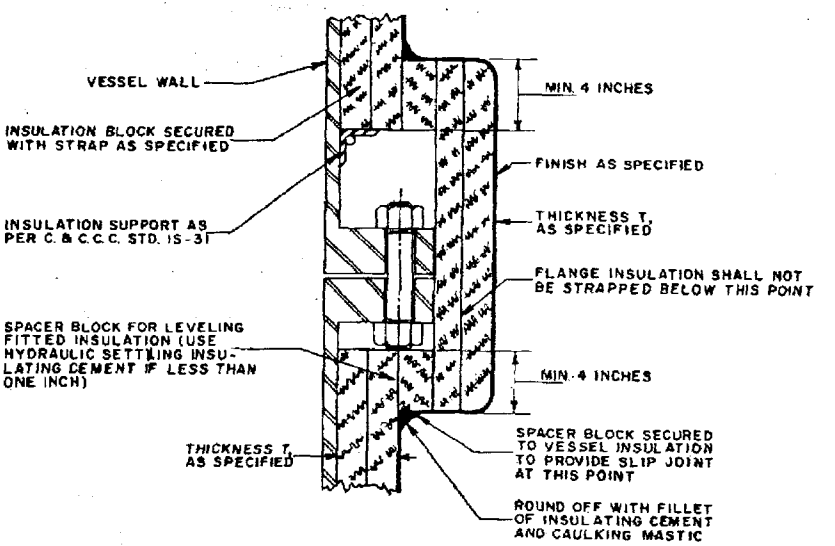
II. SPECIFICATION 25-H

B. APPLICATION - contd

1. Equipment - contd

g. Insulated Vessel Flanges

Vessel flanges shall be insulated with block in the same manner as specified for body of vessel. An insulation support shall be provided immediately above vessel flange. The top of projecting flange insulation shall be sloped to shed water. Typical installation is shown in Figure 25-H-6.



APPLICATION OF HYDROUS CALCIUM SILICATE TO VESSEL FLANGE

FIG. 25 - H - 6

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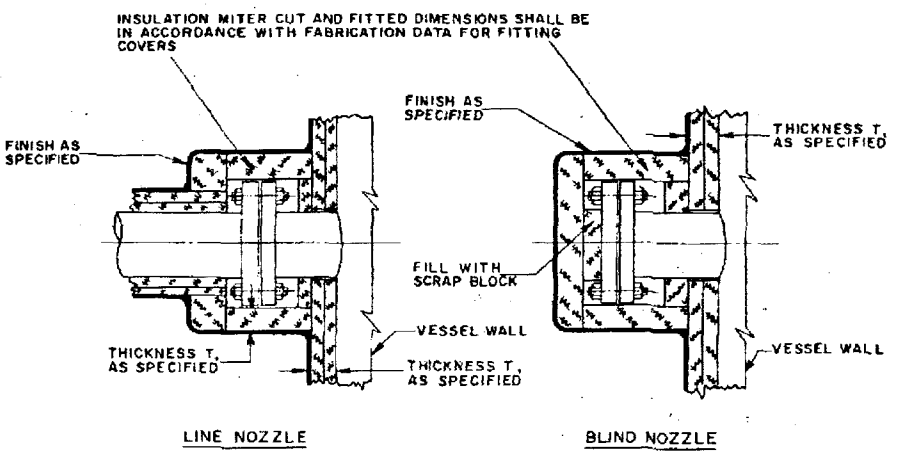
II. SPECIFICATION 25-H

B. APPLICATION - contd

1. Equipment - contd

h. Vessel Nozzles

Vessel nozzles shall be insulated as shown in Figure 25-H-7.



APPLICATION OF HYDROUS CALCIUM SILICATE TO VESSEL NOZZLES

FIG. 25 - H - 7

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II. SPECIFICATION 25-H

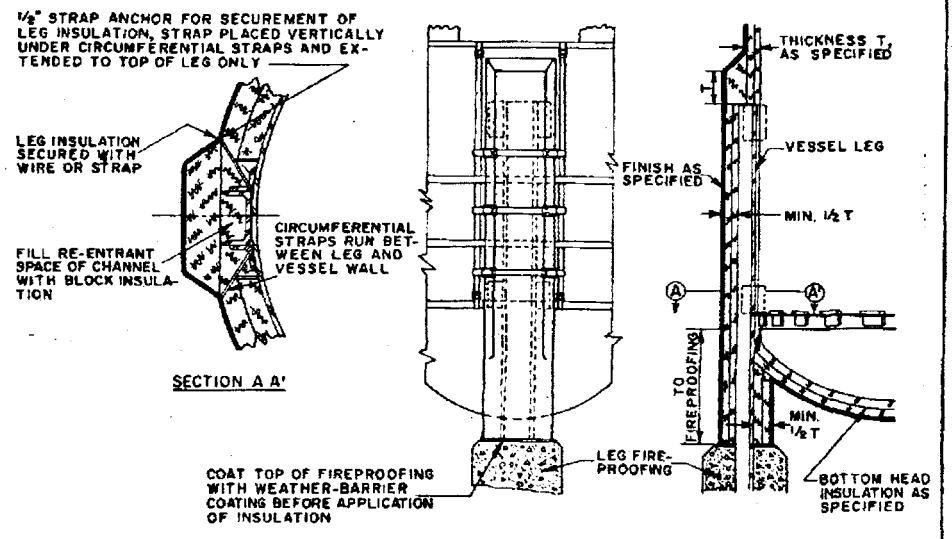
B. APPLICATION - contd

1. Equipment - contd

i. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down channel legs to fireproofing. Thickness shall be a minimum of one-half that specified for body of vessel.

(2) Vessel insulation shall be butted firmly against tank leg flange. Re-entrant space between channel flanges and over channel flanges between body insulation shall be filled with block. Installation shall be as shown in Figure 25-H-8.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO VESSEL LEGS

FIG. 25 - H - 8

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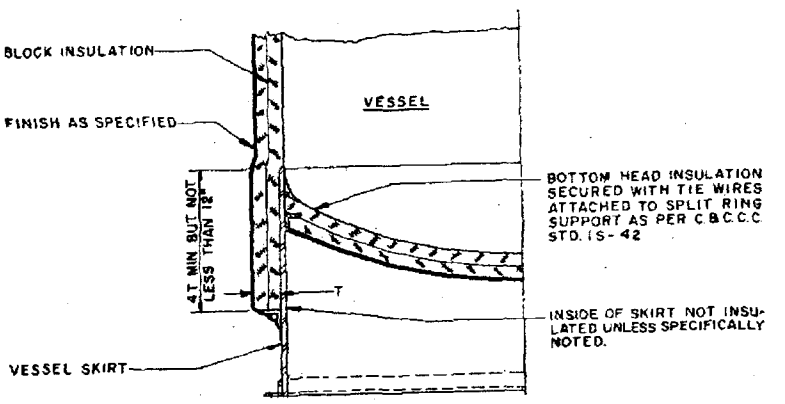
II. SPECIFICATION 25-H

B. APPLICATION - contd

1. Equipment - contd

j. Vessel Skirts

Skirts supporting vertical equipment shall have their outer surfaces insulated. Unless otherwise specified, insulation shall extend downward, from junction of skirt with bottom head, a minimum of four times the specified thickness, but not less than twelve inches, or to bottom of skirt, if that distance is less than twelve inches. Thickness shall be as specified for body of vessel. The bottom head insulation shall be supported in accordance with C&CCC Standard IS-42. Installation shall be as shown in Figure 25-H-9.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO VESSEL SKIRT

FIG. 25-H-9

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II. SPECIFICATION 25-H

B. APPLICATION - contd

1. Equipment - contd

k. Surface Finish

When specified thickness of insulation has been applied, any small cracks or depressions shall be pointed up with insulating cement, troweled flush with surface of insulation.

l. Weather-Barrier

Weather-barrier shall be installed in accordance with the GENERAL SPECIFICATIONS, I.B.19.

2. Piping

a. Pipe Insulation

(1) Insulation shall be applied to piping in accordance with GENERAL SPECIFICATIONS, I.B.4, 5, 6, and 7.

(2) Unless otherwise specified, insulation in excess of two and one-half inches total thickness shall be applied in multi-layer construction as specified in GENERAL SPECIFICATION, I.B.1.

b. Fittings, Flanges and Valves

(1) Fittings, flanges and valves shall be insulated with prefabricated fitting covers (preferred method) in accordance with C&CCC Dimensional Standards Fabrication Manual.

(2) Fitting, flange and valve covers may be field fabricated provided work is in accordance with and/or approved by the Field Representative of the Department of Design and Construction. Segments shall be carefully fitted to insure tight joints.

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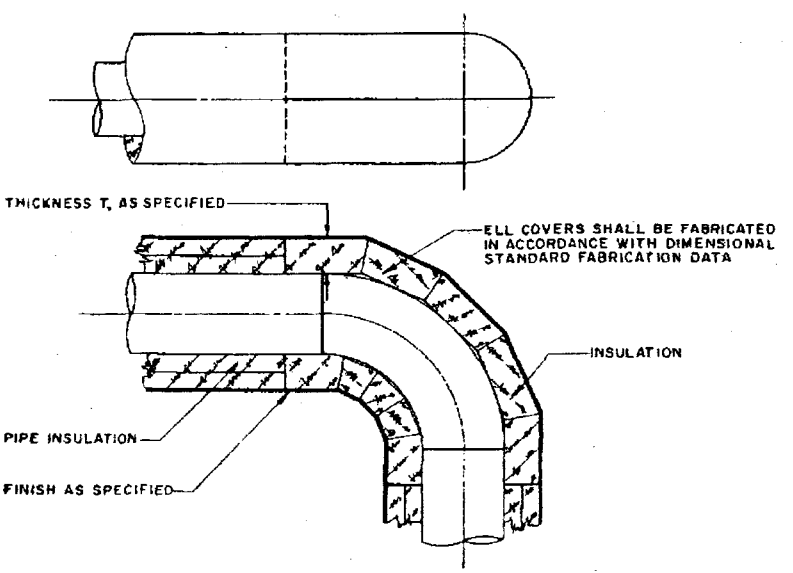
II. SPECIFICATION 25-H

B. APPLICATION - contd

2. Piping - contd

b. Fittings, Flanges and Valves - contd

(3) Insulation for all fittings shall be fitted and assembled with tight joints. Cementing of shop fabricated assemblies shall be done with specified fabricating cement. In all cases the joints shall be as thin as possible, with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids, and holes filled with fabricating cement, be permitted. Typical installations are shown in Figures 25-H-10, 25-H-11, 25-H-12, and 25-H-13.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO WELDING ELL

FIG. 25 - H - 10

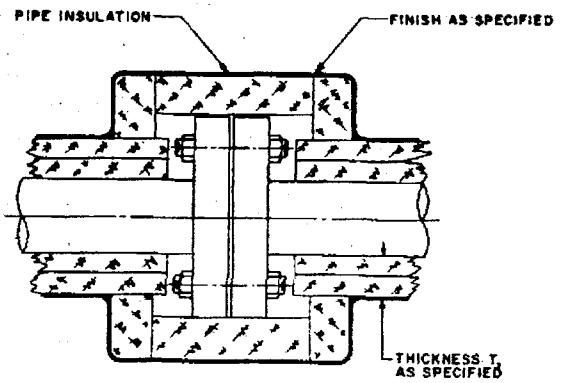
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II. SPECIFICATION 25-H

B. APPLICATION - contd

2. Piping - contd

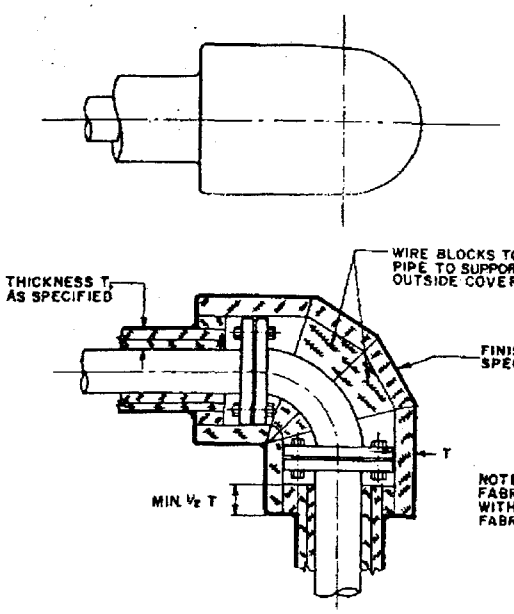
b. Fittings, Flanges and Valves - contd



NOTE: FLANGE COVER FABRICATED IN ACCORDANCE WITH DIMENSIONAL STANDARD FABRICATION DATA.

APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO LINE FLANGE

FIG. 25 - H - 11



NOTE: FLANGED ELL COVER FABRICATED IN ACCORDANCE WITH DIMENSIONAL STANDARD FABRICATION DATA.

APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO FLANGED ELL

FIG. 25 - H - 12

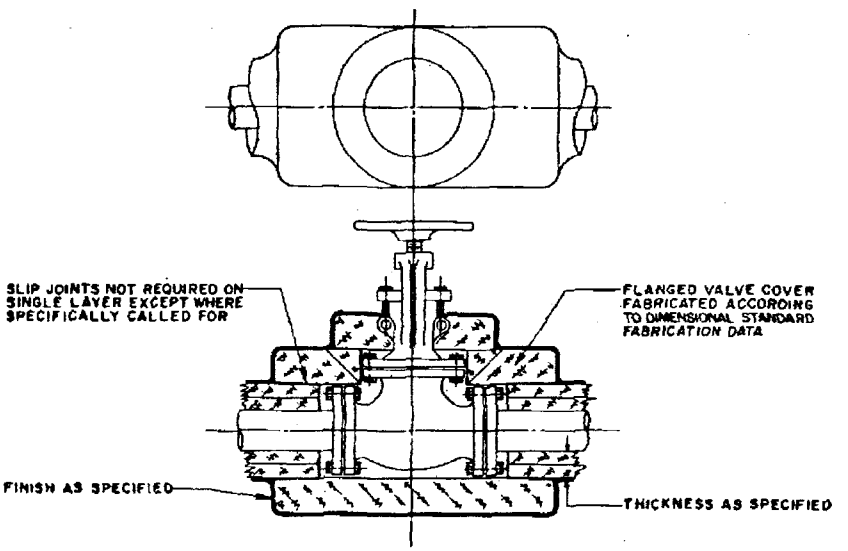
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II. SPECIFICATION 25-H

B. APPLICATION - contd

2. Piping - contd

b. Fittings, Flanges and Valves - contd



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO FLANGED VALVE

FIG. 25-H-13

(4) Fitting insulation shall be secured with specified wire or strap as required.

c. Steam Traced Installations

Steam-trace lines, where specified, shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

d. Surface Finish

Where present, small cracks and depressions shall be filled and smoothed with insulating cement prior to application of weather-barrier.

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II. SPECIFICATION 25-H

B. APPLICATION - contd

2. Piping - contd

e. Weather-Barrier

Weather-barrier shall be installed in accordance with GENERAL SPECIFICATION, I.B.19.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 31-H — Prefabricated Aluminum

Scope

This specification covers the application of prefabricated aluminum insulation for use on equipment and piping normally operating at temperatures from 32 F up to and including 1000 F. It is applicable to both indoor and outdoor service.

Procedures outlined in the GENERAL SPECIFICATION, are applicable to and constitute an integral part of this Specification.

A. MATERIAL

1. Composition

Insulation shall consist of prefabricated units comprised, in general, of a rigid outer aluminum shell, enclosing aluminum sheets properly spaced and reinforced with supports (separators). Supports shall be designed and fabricated of a material, having low heat transmission and a moisture absorptivity not to exceed 1% after 24 hours, to form isolated air chambers. Units shall be equipped with means for securement.

2. Properties

a. Properties shall be as listed in the following table:

Emmisivity	Shall be approx. 0.03
Reflectivity	Shall be approx. 95%
Temperature Limits . . .	Shall be suitable for use from plus 33 F up to and including plus 1000 F without deterioration or cracking of parts.

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II. SPECIFICATION 31-H

A. MATERIAL - contd

2. Properties - contd

b. Form

Prefabricated aluminum insulation shall be furnished in units, which can be easily handled, in the following forms:

(1) Sectional Pipe Insulation

(a) Sectional pipe insulation, composed primarily of aluminum inner sheets of No. 34 B & S Gage (Minimum thickness) and aluminum outer shell of No. 20 B & S Gage (Minimum thickness).

(b) Pipe insulation shall be made in two unit sections. One circumferential edge of each unit and the longitudinal edges of one half section shall be extended to provide overlap and watershed. Joints of units shall be fabricated to form effective thermal insulation.

(c) Longitudinal edges of inner sheets shall be bent inward sufficiently to provide reinforcement and a tight joint with opposing sheets upon closure.

(d) Sectional pipe insulation shall be furnished with metal bands (preferred) or other fastening devices where authorized.

(2) Fitting, flange and valve covers shall be prefabricated, and of the same general composition and construction as sectional pipe insulation.

(3) Panel sections, both flat and curved, shall be prefabricated of same general composition and construction as sectional pipe insulation. Minimum thickness for inner sheets shall be No. 34 B & S Gage and No. 18 B & S Gage for outer shell.

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II. SPECIFICATION 31-H

A. MATERIAL - contd

2. Properties - contd

b. Form - contd

(4) Quick removable units for piping and/or equipment shall be prefabricated and of the same general composition and construction as sectional pipe insulation except that the minimum thickness for outer shell shall be No. 16 B & S gage. These units shall be of heavy-duty construction and designed so as to be easily removed and reinstalled. Where required to facilitate quick removal, special latches shall be provided for securement.

(5) Units shall be provided with cut-outs for supports, nozzles and other projections where required.

(6) The number of reflective surfaces and the spacing of the reflective sheets shall be as designated by the Department of Design and Construction.

3. Accessory Materials

a. Prefabricated Aluminum - Mirror Insulation or approved alternate.

b. Stainless Steel Insulation Strap - 3/8 inch x .015, Type 304 or approved alternate.

c. Aluminum Clips - Double pronged, A. J. Gerrard or approved alternate.

d. Aluminum Sheet Metal Screws (Minimum Size No. 12)

e. Caulking Mastic - Suitable for temperature to which it will be subjected.

f. Aluminum Pressure Sensitive Sealing Tape - Suitable for temperature to which it will be subjected.

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II. SPECIFICATION 31-H

B. APPLICATION

1. Equipment

a. Supports

Equipment shall be provided with insulation supports as specified in the GENERAL SPECIFICATIONS.

b. Thickness Schedule

Unless otherwise specified, insulation shall be applied in one layer.

c. Curved Surfaces

Panels fabricated for curved surfaces shall be applied with edges closely abutting and with outer casing laps, or trim strips, arranged to shed water. Panels shall be secured to each other with sheet metal screws through the casing laps, or trim strips, over joints to form a continuous envelope over the surface to be insulated, except at expansion joints, flanges, etc. Where required, panels shall be secured with insulation strap or special fasteners.

d. Flat Surfaces

Panels fabricated for flat surfaces shall be applied in the same manner as specified for curved surfaces. Where the span of surface to be insulated exceeds 30", panels shall be secured to the surface by a method approved by owner.

2. Piping

a. Pipe Insulation

(1) Insulation supports, where required, shall be provided by the Contractor.

(2) Unless otherwise specified, insulation shall be applied in one layer.

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II. SPECIFICATION 31-H

B. APPLICATION - contd

2. Piping - contd

a. Pipe Insulation - contd

(3) Insulation shall be applied to piping with the flush separator end of each section inserted into overlapping end of abutting sections. The extended longitudinal edges of each section shall be lapped over flush edges of opposing half-section so that all joints are tightly abutted.

(4) Lapped edges of outer shell shall be placed so as to shed water.

b. Fitting, Flange, Valve and Pipe Bend Covers

Fittings, flanges, valves and bent piping shall be insulated in a manner similar to that for straight piping. The fitting covers shall be applied with telescoping joint connections to the adjacent pipe insulation. In cases where the covers adjoin other types of insulation, the covers shall be designed to overlap the dissimilar insulation.

c. Securement

Insulation shall be secured in place with insulation strap, or screws, furnished by the manufacturer, as specified in the Accessory Materials Section of this Specification.

d. General

(1) Care shall be taken in the application to prevent crushing or other abuse of the insulation, and to preserve the factory finish of the outer shell.

(2) Where any field cutting or fitting around supports or nozzles is required, care shall be exercised to insure good workmanship, and to seal the individual air chambers in the insulation.

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II. SPECIFICATION 31-H

B. APPLICATION - contd

2. Piping - contd

d. General - contd

(3) Where equipment or piping is located outdoors, or where otherwise required, joints or openings in outer shell of the insulation shall be caulked or flashed to form a watershed. Where caulking mastic is impractical to use for sealing joints or openings, as in the case of removable units, aluminum tape, as specified, shall be used.

(4) Provision shall be made in the assembly of the insulation units, to allow for expansion and contraction of the surfaces insulated, without damage to the insulation.

(5) Steam-trace lines, where specified, shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 32-H — Hydrous Calcium Silicate

Scope

This specification describes the essential requirements for the purchase and application of preformed hydrous calcium silicate insulation for use on equipment and piping, operating above 70°F, specified to be protected from fire exposure.

Procedures outlined in the GENERAL SPECIFICATION are applicable to and constitute an integral part of this Specification, with exceptions as noted herein.

A. MATERIAL

1. Composition

Material shall be composed of hydrous calcium silicate blended with asbestos fibers in suitable proportion, with or without inorganic filler added.

2. Properties

Hydrous calcium silicate insulation shall have the following properties:

Absorptivity	Not more than 93% of volume after 24 hours submersion in water.
Alkalinity	pH shall be not more than 10.0
Capillarity	When placed on wet surface absorption after one half hour shall be less than 100% and after seven days less than 30% of its original weight.

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II. SPECIFICATION 32-H

A. MATERIAL - contd

2. Properties - contd

Combustibility	Shall be incombustible.
Compressive Strength . . .	Percent of deformation shall be less than listed below:

Load lbs./sq.in.	Deformation per cent
20	2
60	6
100	10

Density	10 to 14 lbs./cu. ft.
Flexural Strength	Shall be not less than 40 psi.
Elasticity, Modulus of . . .	Shall be not less than 35,000 psi.
Hygroscopicity.	After oven dried at 200°F to 230°F, sample shall not gain over 10% by weight when exposed to air at 70 F, 90 RH for 14 days.
Resistance to Abrasion . . .	When placed in Rotap on twenty mesh a 3 x 3 x 1-1/2 sample shall not have lost more than 25% after 10 minute run, nor more than 40% after 20 minute run.
Resistance to Acids or Caustics . . .	It shall be resistant to most common caustics. (Not considered as an acid resistant material.)
Specific Gravity	0.15 to 0.28
Specific Heat	0.20 to 0.30 Btu/lb.°F.

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II. SPECIFICATION 32-H

A. MATERIAL - contd

2. Properties - contd

Coefficient of Expansion .	After being heated to 1800°F, then cooled, expansion upon reheating shall not exceed .000004 per °F.
Coefficient of Shrinkage . .	When heated from 70°F to 1800°F (not reheated) linear shrinkage shall be less than 2%.
Temperature Limits . . .	Shall be suitable for use from 0°F to 1800°F without mechanical, thermal or chemical failure.
Modulus of Rupture . . .	Shall be above 50 psi
Thermal Conductivity . .	Shall not exceed values at the following mean temperatures:

Mean Temp. F	Conductivity Btu/hr., Sq. Ft., °F, inch Thick
100	0.43
400	0.48
800	0.78
1200	1.09

Thermal Diffusivity . . .	Shall not exceed 0.325 sq. ft. per day.
Thermal Shock Resistance .	Material shall not spall, chip or crack, or otherwise fail when heated to 1800°F and then quenched with water.

3. Accessory Materials

a. Hydrous Calcium Silicate Insulation - Kaylo No. 20 or approved alternate.

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II. SPECIFICATION 32-H

A. Material - contd

3. Accessory Materials - contd

b. Wire - Stainless steel, 0.0475 inch diameter, type 304 cold drawn bright annealed 18 gage.

c. Insulation Strap - Stainless steel, 1/2 inch x 0.020 inch, type 304 or approved alternate.

d. Clips - Stainless steel, 1/2 inch double pronged, type 304, A. J. Gerrard or approved alternate.

e. Heat Resistant Sealer - Benjamin Foster No. 30-43 or approved alternate.

f. Weather-Barrier Coating (Color as Specified) - Vimasco WC-1, Benjamin Foster Sealfas "C" or approved alternate.

g. Reinforcing Cloth - Glass Fiber, 10 x 10 thread count, Perma Glass Mesh, Glasfab or approved alternate.

h. Fabricating Cement - Franset Refractory Cement, or approved alternate.

i. Wire Netting - One inch, hexagonal mesh, No. 20 gage, stainless steel or monel.

j. Insulating Cement - Hydraulic setting, Baldwin-Hill Powerhouse, Eagle Picher one coat or approved alternate.

k. Mineral Wool Blanket - Black, spun rock wo l, hex netting one side, expanded metal lath on the other side.

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II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

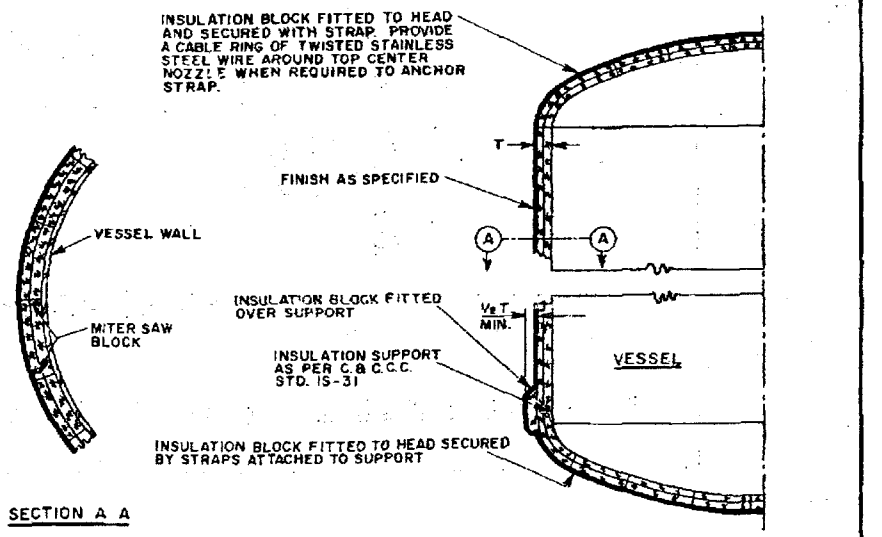
a. Equipment shall be provided with insulation supports as called for in the GENERAL SPECIFICATIONS.

b. Thickness Schedule

Unless otherwise specified, insulation in excess of 1-1/2 inches total thickness shall be applied in two layers in accordance with thickness schedule shown in II. B. 2. a. (1), of this Specification.

c. Curved Surfaces

On all equipment, insulation block shall be cut into curved segments to fit vessel surface and applied to vessel sides and heads in staggered position with all joints tightly butted. Block shall be applied to vessel sides with linear dimension paralleling axis of vessel. Typical installation is shown in Figure 32-H-1.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO VESSEL

FIG. 32 - H - 1

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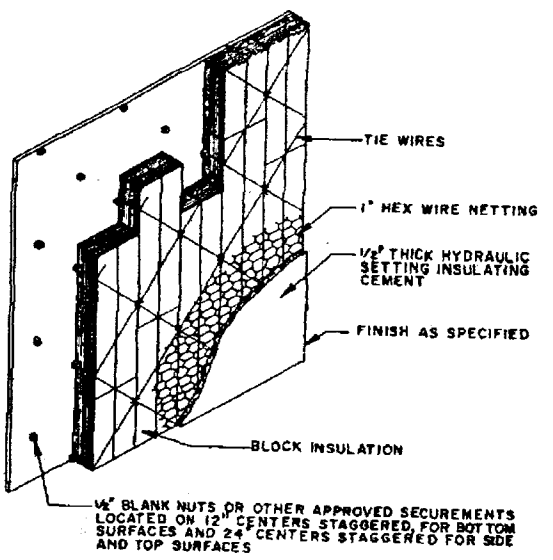
II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

d. Flat Surfaces

Block insulation shall be applied to flat surfaces in staggered position with all joints tightly butted. It shall be secured with wire attached to blank nuts or other approved securement. On rectangular equipment, the blank nuts or other approved securements, shall be placed on 12-inch centers, staggered, for bottom surfaces and on 24-inch centers, staggered, for side and top surfaces. Typical installation is shown in Figure 32-H-2.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO FLAT SURFACE

FIG. 32-H-2

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II. SPECIFICATION 32-H

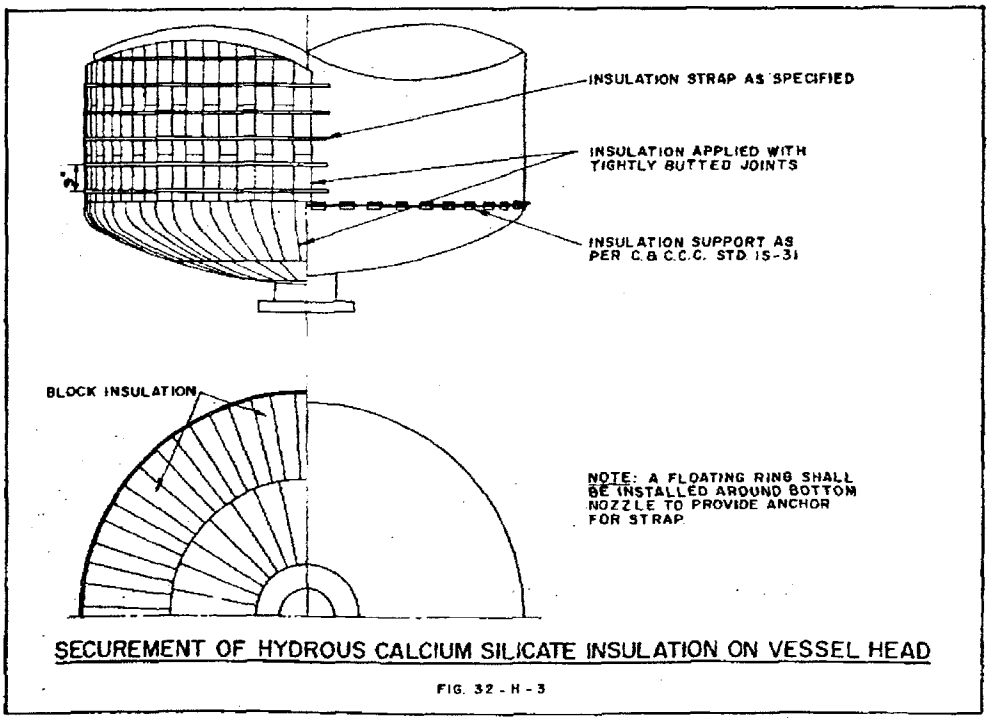
B. APPLICATION - contd

1. Equipment - contd

e. Securement

(1) All layers of insulation shall be secured with insulation strap where contour of vessel permits firm and effective attachment. Insulation applied to irregular surfaces, where strap is impracticable, shall be secured with wire, drawn taut, ends twisted and embedded in insulation.

(2) All layers of insulation on bottom heads of vertical equipment and heads of horizontal equipment shall be secured in place with insulation strap attached to insulation support as specified in UCCC Standard IS-31 and Figure 32-H-3.



SECUREMENT OF HYDROUS CALCIUM SILICATE INSULATION ON VESSEL HEAD

FIG. 32 - H - 3

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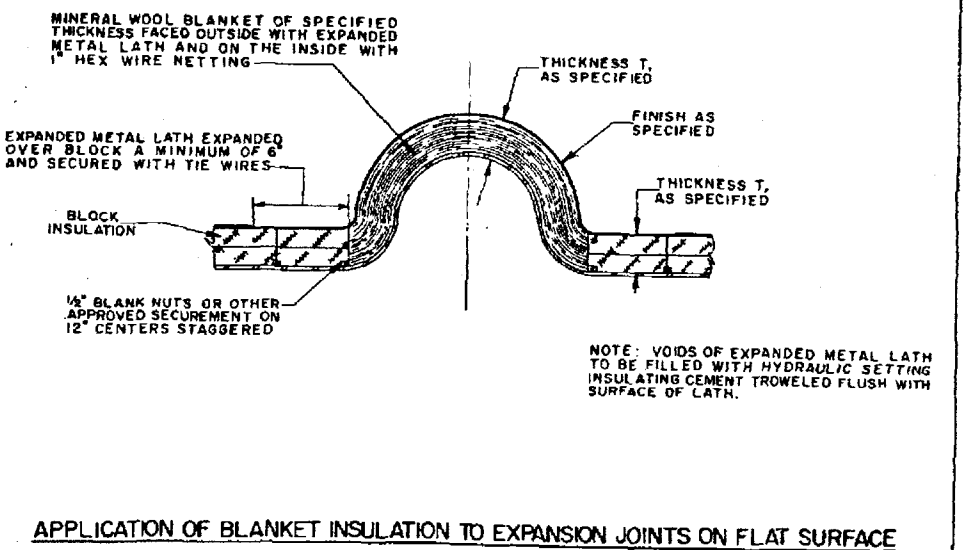
II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joints

Expansion joints in flat surfaces or cylindrical vessels shall be insulated with flexible blanket insulation. Typical installation is shown in Figure 32-H-4.



APPLICATION OF BLANKET INSULATION TO EXPANSION JOINTS ON FLAT SURFACE

FIG. 32 - H - 4

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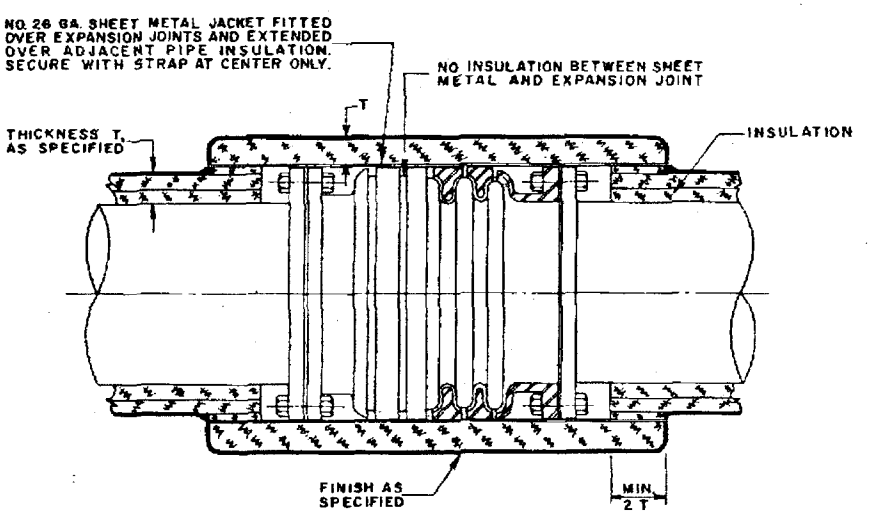
II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

g. Mechanical Expansion Joints

Corrugated mechanical expansion joints in piping (usually listed as equipment items) shall be insulated as shown in Figure 32-H-5. Where movement is likely to occur in the insulation, non-setting sealer shall be applied to surfaces of insulation to provide proper slip joint.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO EXPANSION JOINTS

FIG. 32 - H - 5

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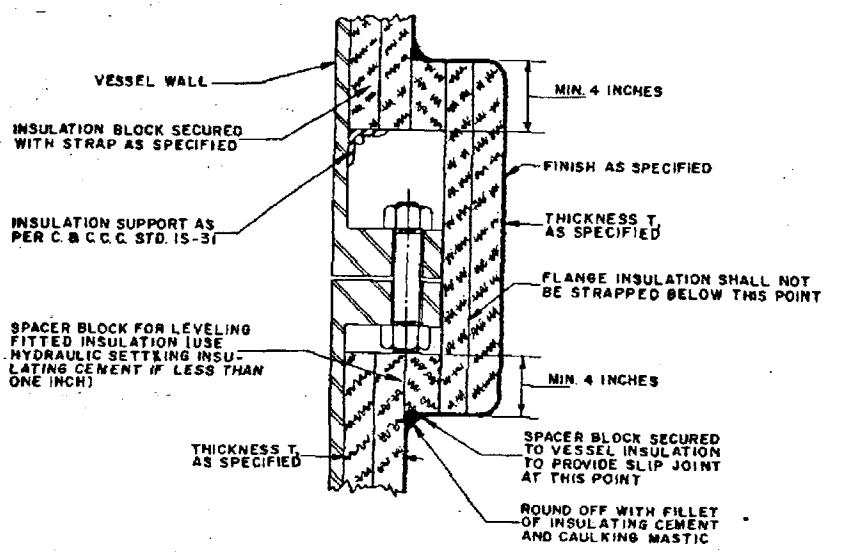
II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

h. Insulated Vessel Flanges

Vessel flanges shall be insulated with block in the same manner as specified for body of vessel. An insulation support shall be provided immediately above vessel flange. The top of projecting flange insulation shall be sloped to shed water. Typical installation is shown in Figure 32-H-6.



APPLICATION OF HYDROUS CALCIUM SILICATE TO VESSEL FLANGE

FIG. 32 - H - 6

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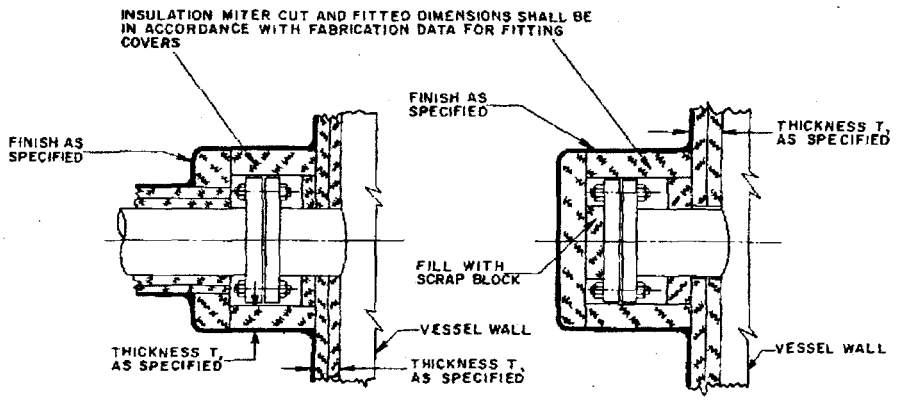
II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

i. Vessel Nozzles

Vessel nozzles shall be insulated as shown in Figure 32-H-7.



APPLICATION OF HYDROUS CALCIUM SILICATE TO VESSEL NOZZLES

FIG. 32-H-7

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II. SPECIFICATION 32-H

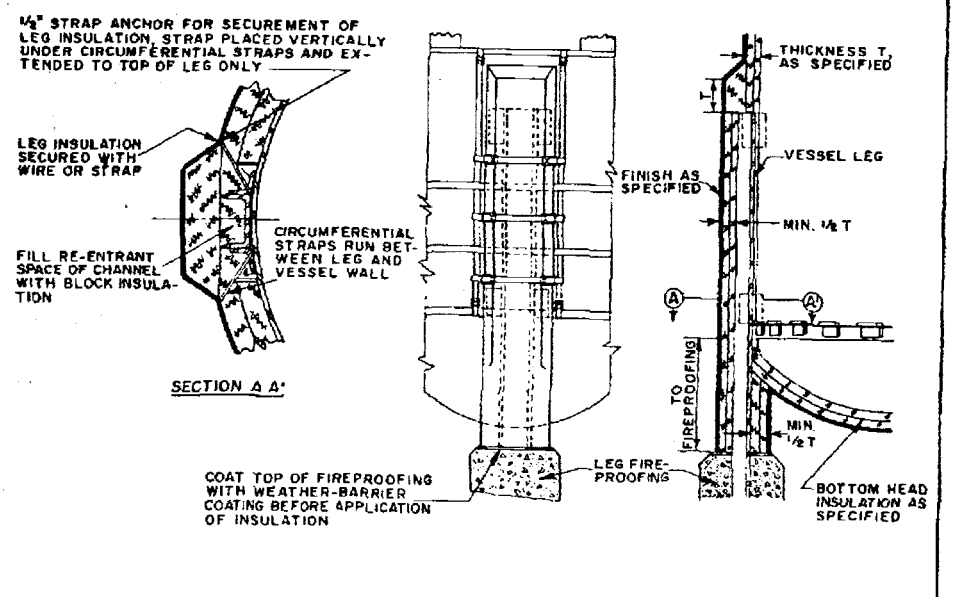
B. APPLICATION - contd

1. Equipment - contd

j. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down legs to the standard fireproofing on legs. Insulation thickness on legs shall be equal to that of vessel.

(2) Vessel insulation shall be butted firmly against tank leg flange. Re-entrant space between channel flanges and over channel flanges between body insulation shall be filled with block. Installation shall be as shown in Figure 32-H-8.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO VESSEL LEGS

FIG. 32 - H - 8

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II. SPECIFICATION 32-H

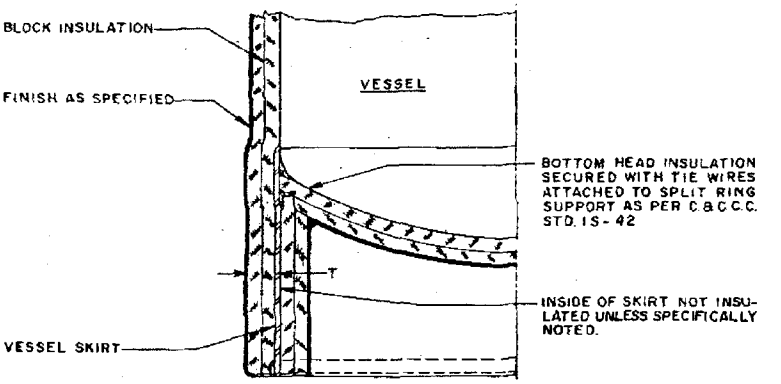
B. APPLICATION - contd

1. Equipment - contd

k. Vessel Skirts

Skirts supporting vertical equipment shall have their outer surfaces insulated. Unless otherwise specified, insulation shall extend from junction of skirt with bottom head to standard fireproofing or to foundation as shown in Figure 32-H-9.

Thickness shall be as specified for body of vessel.



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO VESSEL SKIRT

FIG. 32-H-9

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II. SPECIFICATION 32-H

B. APPLICATION - contd

1. Equipment - contd

1. Surface Finish

When specified thickness of insulation has been applied, any small cracks or depressions shall be pointed up with insulating cement troweled flush with surface of insulation.

m. Weather-Barrier

Weather-barrier shall be installed in accordance with the GENERAL SPECIFICATION, I.B.16.

2. Piping

a. Pipe Insulation

(1) Thickness Schedule

Unless otherwise specified, pipe insulation in excess of 1-1/2 inch total thickness shall be applied in accordance with the following table:

Total Scheduled Thickness, inches	Inner Layer, inches	Outer Layer, inches
2	1	1
2-1/2	1	1-1/2
3	1-1/2	1-1/2
3-1/2	1-1/2	2
4	2	2

(2) Securement

All layers of insulation shall be secured with stainless steel insulation strap spaced in accordance with GENERAL SPECIFICATION, I.B.5,c. and d.

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II. SPECIFICATION 32-H

B. APPLICATION - contd

2. Piping - contd

b. Fittings, Flanges and Valves

(1) All sizes of fittings, flanges and valves shall be insulated with prefabricated fitting covers in accordance with DIMENSIONAL STANDARD FABRICATION DATA. Where impractical to shop fabricate, and with the approval of the representative of the Department of Design and Construction, fitting covers may be field fabricated provided work is in accordance with DIMENSIONAL STANDARD FABRICATION DATA. Segments shall be carefully fitted to insure tight joints.

(2) Cementing of shop fabricated assemblies shall be done with specified fabricating cement. In all cases the joints shall be as thin as possible, with just sufficient cement to obtain good adhesion and complete closure. In no case will wide cement joints, or voids and holes filled with fabrication cement, be permitted. Typical installations are shown in Figures 32-H-10, 32-H-10, 32-H-12 and 32-H-13.

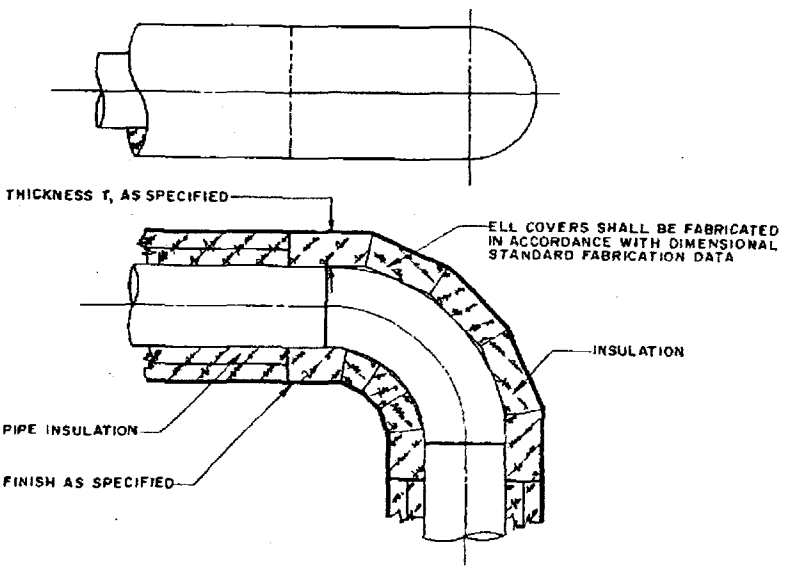
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II. SPECIFICATION 32-H

B. APPLICATION - contd

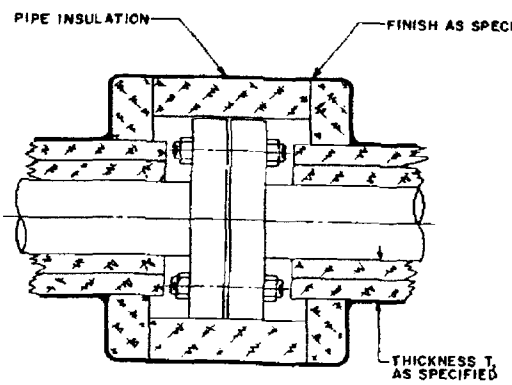
2. Piping - contd

b. Fittings, Flanges and Valves - contd



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO WELDING ELL

FIG. 32 - H - 10



NOTE: FLANGE COVER FABRICATED IN ACCORDANCE WITH DIMENSIONAL STANDARD FABRICATION DATA.

APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO LINE FLANGE

FIG. 32 - H - 11

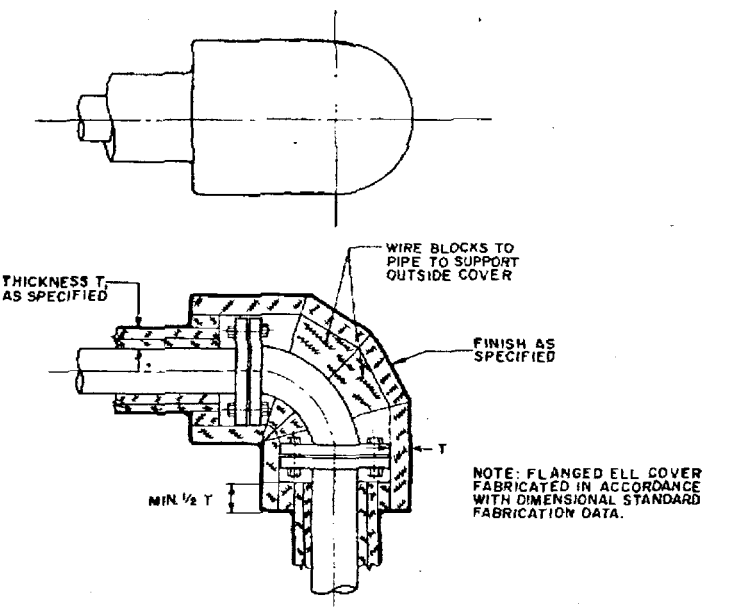
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II. SPECIFICATION 32-H

B. APPLICATION - contd

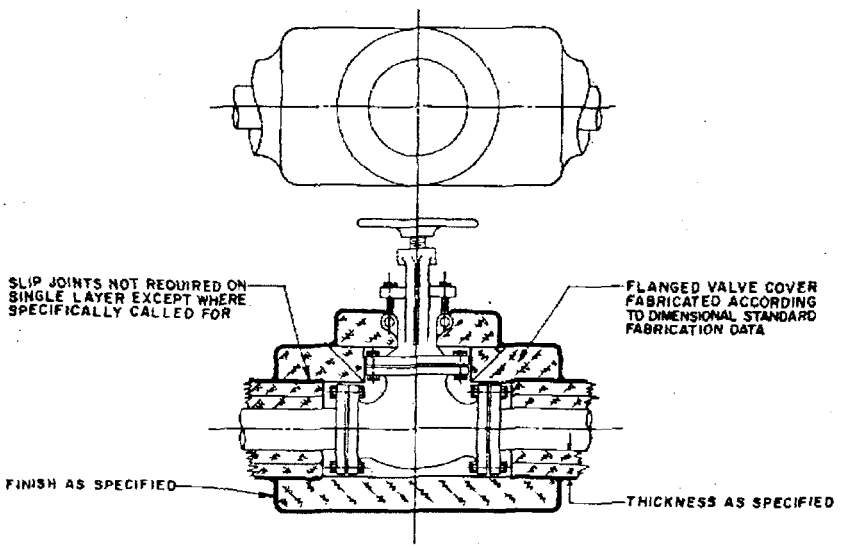
2. Piping - contd

b. Fittings, Flanges and Valves - contd



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO FLANGED ELL

FIG. 32 - H - 12



APPLICATION OF HYDROUS CALCIUM SILICATE INSULATION TO FLANGED VALVE

FIG. 32 - H - 13

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II. SPECIFICATION 32-H

B. APPLICATION - contd

2. Piping - contd

b. Fittings, Flanges and Valves - contd

(3) Surface Finish

(a) Small cracks and depressions, where present, shall be filled and smoothed with insulating cement.

(b) Where specifically noted, fittings, flanges and valves shall be given a skin coat only of specified hard surface finishing cement prior to application of coating.

c. Polyethylene Conduit, Junction Boxes and Copper Tubing

(1) Where specified on Insulation Design Schedule and/or Line List, polyethylene tubing (placed in metal conduit) and copper tubing, (for a minimum distance of 6'-0") from the junction boxes shall be insulated for fire protection.

(2) Unless otherwise specified, insulation shall be a minimum of one inch thickness.

(3) Insulation shall be applied to conduit and junction boxes in staggered position, where possible, and with all joints tightly butted.

(4) Insulation on conduit and copper tubing shall be secured with stainless steel insulation strap.

(5) Insulation on junction boxes shall be secured with stainless steel wire and blank nuts. If welding on junction boxes and covers is prohibited, stick clip fasteners shall be used.

The body of the junction boxes shall be insulated separately from the removable covers. The insulation on the covers shall be cut back from the bolt holes to provide easy removal of covers.

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II. SPECIFICATION 32-H

B. APPLICATION - contd

2. Piping - contd

d. Weather-Barrier

Weather-barrier shall be installed in accordance with GENERAL SPECIFICATION, I.B. 19.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 32-L — Hydrous Calcium Silicate and Cellular Glass

Scope

This specification describes the essential requirements for the purchase and the application of hydrous calcium silicate and cellular glass insulation to Low Temperature Equipment and Piping, normally operating below 70°F, to be protected from fire exposure.

Procedures outlined in the GENERAL SPECIFICATION, are applicable to and constitute an integral part of this Specification.

A. MATERIAL

1. Hydrous Calcium Silicate

a. Composition

Material shall be composed of hydrous calcium silicate blended with asbestos fibers in suitable proportion, with or without inorganic filler added.

b. Properties

Hydrous calcium silicate insulation shall have the following properties:

Absorptivity	Not more than 93% of volume after 24 hours submersion in water.
Alkalinity	pH shall be not more than 10.0.
Capillarity	When placed on wet surface absorption after one-half hour shall be

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II. SPECIFICATION 32-L

A. MATERIAL - contd

1. Hydrous Calcium Silicate - contd

b. Properties - contd

less than 100%, and after seven days less than 300% of its original weight.

Coefficient of Expansion . . After being heated to 1800°F, then cooled, expansion upon reheating shall not exceed .000004 per °F.

Coefficient of Shrinkage . . When heated from 70°F to 1800°F (not reheated) linear shrinkage shall be less than 2%.

Temperature Limits . . . Shall be suitable for use from 0°F to 1800°F without mechanical, thermal or chemical failure.

Modulus of Rupture . . . Shall be above 50 psi

Thermal Conductivity . . . Shall not exceed values at the following mean temperatures:

Mean Temp. °F	Conductivity Btu/hr., sq.ft., °F, in. thickness
100	0.43
400	0.58
800	0.78
1200	1.09

Thermal Diffusivity . . . Shall not exceed 0.325 sq. ft. per day.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 39-H Underground Bituminous Fill

Scope

This specification describes the purchase and application of a bituminous insulation for use on underground flanged piping normally operating at temperatures from 220°F up to and including 520°F.

A. MATERIAL

1. Composition

Material shall be composed of granulated bitumen, or volcanic rock mixed with a bitumen, when applied as loose fill and heat applied within pipe, produces a waterproof Thermal Insulation.

2. Properties

Bituminous fill insulation shall have the following properties.

Acid Resistance	Not effected by most common acids.	
Alkalinity	Not effected by most common alkalies.	
Capillarity	Water resistant.	
Composition	Pure bitumen, bitumen with volcanic rock, or approved equal.	
Density	25 to 41 lbs/cu. ft.	
Specific Heat	300°F	0.52
	500°F	0.61

UCC 022032

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II. SPECIFICATION 39-H - contd

A. MATERIALS - contd

2. Properties - contd

Thermal Conductivity . . .	Shall not exceed values at the following mean temperatures:

Mean Temp°F	Conductivity Btu/hr/sq ft
300	0.54

Temperature Limits . . .	220°F to 520°F

3. Accessory Materials

a. American Gilsonite Co., Gilsulate, Miracle Adhesive Insulfil, or approved alternate.

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II. SPECIFICATION 32-L

A. MATERIAL - contd

2. Properties - contd

Combustibility	Shall be incombustible.
Compressive Strength . . .	Percent of deformation shall be less than listed below:

Load lbs./sq.in.	Deformation per cent
20	2
60	6
100	10

Density	10 to 14 lbs./cu. ft.
Flexural Strength	Shall be not less than 40 psi.
Elasticity, Modulus of . . .	Shall be not less than 35,000 psi.
Hygroscopicity.	After oven dried at 200°F to 230°F, sample shall not gain over 10% by weight when exposed to air at 70 F, 90 RH for 14 days.
Resistance to Abrasion . . .	When placed in Rotap on twenty mesh a 3 x 3 x 1-1/2 sample shall not have lost more than 25% after 10 minute run, nor more than 40% after 20 minute run.
Resistance to Acids or Caustics . . .	It shall be resistant to most common caustics. (Not considered as an acid resistant material.)
Specific Gravity	0.15 to 0.28
Specific Heat	0.20 to 0.30 Btu/lb. °F.

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II. SPECIFICATION 32-L

A. MATERIAL - contd

1. Calcium Silicate - contd

b. Properties - contd

Thermal Shock Resistance	. Material shall not spall, chip or crack, or otherwise fail when heated to 1800°F and then quenched with water.

2. Cellular glass insulation shall have the following proper

Acid Resistance	. Impervious to common acids and acid fumes.
Alkalinity	. pH = 7.5
Capillarity	. 0
Coefficient of Expansion	. 0.0000040 per °F
Combustibility	. Incombustible
Composition	. A true glass; completely inorganic
Compressive Strength	. 100 lbs. per sq. in.
Density	. 9 lbs. per cu. ft.
Flexural Strength	. 100 lbs. per sq. in.
Hygroscopicity	. No increase in weight in 246 days in air at 90% relative humidity.
Modulus of Elasticity	. 200,000 lbs. per sq. in.
Shear Strength	. 64 lbs. per sq. in.
Specific Gravity	. 0.16
Specific Heat	. 0.20 Btu per lb.
Tensile Strength	. 84 lbs. per sq. in.
Thermal Conductivity	. Shall not exceed values at the following mean temperatures:

Mean Temp. °F	Conductivity Btu/hr., sq.ft., °F, in. thickness
50	0.40
300	0.55

Thermal Diffusivity	. 0.40 sq. ft. per day.
Water Absorption	. 0.2% by volume on 2" x 12" x 18" block (all on surface only)..
Temperature Limits	. Minus 350 F to plus 600 F.

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II. SPECIFICATION 32-L

A. MATERIAL - contd

3. Accessory Materials

a. Hydrous calcium silicate insulation - Kaylo No. 20 or approved alternate.

b. Cellular glass insulation - Foamglas.

c. Stainless Steel - Insulation Strap Type 304, 1/2" x 0.020" or approved alternate.

d. Stainless Steel Die Cut Strap - 3/4 inch x 0.023 inch, 2-inch fingers on 9-inch centers, A. J. Gerrard or approved alternate.

e. Clips - Stainless Steel, 1/2 inch double pronged, Type 304 or approved alternate.

f. Stainless Steel Wire, 0.0475 inch diameter, 18 gage, Type 304 cold drawn, bright-annealed, stainless steel wire or approved alternate.

g. Fabricating cement (for use with calcium silicate) Franset refractory cement, or approved alternate.

h. Fabricating cement (for use with cellular glass) Miracle RT-100, or approved alternate.

i. Cushioning blanket - 3 lb. density, 1/2-inch thick glass fiber insulation, or approved alternate.

j. Weather-barrier coating (color as specified) - Vimasco WC-1 or Benjamin Foster Sealfas "C" or approved alternate.

k. Reinforcing cloth - Glass fiber, 10 x 10 thread count with starch binder, Glass Mesh, Inc. or approved alternate.

l. Vinyl anti-abrasion coating - Vimasco 500, or approved alternate.

m. Vinyl asphalt joint sealer - Vimasco 49, or approved alternate.

n. Non-setting sealer - Benjamin-Foster 30-73, or approved alternate.

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II. SPECIFICATION 32-L

B. APPLICATION

1. Equipment

a. Equipment shall be provided with insulation supports as called for in the GENERAL SPECIFICATIONS I. B. 4.

b. Thickness Schedule

Unless otherwise specified, insulation shall be applied in multi-layer construction. Inner layer shall be one inch thick glass fiber blanket, compressed to one-half inch. Second layer, or inner layers, as specified in GENERAL APPLICATION I. B. 1., shall be required thickness of cellular glass, but not less than 1-1/2 inch thick. Outer layer shall be 1-1/2 inch thick hydrous calcium silicate insulation.

c. Cushioning Blanket

On all equipment, a one-half inch thick blanket shall be applied over the entire surface, as a cushioning material, prior to the application of the cellular glass insulation. Blanket shall be held in place with a minimum amount of No. 18 gage, stainless-steel wire. Cellular glass insulation shall then be applied over blanket in the following manner. Cushioning material shall not be considered as part of the specified insulation thickness.

d. Curved Surfaces

(1) Cellular glass block insulation (curved segments or shaped head segments) shall be shop fabricated and fitted to a one-inch greater diameter than that of the vessel to which it is applied. Block insulation shall be applied over cushioning material on all equipment, with all joints tightly butted. Multiple layers of insulation shall be applied so that the butt joints of one layer do not coincide with those of any other layer.

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II. SPECIFICATION 32-L

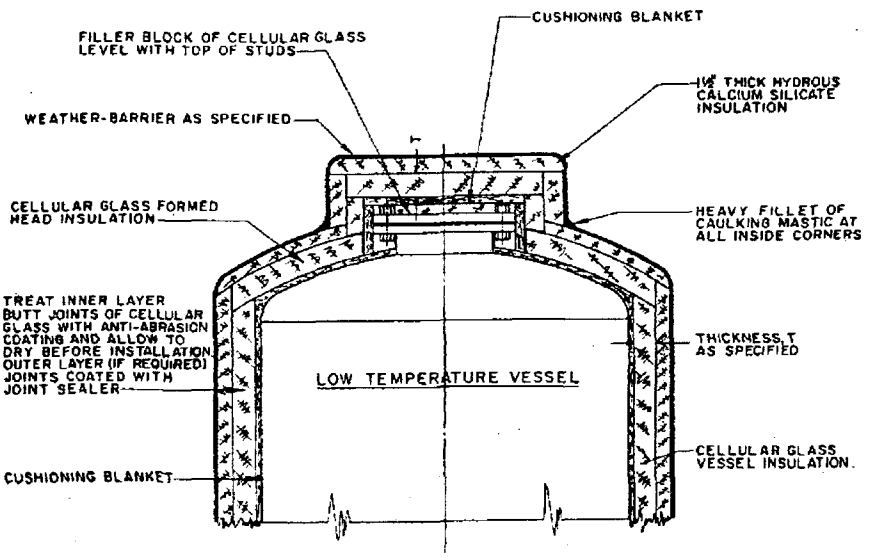
B. APPLICATION - contd

1. Equipment - contd

d. Curved Surfaces - contd

(2) All butt edges and ends of insulation fabricated for inner layer, or layers, shall be given a smooth brush or spray coat of anti-abrasion coating and allowed to dry for a minimum of one-half hour, but preferably two hours, before application of insulation to equipment.

(3) All butt edges and ends of outermost layer of cellular glass (or single layer) formed insulation shall be sealed with a buttered coat of vinyl asphalt joint sealer. This coating shall be only of sufficient thickness, to provide proper adhesion, seal, and cushion between the individual pieces of insulation. Typical installation is shown in Figure 32-L-1.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION
ON LOW TEMPERATURE VESSEL HEAD & NOZZLE

FIG. 32-L-1

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II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

d. Curved Surfaces - contd

(4) Calcium silicate block shall be properly cut into curved segments to fit the outside surface of the cellular glass insulation, and applied to insulated sides and heads of vessel in staggered position, with all joints tightly butted. Block shall be applied to vessel sides with linear dimension paralleling axis of vessel.

e. Securement

(1) All layers of cellular glass and calcium silicate insulation shall be secured in place with stainless steel insulation strap where contour of vessel permits firm and effective attachment. Insulation shall be secured to irregular surfaces, with No. 18 gage stainless steel wire.

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II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

e. Securement - contd

(2) Inner layer or layers of cellular glass insulation on bottom heads of vertical equipment, or heads of horizontal equipment, shall be held in place with specified stainless-steel insulation strap secured to insulation supports as shown in UCCC Standards IS-31, IS-36, and IS-42. Any slots cut in the cellular glass insulation, resulting from tightening of the tie wires, shall be filled with specified joint sealer. Outer layer of cellular glass insulation on bottom heads of vertical equipment, or heads of vertical equipment, shall be secured with insulation strap, as shown in Figure 32-L-2.

32-L-2

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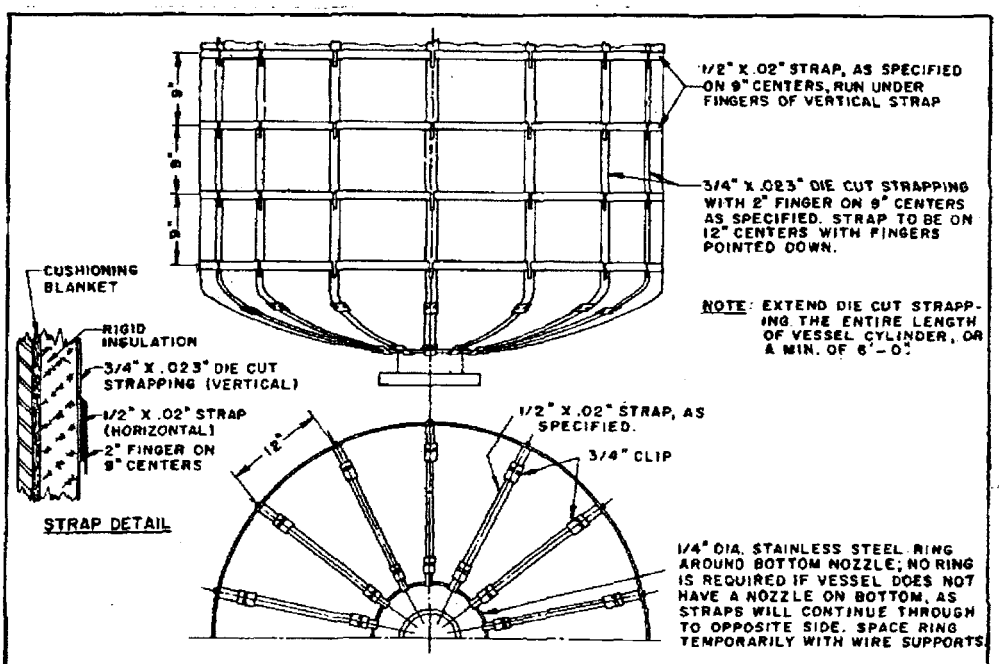
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

e. Securement - contd

(3) Outer layer of calcium silicate on bottom heads of vertical equipment or heads of horizontal equipment shall be secured with stainless steel insulation strap as shown in Figure 32-L-3.



SECUREMENT FOR OUTER LAYER OF HYDROUS CALCIUM SILICATE INSULATION OVER CELLULAR GLASS INSULATION ON WELDED DISHED HEADS

FIG. 32-L-3

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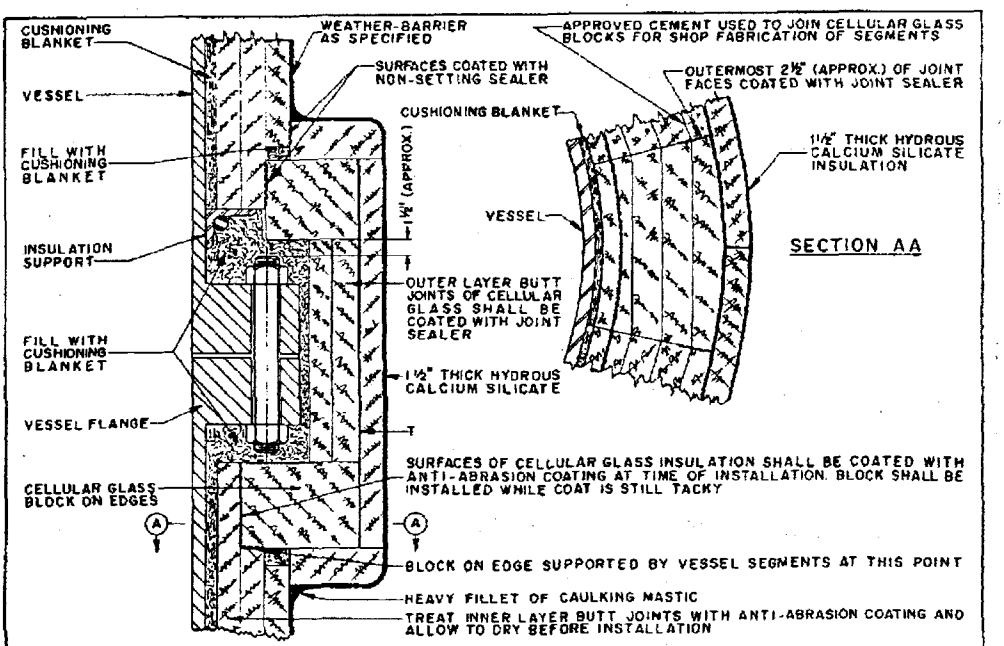
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joint

(1) Cellular glass - calcium silicate applications shall be provided with expansion-contraction joints at vessel flanges, constructed as shown in Figure 32-L-4. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation, as shown, to provide proper slip joint.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION ON LOW TEMPERATURE VESSEL FLANGE

FIG. 32-L-4

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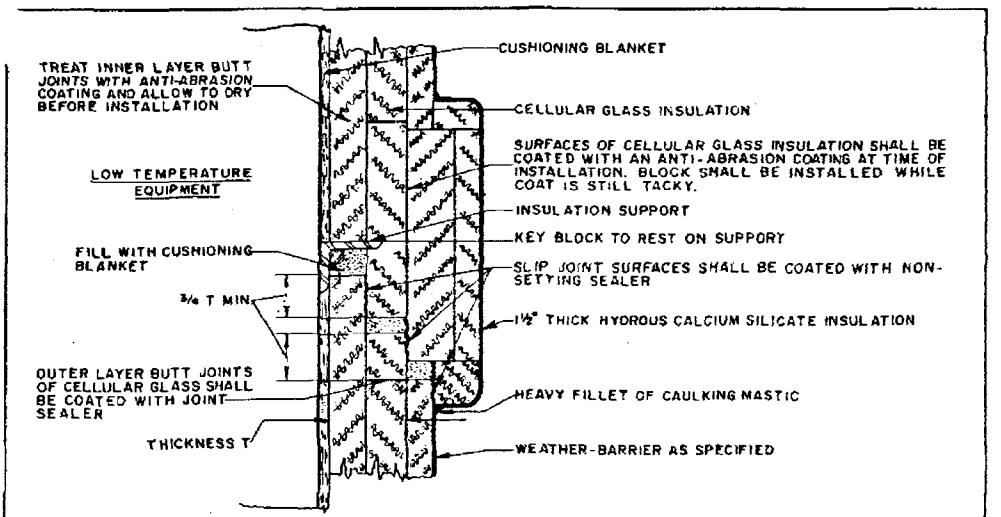
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joint - contd

(2) Longitudinal contraction of vessels shall be provided for by installing expansion-contraction joints at the insulation supports, as shown in Figure 32-L-5. Where more than one total thickness is specified for a vessel, an insulation support shall be provided at the junction of two different thicknesses, and insulated in a manner similar to that shown in Figure 32-L-5. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation, to provide proper slip joint.



HYDROUS CALCIUM SILICATE - CELLULAR GLASS INSULATION
CONTRACTION JOINT ON LOW TEMPERATURE VESSEL

FIG 32-L-5

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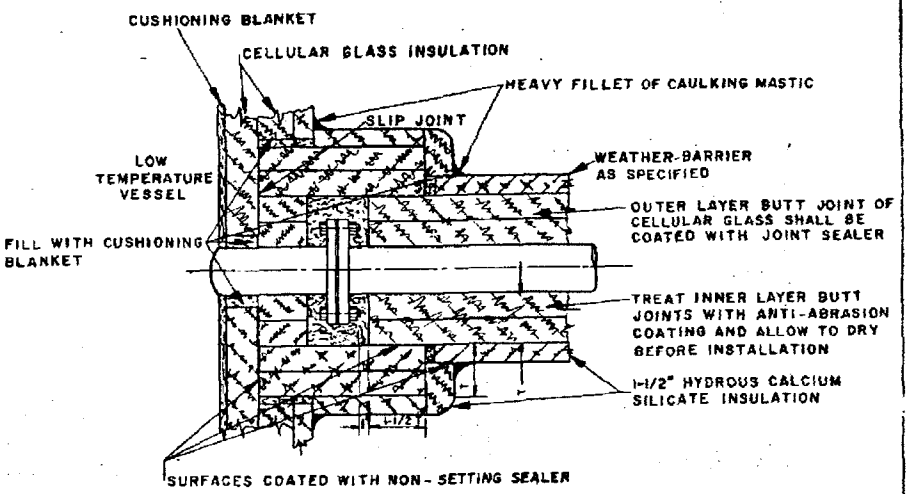
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

f. Expansion Joints - contd

(3) One inch of cushioning blanket shall be packed around nozzles and projections where they extend through the insulation, as shown in Figure 32-L-6. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation to provide proper slip joint.



HYDROUS CALCIUM SILICATE - CELLULAR GLASS INSULATION OF NOZZLE ON LOW TEMPERATURE VESSEL

FIG. 32-L-6

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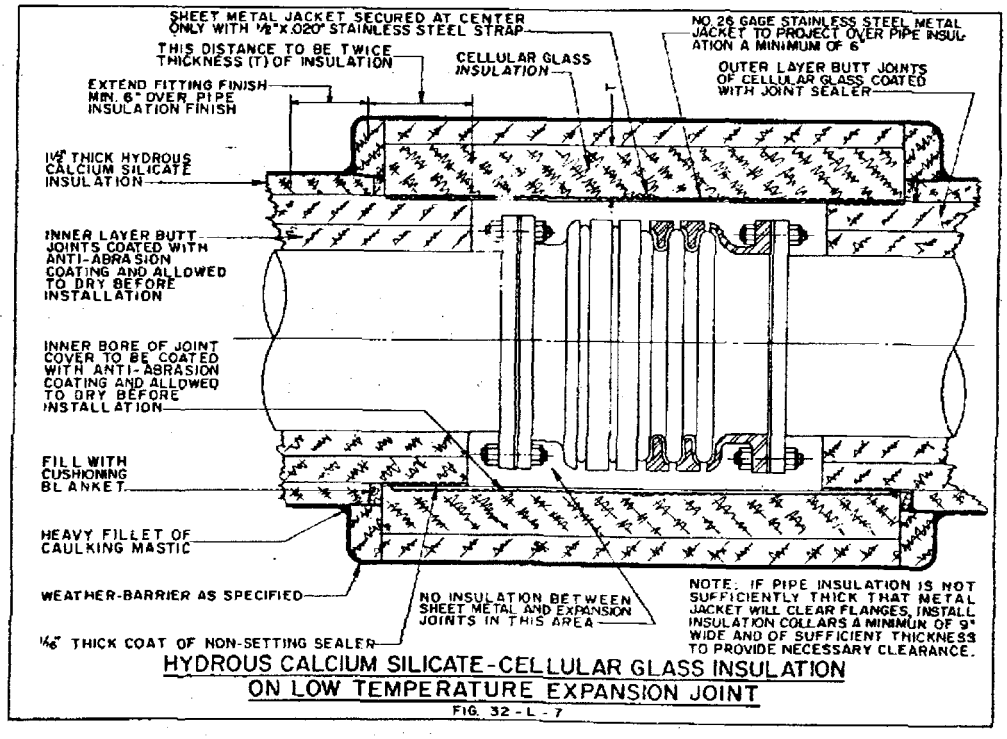
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

g. Mechanical Expansion Joints

Corrugated mechanical expansion joints in piping (usually listed as equipment items) shall be insulated as shown in Figure 32-L-7. Where movement is likely to occur, non-setting sealer shall be applied to surfaces of insulation to provide proper slip joint.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION
ON LOW TEMPERATURE EXPANSION JOINT

FIG. 32-L-7

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II. SPECIFICATION 32-L

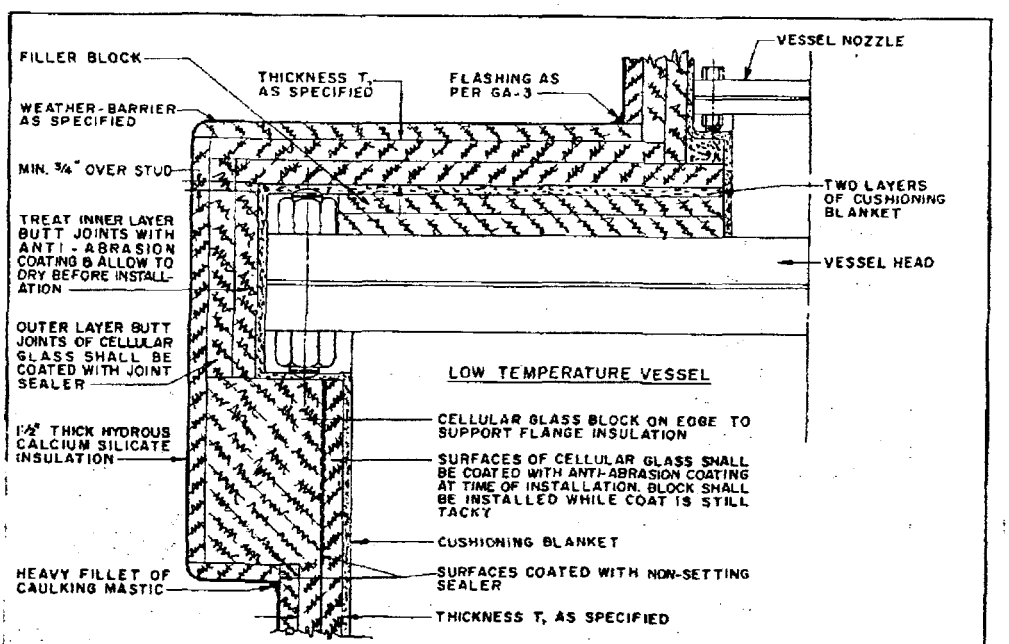
B. APPLICATION - contd

1. Equipment - contd

h. Flat Heads

(1) Insulation on top flat-heads of vertical equipment shall be applied in the same manner as previously described in this Specification. Water pockets shall be eliminated and proper drainage provided as shown in Figure 32-L-8.

(2) All top nozzles on insulated equipment shall be provided with flashing as shown in Figure GA-3, of GENERAL SPECIFICATIONS.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION ON LOW TEMPERATURE FLAT VESSEL HEAD

FIG 32-L-8

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II. SPECIFICATION 32-L

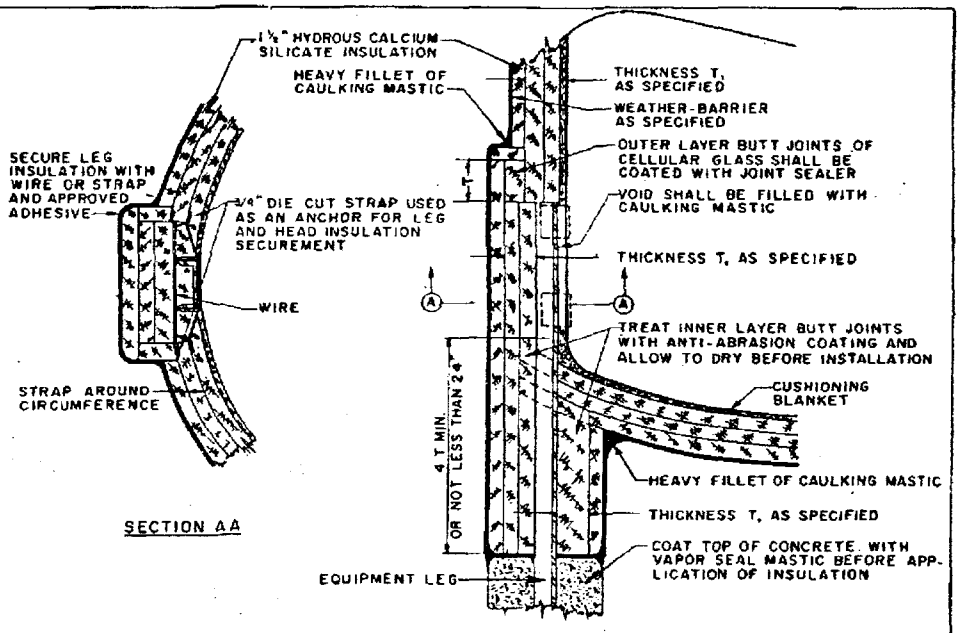
B. APPLICATION - contd

1. Equipment - contd

i. Vessel Legs

(1) Vessel legs shall be insulated with block which shall extend over channel flanges and down channel legs to the junction with any fire resistant material. Thickness shall be as specified for body of vessel. Body insulation shall be brought up to and butted firmly against tank leg flange.

(2) Re-entrant space between channel flanges shall be filled with block and cemented in place with an approved adhesive. Surface of fire-resistant material abutting tank leg insulation shall be coated with weather-barrier coating. Installation shall be as shown on Figure 32-L-9.



HYDROUS CALCIUM SILICATE - CELLULAR GLASS INSULATION FOR LOW TEMPERATURE VESSEL LEG

FIG. 32-L-9

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II. SPECIFICATION 32-L

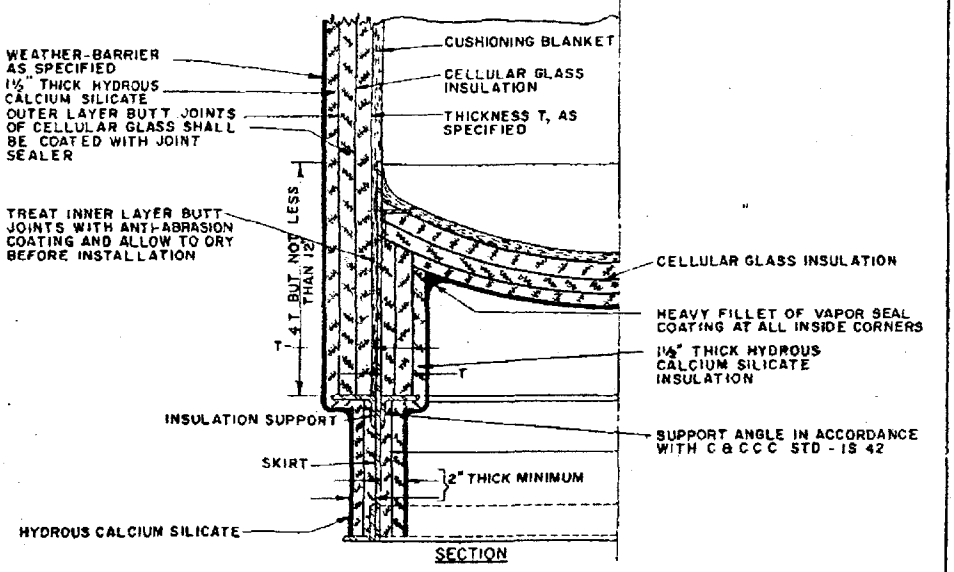
B. APPLICATION - contd

1. Equipment - contd

j. Vessel Skirts

(1) Both interior and exterior surfaces of skirts supporting vertical equipment shall be insulated. Insulation shall extend downward, from junction of skirt with bottom head, to junction with fire resistant material or to concrete pad. Thickness of insulation over skirt shall be as specified for body of vessel. Insulating material shall be secured to inside of skirt with adhesive cement.

(2) Support for insulation inside skirts and support for securement of bottom head insulation shall be in accordance with UCCC Standard IS-42. Installation shall be as shown in Figure 32-L-10.



HYDROUS CALCIUM SILICATE CELLULAR GLASS INSULATION
ON LOW TEMPERATURE VESSEL SKIRT

FIG. 32-L-10

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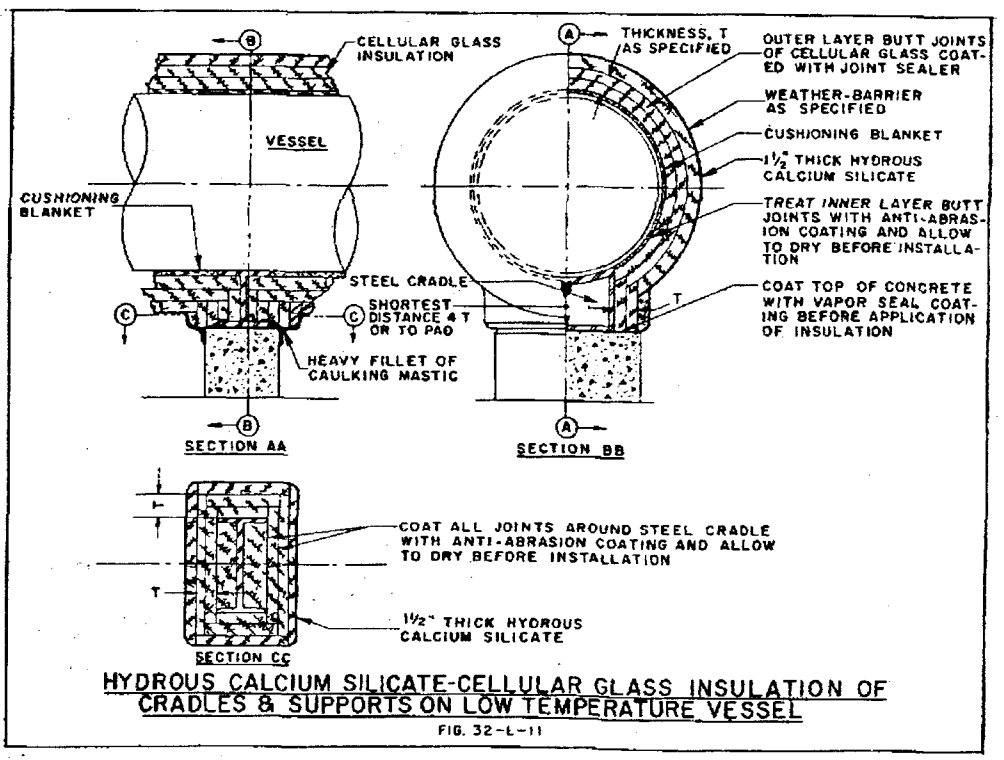
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

k. Equipment Supports

(1) Where equipment is supported on cradles, vessel insulation shall extend over cradles as shown in Figure 32-L-11.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION OF CRADLES & SUPPORTS ON LOW TEMPERATURE VESSEL

FIG. 32-L-11

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II. SPECIFICATION 37-H

B. APPLICATION - contd

3. Field Connections - contd

(2) Mechanical Conduit Connections (Fig. 37-H-2) - contd

d. The asphalt shall be poured in joint, at a temperature between 400°F and 450°F, in the following stages.

1. Fill to top of insulation and let cool for one hour.
2. Fill to within 1/2" of the top and let cool for one hour.
3. Fill until asphalt is level with top of metal jacket.

4. Conduit Terminals

a. When the insulation conduit terminates at a building, manhole or pit, it shall extend through the concrete to the inner face. A weather seal shall be applied between the conduit and the concrete.

b. A water seal shall be applied to the conduit end, and the remainder of the line insulated as specified in the Insulation Line and Equipment List.

5. Backfill

a. Boulders and concrete debris shall not be used as a portion of the backfilling materials.

b. The soil shall be carefully deposited in uniform layers not over 6" thick, carefully and solidly tamped so as not to injure or disturb the conduit.

c. Backfilling shall be done to both sides of the conduit simultaneously.

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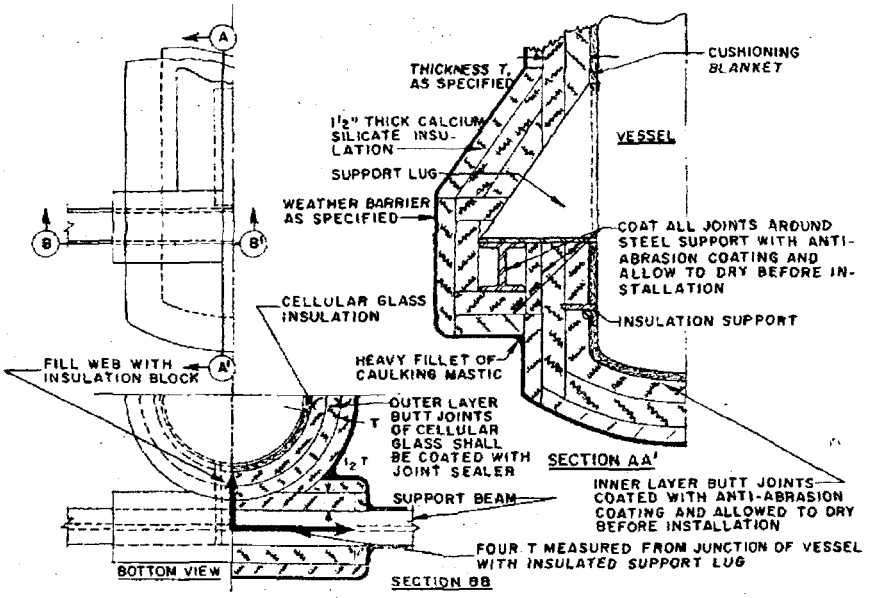
II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

k. Equipment Supports - contd

(2) Where equipment is supported by structural steel members, insulation shall be extended not less than four times the specified insulation thickness in each direction, measured from junction of vessel with insulated support lug. Thickness of insulation over steel supports shall be not less than one-half that specified for body of vessel. Thickness of insulation over support lugs to be the same as body insulation. Installation shall be as shown in Figure 32-L-12.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION
ON LOW TEMPERATURE VESSEL LUGS & SUPPORTING STEEL

FIG.-32-L-12

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II. SPECIFICATION 32-L

B. APPLICATION - contd

1. Equipment - contd

1. Weather-Barrier

Weather-barrier shall be applied in accordance with GENERAL SPECIFICATIONS, I.B.9.

2. Piping

a. Pipe Insulation

(1) Unless otherwise specified, insulation shall be applied in multiple layers. Inner layer, or layers, shall be the required thickness of cellular glass insulation. The outer layer shall be a minimum 1-1/2 inch thick hydrous calcium silicate insulation.

(2) Cellular glass insulation thicknesses in excess of 2-1/2 inches shall be applied in multiple layers as specified in GENERAL SPECIFICATIONS, I.B.4.

(3) Pipe insulation shall be applied in staggered position, in accordance with Figures GA-1 and GA-2 of the GENERAL SPECIFICATIONS.

(4) All butt edges and ends of single layer cellular glass insulation, and outer layer of multiple layer cellular glass applications shall be buttered with joint sealer before application. Joints shall be drawn together, when insulation is applied, so that only a very thin, vapor-tight, vapor-seal coat separates the sections of insulation.

(5) Insulation shall be applied with all joints tightly butted and fitted, to eliminate voids. Large voids shall not be filled with vapor seal coating, but eliminated either by refitting or replacing insulation. Any rounded corners, on the insulation surfaces to be butted, shall be trued before application.

(6) Butt edges and ends, of all inner layers of cellular glass, shall be given a smooth brush or spray coat of

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II. SPECIFICATION 32-L

B. APPLICATION - contd

2. Piping - contd

a. Pipe Insulation - contd

coating and allowed to dry for a minimum of one-half hour, but preferably two hours, before application. Care shall be exercised to obtain a thin even coat of only sufficient thickness to cover and fill the cut cells of the insulation.

(7) Outer layer of calcium silicate shall not be cemented to the inner layer of cellular glass.

(8) When scheduled for installations where thermal shock is expected, a cushioning material, as specified, shall be applied to bare pipe prior to application of cellular glass insulation.

b. Fitting, Flange and Valve Covers

(1) Fittings, flanges, and valve covers shall be shop fabricated, in accordance with the UCCC DIMENSIONAL STANDARDS FABRICATION MANUAL.

(2) Fittings, flanges and valve covers shall be fabricated in two layers. Inside layer shall be the specified thickness of cellular glass insulation. Outside layer shall be 1-1/2 inch thick hydrous calcium silicate insulation.

(3) Welded fitting covers shall be fabricated to fit snugly on the pipe. The two halves of the cover shall be cemented together, with joint sealer applied to the outermost 2-1/2 inches (approx.) of the inner layers of cellular glass. The adjacent pipe insulation shall be fitted tightly to the butt ends of the fitting cover and sealed as specified for piping. Typical fitting covers are shown in Figures 32-L-13 and 32-L-14.

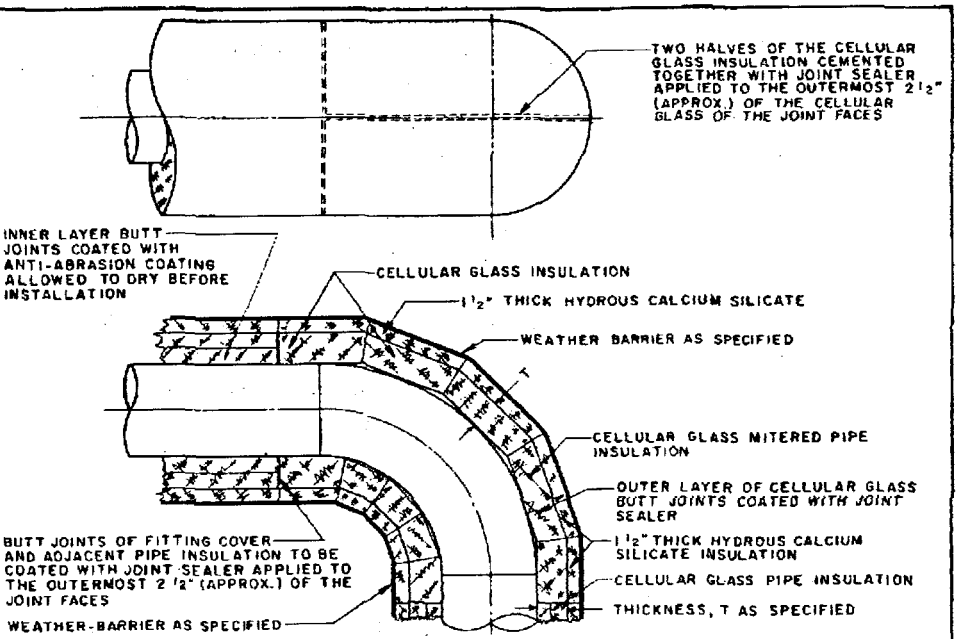
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II. SPECIFICATION 32-L

B. APPLICATION - contd

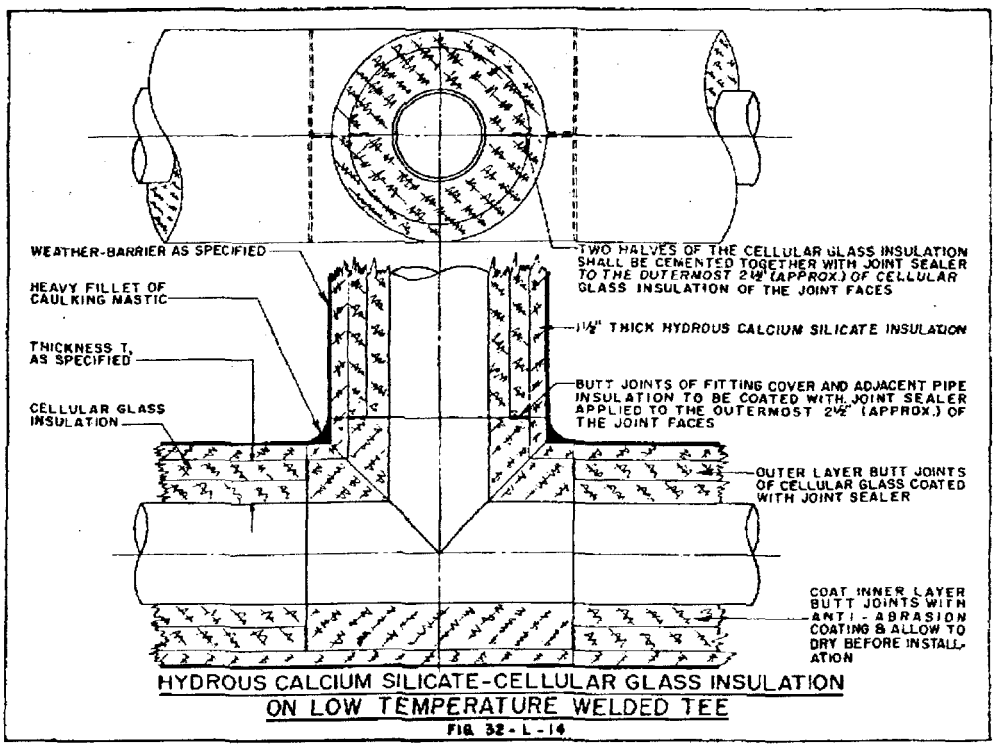
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



HYDROUS CALCIUM SILICATE CELLULAR GLASS INSULATION
ON LOW TEMPERATURE WELDED ELL

FIG. 32-L-13



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION
ON LOW TEMPERATURE WELDED TEE

FIG. 32-L-14

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II. SPECIFICATION 32-L

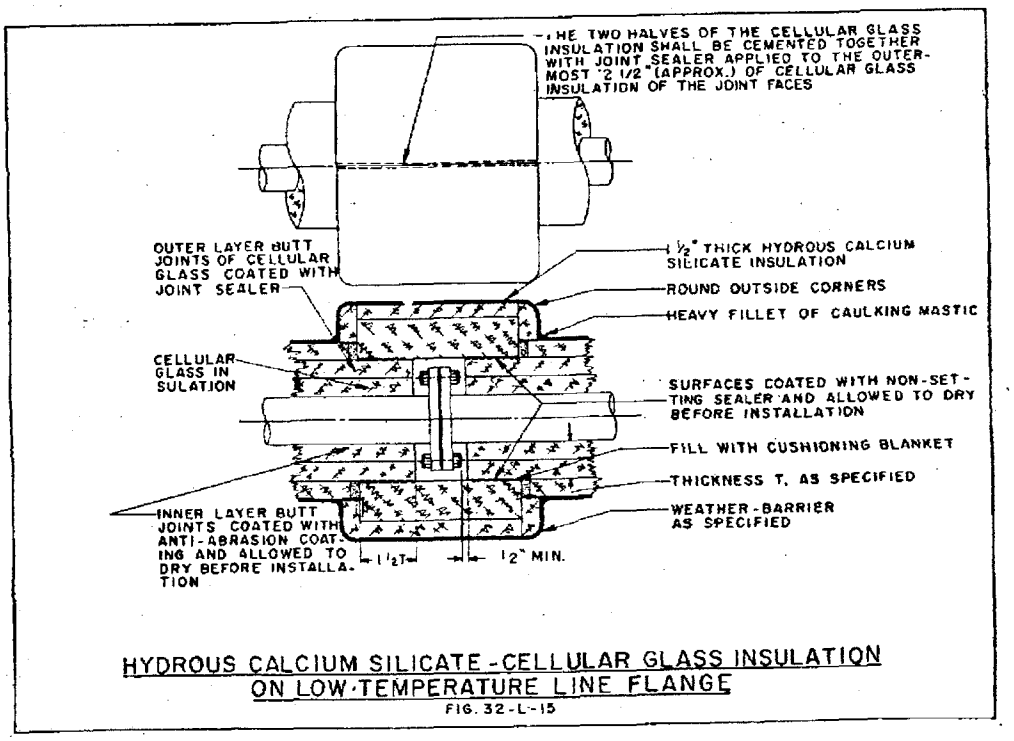
B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers - contd

(4) All valves shall be packed and filled around valve stem, and packing gland assembly, with valve sealer, to avoid water pockets.

(5) Installation of typical fittings and valve are shown in Figures 32-L-15, 32-L-16, and 32-L-17.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION ON LOW-TEMPERATURE LINE FLANGE

FIG. 32-L-15

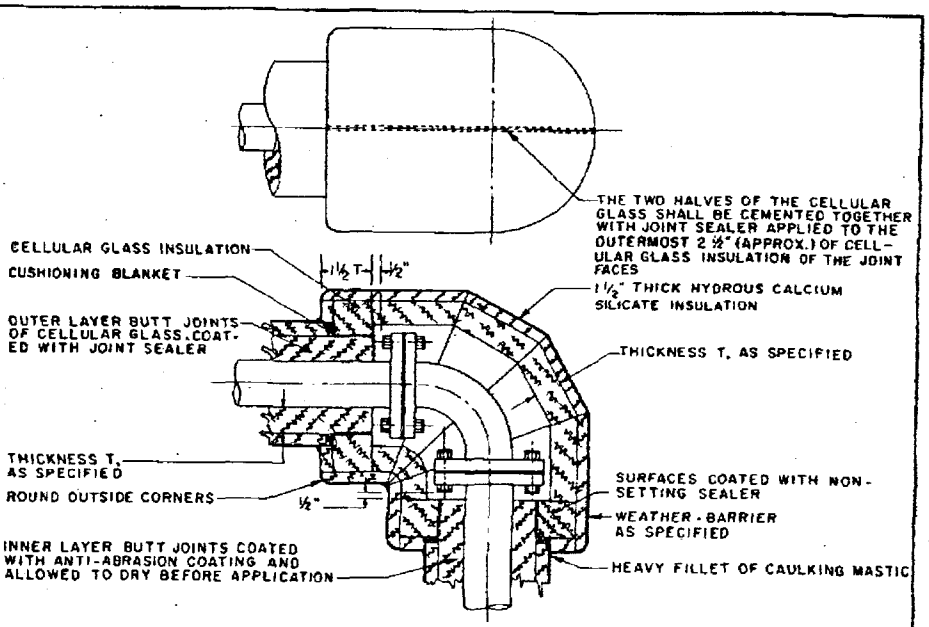
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II. SPECIFICATION 32-L

B. APPLICATION - contd

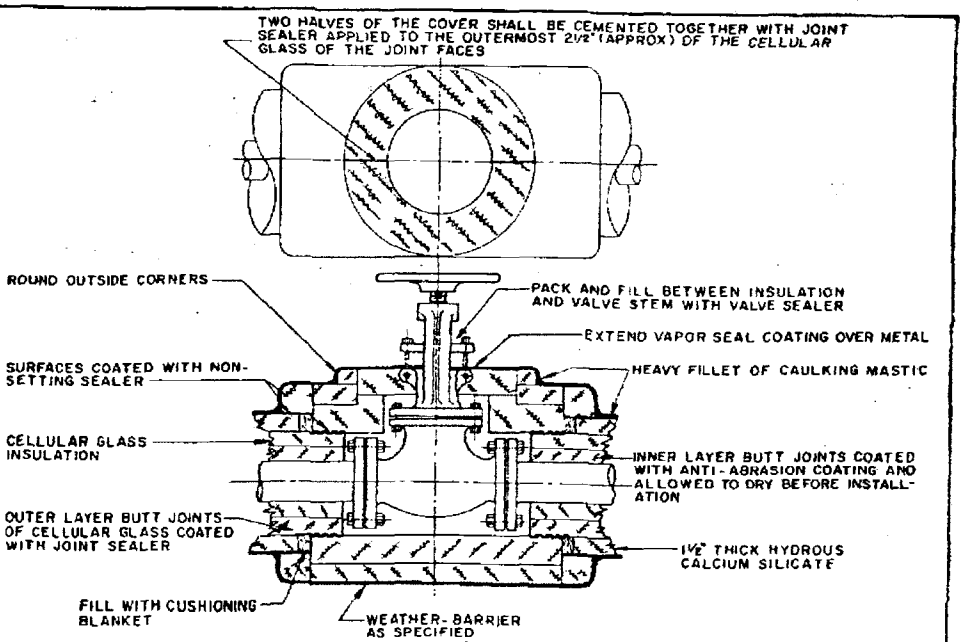
2. Piping - contd

b. Fitting, Flange and Valve Covers - contd



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION ON LOW TEMPERATURE FLANGED ELL

FIG. 32-L-16



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION ON LOW TEMPERATURE FLANGED VALVE

FIG. 32-L-17

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II. SPECIFICATION 32-L

B. APPLICATION - contd

2. Piping - contd

b. Fitting, Flange and Valve Covers - contd

(6) All fittings shall be fitted and assembled with very thin, tight joints. Cellular glass fittings shall be cemented with specified fabricating cement. In all cases the joints shall be thin, with just sufficient cement to obtain good adhesion and complete closure. Wide cement joints, voids, or holes plugged with fabricating cement will not be permitted.

c. Securement

All layers of cellular glass and calcium silicate pipe insulation shall be secured in place with stainless steel Insulation Strap in accordance with spacing specified in GENERAL SPECIFICATIONS, I.B.5, c, d.

d. Supports and Hangers

(1) Where horizontal, low temperature piping is supported on the outside of insulation surfaces, as per UCCC Standard IS-19, insulation (cellular glass) shall be complete with weather-barrier applied before piping is placed in cradles. UCCC Standard IS-19 is a guide to the maximum horizontal span of pipe which may be supported on the outside of insulation.

(2) Hangers attached directly to piping shall be insulated as shown in Figure 32-L-18.

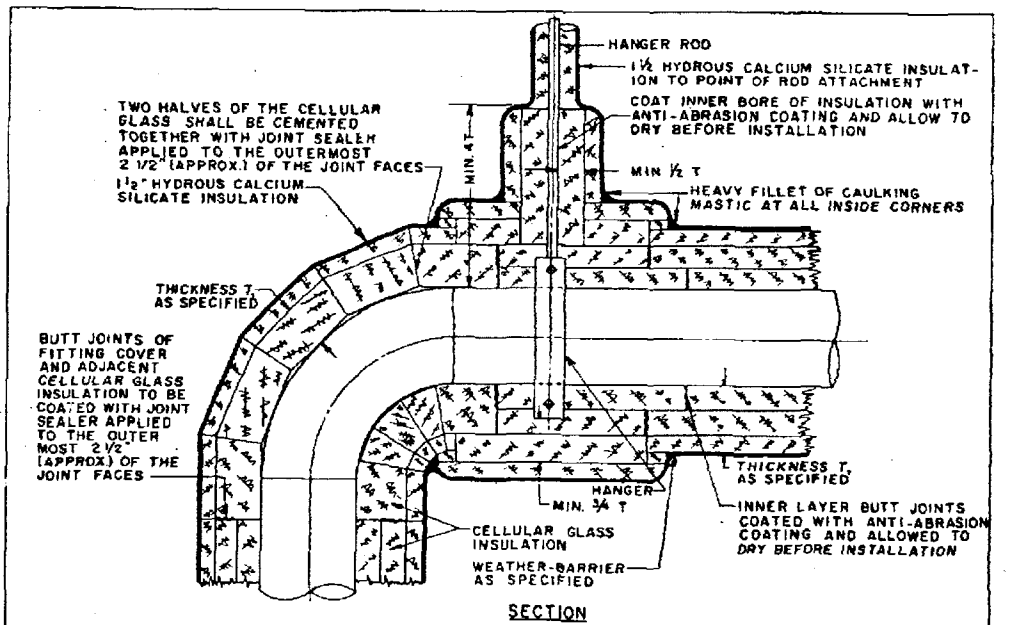
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II. SPECIFICATION 32-L

B. APPLICATION - contd

2. Piping - contd

d. Supports and Hangers - contd



HYDROUS CALCIUM SILICATE - CELLULAR GLASS INSULATION ON HANGER CONNECTED DIRECTLY TO LOW TEMPERATURE PIPE

FIG. 32-L-18

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II. SPECIFICATION 32-L

B. APPLICATION - contd

2. Piping - contd

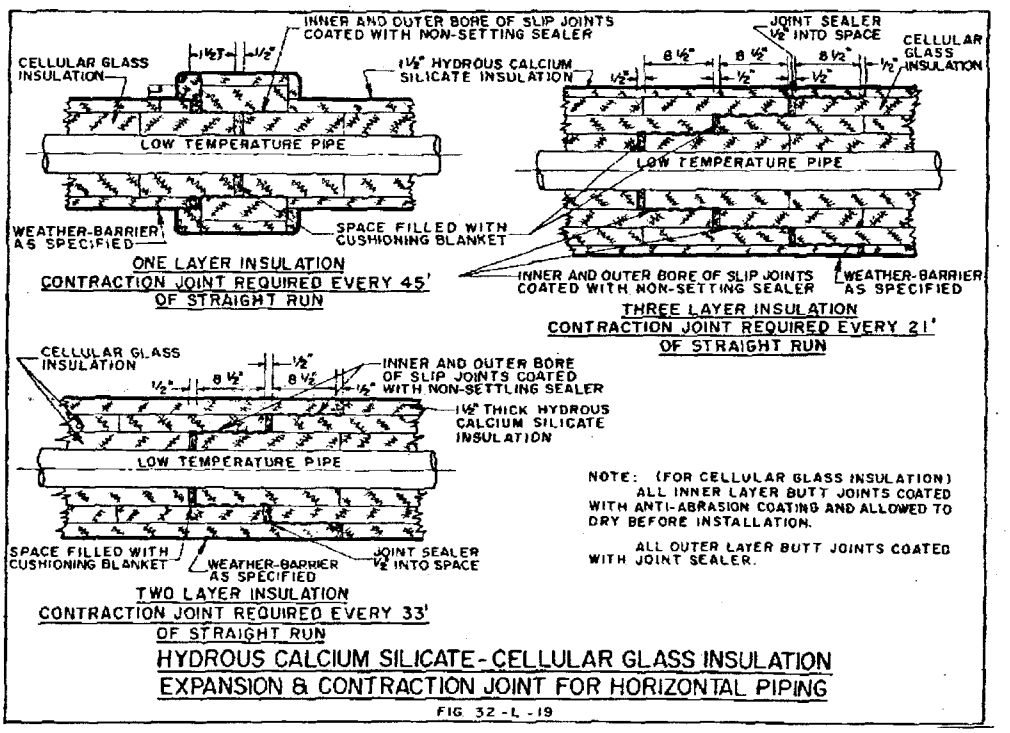
e. Expansion-Contraction Joints

(1) Expansion and contraction joints shall be installed, as per Figure 32-L-19, in both horizontal and vertical straight run piping, at intervals as follows:

Single layer	-	one for each 45 feet
Double layer	-	one for each 33 feet
Triple layer	-	one for each 21 feet

(2) Where flanged joints occur within these limits, expansion and contraction shall be provided for in the flange cover and expansion-contraction joints in insulation will not be required.

(3) Joints shall be packed tightly with strips of cushioning blanket.



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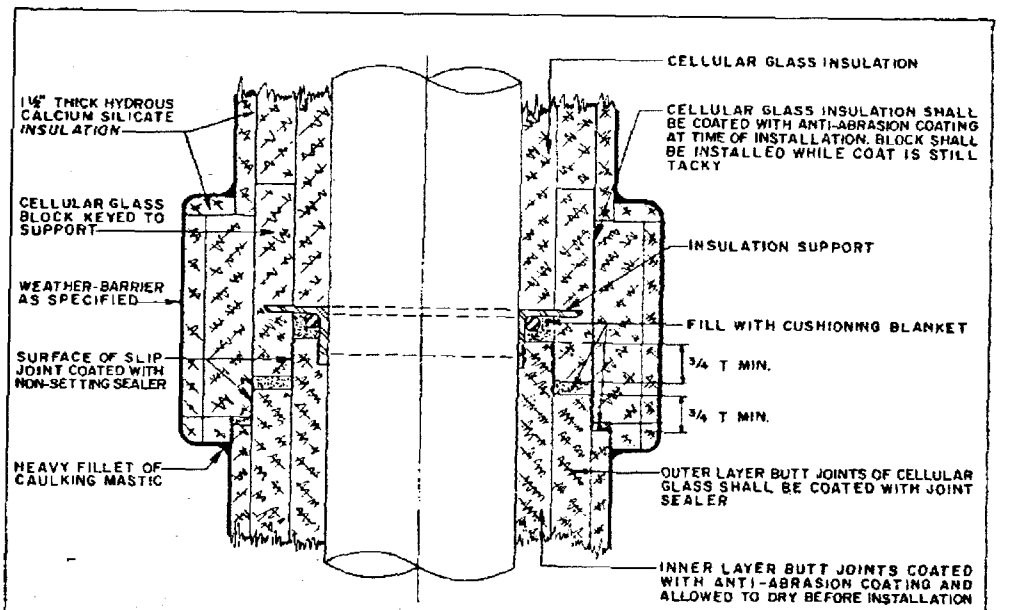
II. SPECIFICATION 32-L

B. APPLICATION - contd

2. Piping - contd

e. Expansion-Contraction Joints - contd

(4) Where it is necessary to install expansion-contraction joints in insulation on vertical piping, an insulation support shall be provided. Installation shall be as shown in Figure 32-L-20.



HYDROUS CALCIUM SILICATE-CELLULAR GLASS INSULATION VERTICAL EXPANSION AND CONTRACTION JOINT ON LOW TEMPERATURE PIPING

FIG. 32-L-20

f. Weather-Barrier Coating

Weather-barrier shall be installed in accordance with the GENERAL SPECIFICATION, I.B.16.

g. Steam Traced Installations

Steam-trace lines, where specified, shall be installed and insulated in accordance with the GENERAL SPECIFICATION, I.B.15.

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UNION CARBIDE CHEMICALS COMPANY
DEPARTMENT OF DESIGN AND CONSTRUCTION

THERMAL INSULATION SPECIFICATIONS

II. SPECIFICATION 37-H — Insulated Conduit

Scope

This specification describes the essential insulation requirements for the installation of insulated conduit used on underground systems normally operating at temperatures up to and including 750°F.

A. MATERIAL

1. Composition

a. The insulated conduit is an insulated prefabricated pipe system, encased in a corrosion protected metal jacket.

b. Insulation material for use in conduit will be specified in Insulation Line and Equipment List.

2. Accessory Materials

a. Insulated Conduit - Ric-wil Hel-cor, Durant Pre-Sealed, Kaiser Ebko, or approved alternate.

b. The insulated conduit piping system shall be purchased as a package unit, in accordance with the piping drawings and piping specifications, with all necessary accessories and installation instructions furnished by the conduit manufacturer.

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II. SPECIFICATION 37-H

B. APPLICATION

1. Trench Preparation

   a. Lines shall be installed in accordance with piping drawings.

   b. The bottom of the trench shall be smooth and uniform prior to the installation of conduit.

2. Process Pipe

   a. After process line has been welded and tested, insulation shall be applied to uninsulated joints.

   b. All loose paint, dirt, grease, rust, scale, wax, and other extraneous materials shall be removed from the exposed ends of the pipe before the conduit connections are made.

   c. Insulation of the type specified for conduit, shall be applied to the area of the pipe left bare for field welding, and joints and cracks filled with insulating cement.

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II. SPECIFICATION 37-H

B. APPLICATION - contd

3. Field Connections

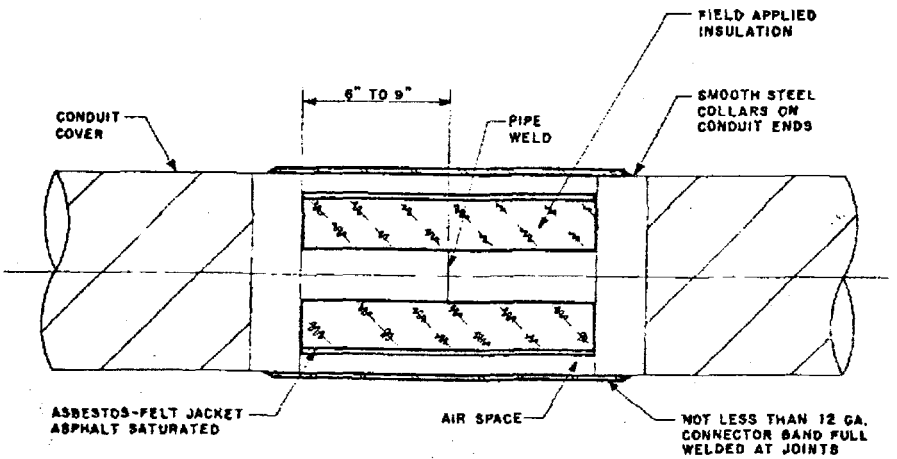
(1) Field Welded Conduit Connections (Fig. 37-H-1)

a. An asbestos felt jacket shall be applied over the insulation and secured with wire.

b. The cylindrical conduit closure supplied by the manufacturer shall be installed at the joint, and the circumferential and longitudinal joints welded.

c. The system shall be required to withstand air test at 15 PSI without leaks.

d. The welds shall be smoothed and cleaned, and an industrial tape applied around each circumferential weld. Entire connection shall then be wrapped continuously with tape.



PREFABRICATED INSULATED PIPE CONDUIT

TYPICAL WELDED FIELD CONNECTION

FIGURE 37-H-1

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II. SPECIFICATION 37-H

B. APPLICATION - contd

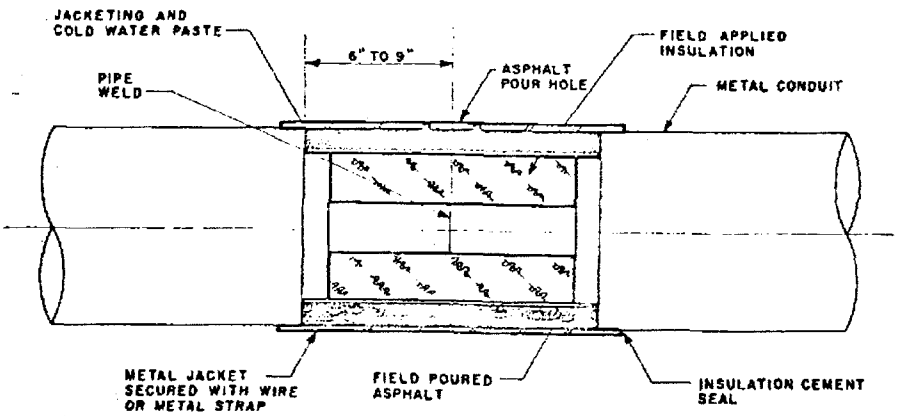
3. Field Connections - contd

(2) Mechanical Conduit Connections (Fig. 37-H-2)

a. Entire area of exposed insulation shall be thoroughly covered with jacketing and cold water paste.

b. The outer metal jacket, furnished by manufacturer, shall be installed over-lapping the conduit jacket at both ends, and sealed with insulating cement before securing with stainless steel insulation strap.

c. A 2" x 3" pour hole shall be cut in the top center of the connection jacket if the pipe is level. The pour hole shall be located at the highest point.



PREFABRICATED INSULATED PIPE CONDUIT

TYPICAL MECHANICAL FIELD CONNECTION

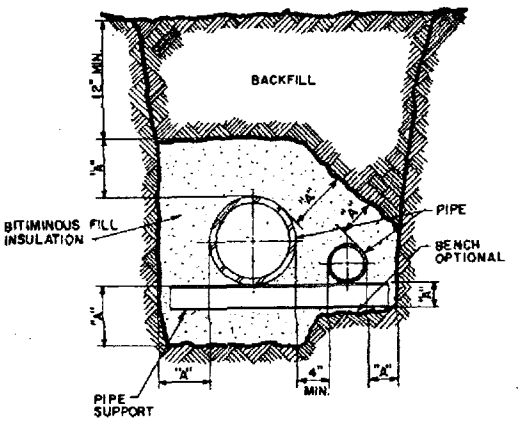
FIGURE 37-H-2

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B. APPLICATION

1. Piping

a. Unless otherwise specified, insulation thickness shall be not less than specified on Fig. 39-H-1. Where the piping passes under areas supporting heavy loads, thickness of insulation on top side of pipe shall be increased 3 inches.



RECOMMENDED ENVELOPS

NOMINAL PIPE SIZE INCHES	DIMENSION "A" MIN. INCHES
1 TO 4	4
5 AND 6	5
8	6
10 AND 12	8
16	11

APPLICATION OF BITIMINOUS FILL INSULATION TO UNDERGROUND PIPING

FIG. 39-H-1

b. The trench shall be dewatered and remain as such, until the installation is completed.

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B. APPLICATION - contd

1. Piping - contd

c. Process lines shall be supported, welded and tested, and loose paint, dirt, rust, scale, wax, and other extraneous materials removed before the insulating material is applied.

d. The bituminous insulation fill shall be poured into the trench and then tamped around the lines with one 10" stroke of a 8" x 8" x 1/4" steel plate per 8" x 8" area.

e. Insulating material shall be kept free of soil or other foreign matter before and during the pouring procedure.

f. Where the width of the trench is greater than required, a leapfrog form shall be used for the side walls. The insulation material shall be applied, and sides backfilled before forms are moved to the next position.

g. The curing of the bituminous insulation shall be not less than the time and temperature specified by the manufacturer for the material supplied.

h. Trench shall be backfilled only after curing is completed, unless the installation is being made in dry soil.

i. A minimum of 12" backfill shall be placed over the top of the bituminous insulation as specified on Fig. 39-H-1.

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