#8

Job No. 776

Account No. [illegible]

Spec. No. SP776 N-1

PLAINTIFF'S EXHIBIT
MON-273

THE BADGER COMPANY, Inc.
CAMBRIDGE 42, MASS.

INSULATION SPECIFICATION

EQUIPMENT AND PIPING

66 Pages

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MONSANTO CHEMICAL COMPANY

CHOCOLATE BAYOU TEXAS

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IV	9/28/64	REV. SHEET 2 AND 8 ADDED SHEETS 32-44	GW	[illegible]
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Design G.W. Date [illegible]

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Eng. [illegible] Date [illegible]

Ch. Dr. _____ Date _____

Spec. No. [illegible]

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INSULATION SPECIFICATION

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XI	[illegible]	ADDED SHEET 66	SW	[illegible]	MONSANTO CHEMICAL COMPANY CHOCOLATE BAYOU TEXAS
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INSULATION SPECIFICATION
EQUIPMENT AND PIPING
SECTION I
GENERAL

SCOPE OF WORK

The insulation sub-contractor shall furnish all supervision, materials, labor, tools, scaffolding, and equipment necessary to execute, construct, and finish in an expeditious, substantial and workmanlike manner all equipment and piping insulation required for project. Any exceptions will be specifically mentioned in this specifica and accompanying drawings.

DRAWINGS & SCHEDULES

The work to be done is shown on drawings included in this specification, together with piping arrangement drawings and such other drawings and data, not listed, as may be necessary in the opinion of the Badger Company to supplement information given therein.

Sub-contractor will be responsible for his material quantities. Tables contained within this specification will give sub-contractor necessary information which will enable him to make his equipment material take-off. Sub-contractor will be given a complete set of piping arrangement drawings together with a schedule showing the pipe lines that will be insulated with the thickness and type of insulation to be used. The sub-contractor will be required to make his own piping insulation take-off from the information given.

WORKMANSHIP

The intent of this specification is to secure a first-class job in all respects. The workmanship shall be of the highest quality throughout, and sub-contractor shall furnish a competent superintendent experienced in this class of work. Surfaces to be insulated shall be brushed clean by sub-contractor before applying the insulation, using wire brushes if necessary.

INSPECTION

An inspector representing the Badger Company or client, shall have the right to inspect all work and material at the factory or on the site, and any work or material found to be defective or which does not meet the requirements of this specification shall be replaced by sub-contractor at his own expense. Such inspection shall not relieve sub-contractor from full responsibility for the quality and correctness of his materials and work.

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CAMBRIDGE 42, MASS.

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SECTION I
GENERAL (Cont.)

SCAFFOLDS

The sub-contractor shall provide, at his own expense, all scaffolding of suitable design and as required for his work. He shall remove from the job said scaffolding on completion of the work of the subcontract.

LOCATION OF JOB SITE

A railroad siding will be available to the sub-contractor near the job site. Sub-contractor will include in his bid the necessary cost for trucking of material from the siding to the storehouse, and from the storehouse to various parts of the job.

STORAGE OF INSULATING MATERIAL

Sub-contractor shall visit the site and acquaint himself with the location and conditions of the job. The Badger Company job superintendent will allocate space for storage of materials.

If there is no building space available, the sub-contractor will include in his bid the cost of material, erecting and removal of a suitable warehouse to meet his requirements.

CLEANUP

Contractor shall conduct his portion of the work in a manner that will generate a minimum amount of debris, and this shall be removed by him to a safe location, indicated by Purchaser's Construction Superintendent, before the end of each work day. Contractor shall also clean equipment, machinery, piping, structures, floors, walls, etc., of any undue or unsightly splatter resulting from his operations each day.

WELDING

Many of the vessels and equipment in this plant are fabricated of special alloys. Many are fully stress relieved. No welding of any type shall be done on any vessel, equipment or piping for attachment of additional supports, clips, etc., without specific written approval from Badger, and this work, when approved, will be supervised by Badger.

II	5/3/44	Rev. per Client's comments. Approved by Client. Certified	GW	WKP
I	3/17/44	For Client's Approval	GW	WKP

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SECTION II
MATERIALS

All materials shall be new; materials such as insulation blocks, pipe covering, cements and weatherproofing compounds shall be delivered to the job site in factory sealed containers.

Insulation shall be of the type and thickness specified herein. All accessory materials necessary to complete application of the insulation system shall be of the type specified herein. Proposals shall be based on use of these materials as specified and no substitution of materials shall be permitted in the base proposal. Alternate proposals based on the use of materials other than those specified may be made. In such alternate proposals the subcontractor shall state the physical and mechanical properties of all materials and shall furnish detailed description and drawings of methods that differ from those outlined in this specification.

1. High Temperature Block and Pipe Insulation

Owens-Corning	Kaylo, or approved equal, to 1200 F.
Owens-Corning	Kaylo 20, above 1200 F.

2. Low Temperature Block and Pipe Insulation

Pittsburgh-Corning	Foamglas, or approved equal

3. Insulating Mastic

Lion Oil Company	K-Kote

4. Accessories for High Temperature Insulation

4.1 Stainless Steel Wire

Wire shall be 14&16 Ga., Type 304, cold-drawn, bright annealed stainless steel.

4.2 Stainless Steel Bands

Flat 3/4 inch x 0.020 inch, Type 304 stainless steel strap shall be used on vessels and equipment operating at 500 F., or less. A.J. Gerrard Expand-R-Strap, or an approved equal, shall be used on vessels and equipment operating above 500 F.

4.3 Insulation Filler Material

Loose insulation material for packing cavities and expansion spaces shall be Fibrofil, a diatomaceous silica with long fiber asbestos, manufactured by Johns-Manville Company.

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SECTION II
MATERIALS (Cont.)

4.4 Caulking Mastic

Material used to smooth depressions and minor voids in the finished insulation surfaces shall be caulking compound, Eagle-Picher, "One-Coat", OCF No. 110, or approved equal.

4.5 Reinforcing Membrane

Membrane used to distribute stresses and re... ce the weather coating on vessels or surfaces not covered by protective jacketing shall be 20 x 20 mesh, asphalt impregnated glass fabric.

4.6 Weather Coating

Material used as ... coating on surfaces not covered by protective jack... be Lion Oil Company Fire Retardant Seal Perm.

4.7 Protective ... & Piping in Battery Limits

Protective ... lated equipment and piping inside battery limit... gated 0.016 in. thick, type 5052 aluminum, wi... hed moisture barrier as manufactured by Childers M... ing Co., or an approved equal. Piping 45° and 90° e... protected with pre-formed Type 1100 or 5052 alum... a factory-applied moisture barrier.

4.8 Protective Ja... ts, ... g off Battery Limits

Material used ... protective jacket to insulated piping off battery limits shall be 45 pound asbestos roofing felt, as manufactured by Johns-Manville Company, or approved equal material.

5. Accessories for Low Temperature Insulation

5.1 Vapor Barrier

Lion Oil Company	Seal Kote Fire Retardant No Flash, Spray or Trowel Grade.

5.2 Reinforcing Membrane

Perma-Glas ompany	No.105 Non-Impregnated Glass Fiber 20 x 10 Mesh, or approved equal.

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		DESCRIPTION	CHKD.	APPD.	CONT. DWG. SPF76 F-1

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SECTION II
MATERIALS (Cont.)

5.3 Joint Sealer

Lion Oil Company	Seal Kote Fire Retardant No Flash, Trowel Grade

5.4 Adhesive

Lion Oil Company	Low Temp, Trowel Grade

5.5 Caulking Mastic

Lion Oil Company	Seal Kote Fire Retardant No Flash, Trowel Grade

5.6 Stainless Steel Bands

A.J. Gerrard Company, or approved equal	3/4" x .020" Type 304, for vessels and equipment. 1/2" x .015" Type 304, for Pipe covering

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I	9/27/64	Per Client's Approval	GW	UEK

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SECTION III

APPLICATION

Insulation for piping and equipment shall be applied as designated on the schedules and detail drawings included in this specification.

1. Hot Service

Vessels, exchangers and general equipment, up to and including 30 inches in diameter shall be insulated with pipe covering. Over 30 inches in diameter use mitred lags cut from flat blocks. Curved blocks may be used if economical and available.

Manholes, flanges and stiffener rings on vessels and exchangers will not be insulated unless specifically designated on schedules or detail drawings. Name plates shall not be covered.

Valves and flanges shall be insulated only in live steam lines, steam traced lines and lines operating over 300 F.

When insulation is specified for personnel protection, it shall be applied only where lines are less than 7'-6" above or three feet from the edge of a platform or walkway.

Where insulation passes over pipe supports, sub-contractor will be required to do the necessary cutting and weatherproofing of insulation. On high vertical risers sub-contractor will provide insulation supports in the form of bar clamps made from 1 x 1/4 steel with the necessary bolts. Bar clamps will be required for every 20'-0" of vertical rise. No bar clamp will be required unless the rise is at least 20'-0".

Allow for expansion on the following equipment:

M.C.C. Item No.	Badger Item No.	Circumferential Expansion	Space required between blocks and shell for expansion
R1-1 thru R1-6	MR-101A-F	3"	7/16"

Austenitic Stainless Steel Surfaces of equipment listed below shall be protected with a moisture barrier of Lion Oil Co. "Seal Kote" prior to insulation. Insulation contractor shall apply a brush or spray coat of light or medium grade mastic, 1/16" minimum dry film thickness, to a clean, dry surface.

MS-303
TT-119 Bonnet
AS-102

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IV	7-28-64	ADDED AS-102	[illegible]	[illegible]
II	5/18/64	Added Austenitic St.Stl. Approved by Client. Certified	[illegible]	[illegible]
[illegible]	3/17/64	For Client's Approval	[illegible]	[illegible]

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THE BADGER COMPANY, Inc.
CAMBRIDGE 42, MASS.

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SECTION III

APPLICATION (Cont.)

2. Cold Service

Low temperature equipment and piping shall be insulated with Foamglas. Use pipe covering on piping and equipment up to and including 36 inches in diameter. Standard curved segments or mitered lags shall be used on larger sizes.

All valves, fittings and flanges in cold lines shall be insulated. Supports or attachments which project through insulation shall be insulated for a distance equal to four times the insulation thickness where possible. Manholes, flanged ends of exchangers, and otherpoints of equipment access shall be protected with built-up insulation covering as described on detail drawings in this specification.

3. Steam Tracing

Steam tracer lines from mains to process lines and from process lines to traps and condensate returns are to be insulated. Complete insulation of piping, fittings and valves is required except for the sections at traps from and including strainers to and including unions below traps. Condensate lines downstream from traps discharging to sewers or grade shall be insulated only where required for personnel protection.

For complete information on steam tracing see "Specifications for Steam Tracing" SPF76 C16. Insulation contractor shall furnish aluminum foil and Thermon where specified.

4. Insulated Instrument Lines

Instrument lead lines shall be insulated as shown on instrument piping drawings. Pressure gage piping, control valves, flow indicators, etc., when installed in lines that are insulated, or traced and insulated, shall be insulated.

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5. General

Care shall be taken that insulation does not interfere with the operation or visibility of instruments such as gage glasses, sight ports, level indicators, etc., or the operation of mechanical or electrical equipment. Nameplates on "cold" equipment shall be covered over with removable plugs of insulation or wood that extend 1" beyond the insulation and sealed with mastic. Application sketches included in this specification are typical. Any piece of equipment not specifically described on the sketches shall be insulated like the equipment it most resembles.

VI	[illegible]	SPF76 C16 WAS C-6	GW	[illegible]
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Insulation on head same thickness as on shell
Secure blocks with 3/4"x.020" T-304 St.Stl.insulation.
Straps & seals spaced 12" apart on circumference.
Trowel on a 3/8" thick coat of caulking mastic and weatherproof.

For method of weatherproofing vessel heads see Sht. 12

For type & thickness of shell insulation see Schedule

Insulation supports by vessel fabricator. For detail see sheet 14

3/4"x.020"Type 304 St.Stl. insul.straps & seals spaced 12"o.c.over block insulation

Fit metal jacket as close as possible around projections. Seal with heat resistant mastic.
Use staggered joint construction. Seal cracks & voids with caulking mastic.

Allow 1"space for expansion joint under each support.
For detail see Sheet 13

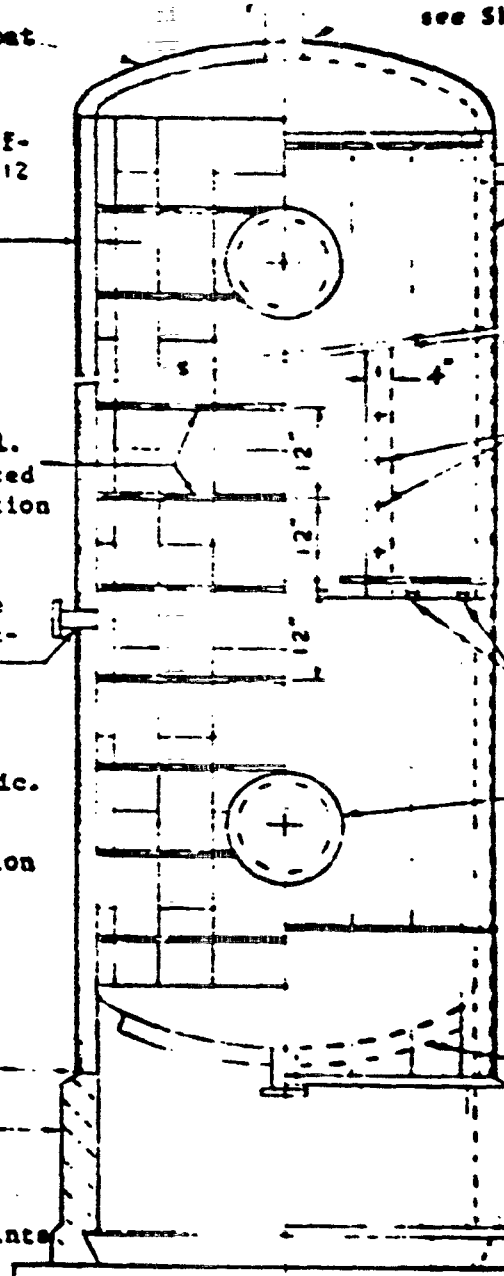
Flash & Seal

Fireproofing by Badger
For Detail see Sht. 16

Two layer insulation shall be applied with joints staggered longitudinally and circumferentially. Each layer shall be secured as shown for single layer

Nozzle insulation when required to be included in piping insulation

For detail of floating ring see Sheet 12



.016"thick corrugated aluminum jacketing with moisture barrier attached.

Laps in jacket to be 4" on vertical seams & 3" on horizontal seams.

Apply jacket with No.8 x 1/2" long aluminum alloy sheet metal screws spaced 6" on centers on vertical seams.

3/4"x.020"T-304 St.Stl. insul.straps & seals at circumferential seams.
For detail of "S"clips see Sheet 13

Manholes & Stiffener rings will not be insulated except where specified.

Stiffener rings shall be encased with aluminum flashing.

Insulate & finish bottom head same as top head.
For list of manholes & stiffener rings see Sheet (Later)

Top of foundation.

INSULATION DETAILS
Vertical Vessels
Hot Service

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II	5/10/64	Approved by Client Certified	FW	WCK
I	3/17/64	For Client's Approval	FW	WCK

THE BADGER COMPANY, Inc.
CAMBRIDGE 42, MASS. Sheet 10

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Surfaces to be insulated shall be clean, dry, and free from frost, rust, etc.

Cement blocks to vessel surface with a coating of low temp adhesive.

Foamglas curved blocks or beveled rings shall be laid up with sl. butt edges and ends of outer layer (or single layer) coated with joint sealer.

For type & thickness of insulation see schedule. provide contraction joints below insulation supports by packing tightly with Lion Oil Co. K-Kote. Add a layer of insulation over outer layer at supports.

Joint sealer slip joint

Use staggered joint construction.

Nozzles shall be insulated per piping insul. schedule.

3/4"x .020" st. stl. straps & seals spaced 9" O.C. to secure each layer of insulation.

Vessel skirts, legs or lugs shall be insulated for a distance equal to four times the thickness of insulation or a minimum of 12" where possible.

• Fireproofing by Badger

Provide type 304 stainless steel floating ring where required to secure straps. For detail see sheet.

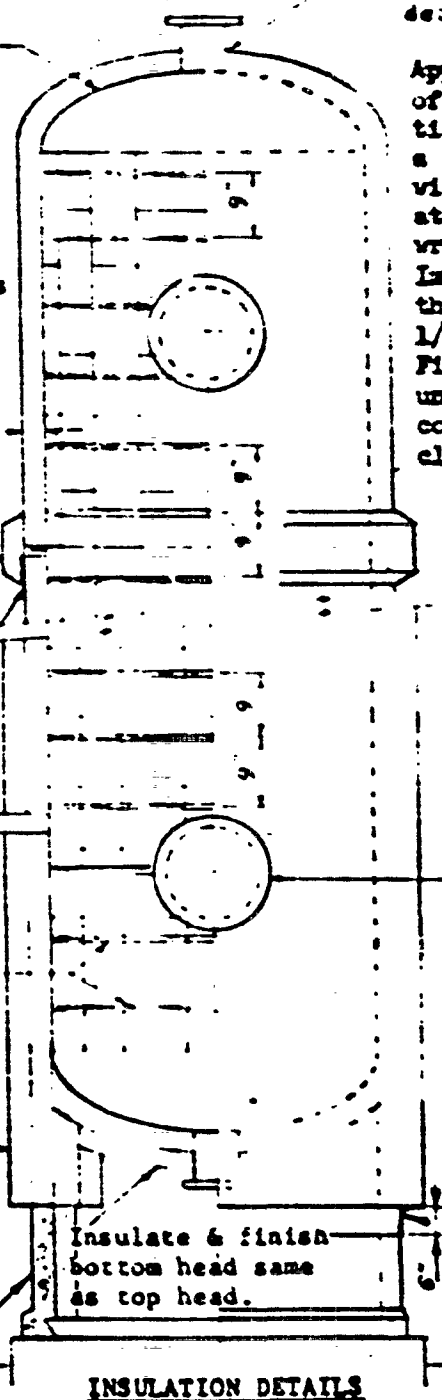
Apply a 1/16" thick (wet) coat of Seal Kote over the insulation. While still wet wipe in a layer of reinforcing membrane with not less than 3" overlap at all seams. Remove all wrinkles and air bubbles. Immediately spray or brush over the membrane a second coat, 1/8" thick (wet), of Seal Kote. Finish shall present a smooth, unbroken surface and completely hide the glass cloth.

Manholes & handholes shall be protected with built up insulation covering, so installed that it is removable and replaceable with minimum damage to the insulation.

For list of manholes see sheet.

Seal with Seal Kote and glass cloth.

Insulate & finish bottom head same as top head.



INSULATION DETAILS
VERTICAL VESSELS OVER 36" DIAM.
COLD SERVICE

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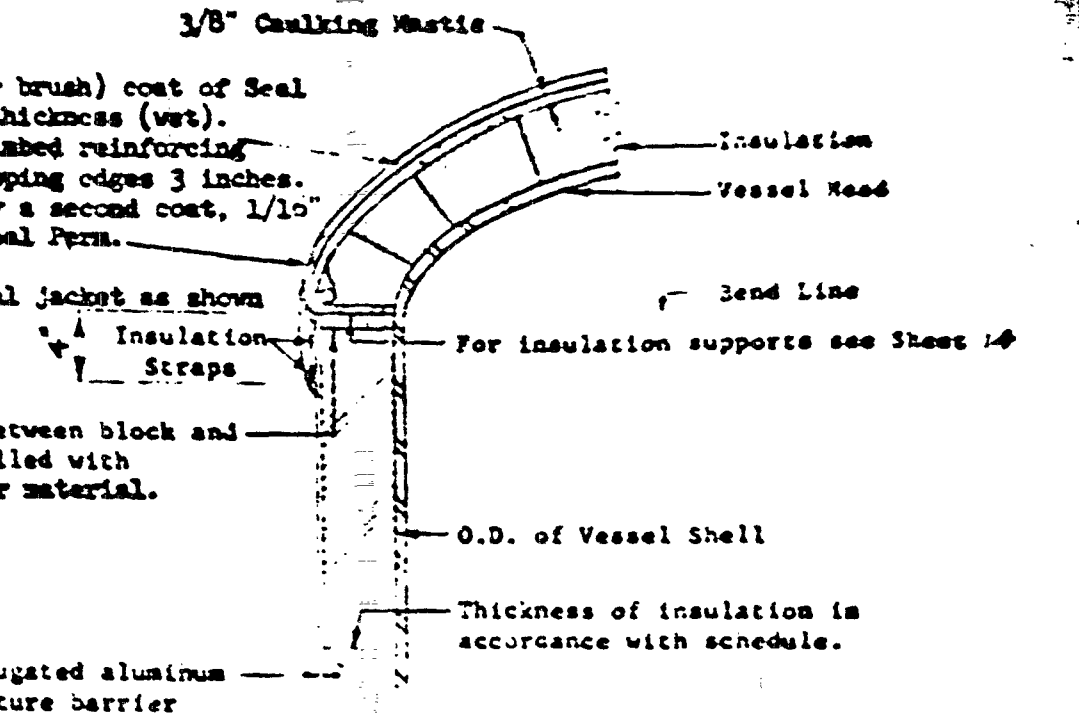
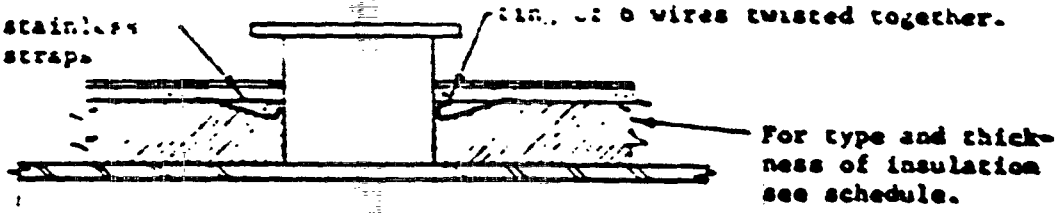
I	9/17/64	For Client's Approval	CW	WSK



INSULATION DETAIL AT VESSEL HEADS - HOT SERVICE



DETAIL OF FLOATING RING

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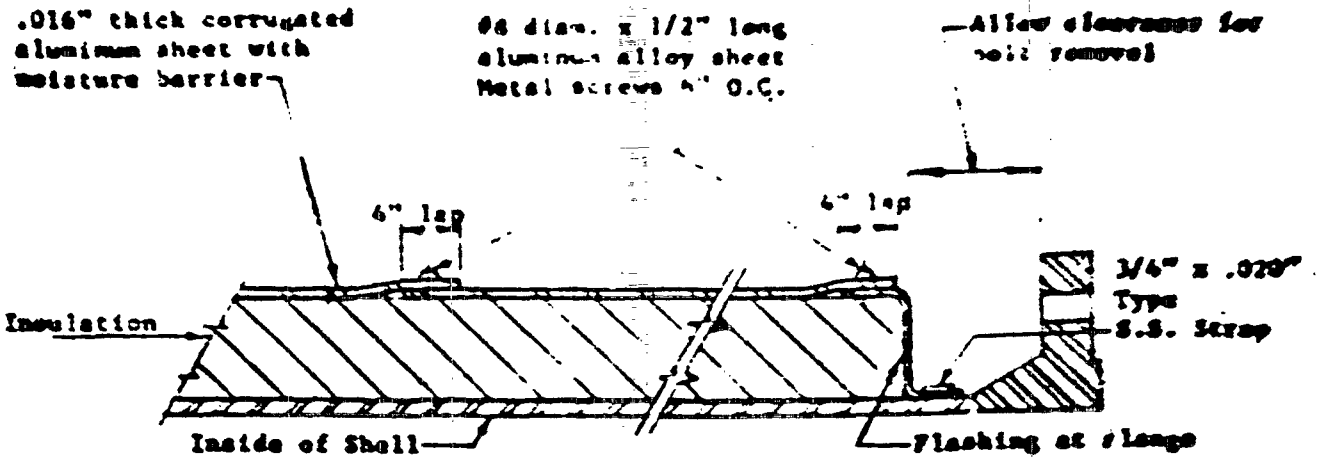
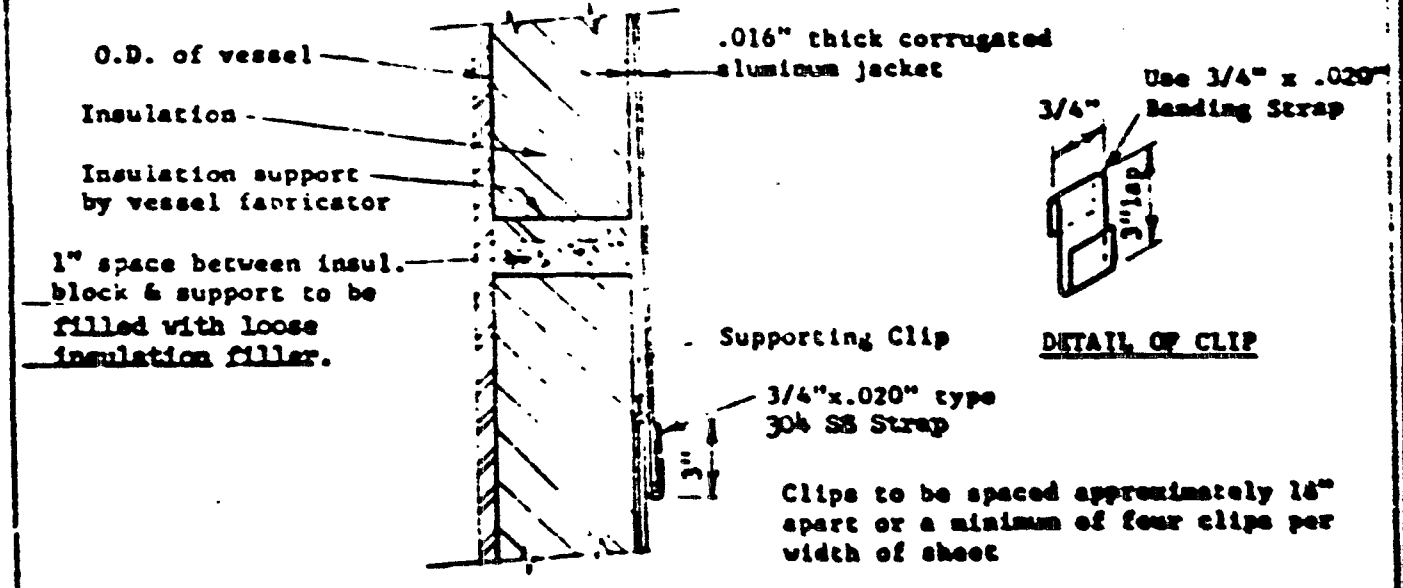


CIRCUMFERENTIAL SEAM DETAILS
HORIZONTAL VESSELS
HOT SERVICE



HORIZONTAL SEAM DETAILS
VERTICAL VESSELS
HOT SERVICE

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I	3/17/66	For Client's Approval	QW	WGKp
NO.	DATE	DESCRIPTION	DRN.	APPD.

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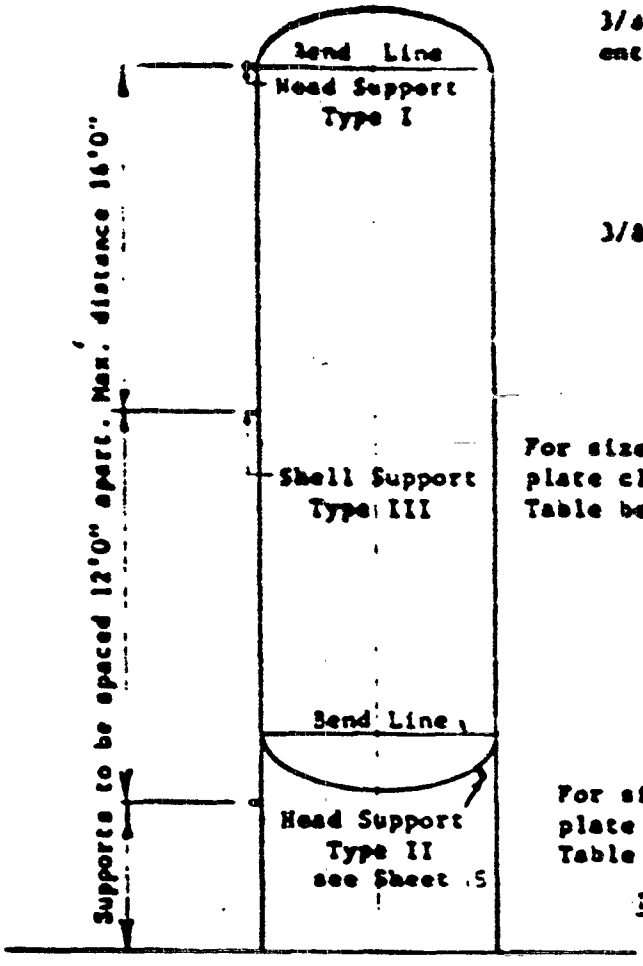
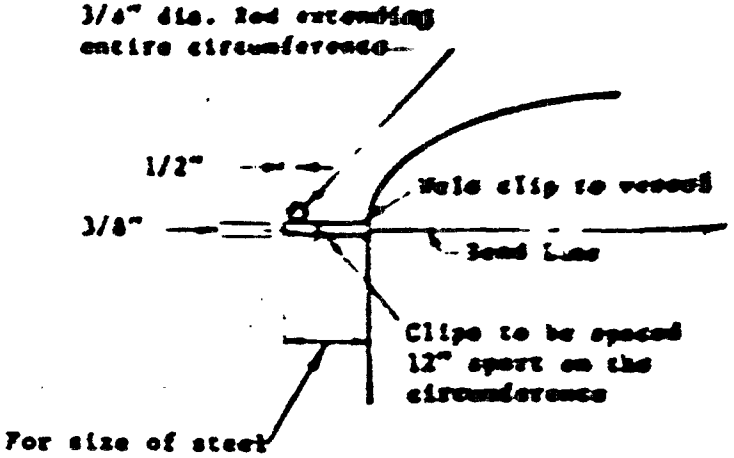
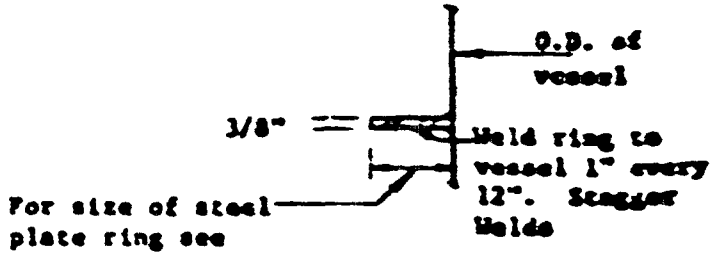




DETAIL OF HEAD SUPPORT TYPE I



DETAIL OF SHELL SUPPORT TYPE III

INSULATION SUPPORTS
Table of Dimensions

Insulation Thickness	Support Type I Size Plate Clip	Support Type III Width Plate Ring
1"	1" x 1"	1"
1½"	1½" x 1½"	1"
2"	2" x 2"	1½"
2½"	2½" x 2½"	2"
3"	3" x 3"	2½"
3½"	3½" x 3½"	3"
4"	4" x 4"	3½"

NOTE: Insulation Supports by Vessel Fabricator.

II	Burke	Approved by Client. Certified	JW	WSK
I	Burke	For Client's Approval	JW	WSK

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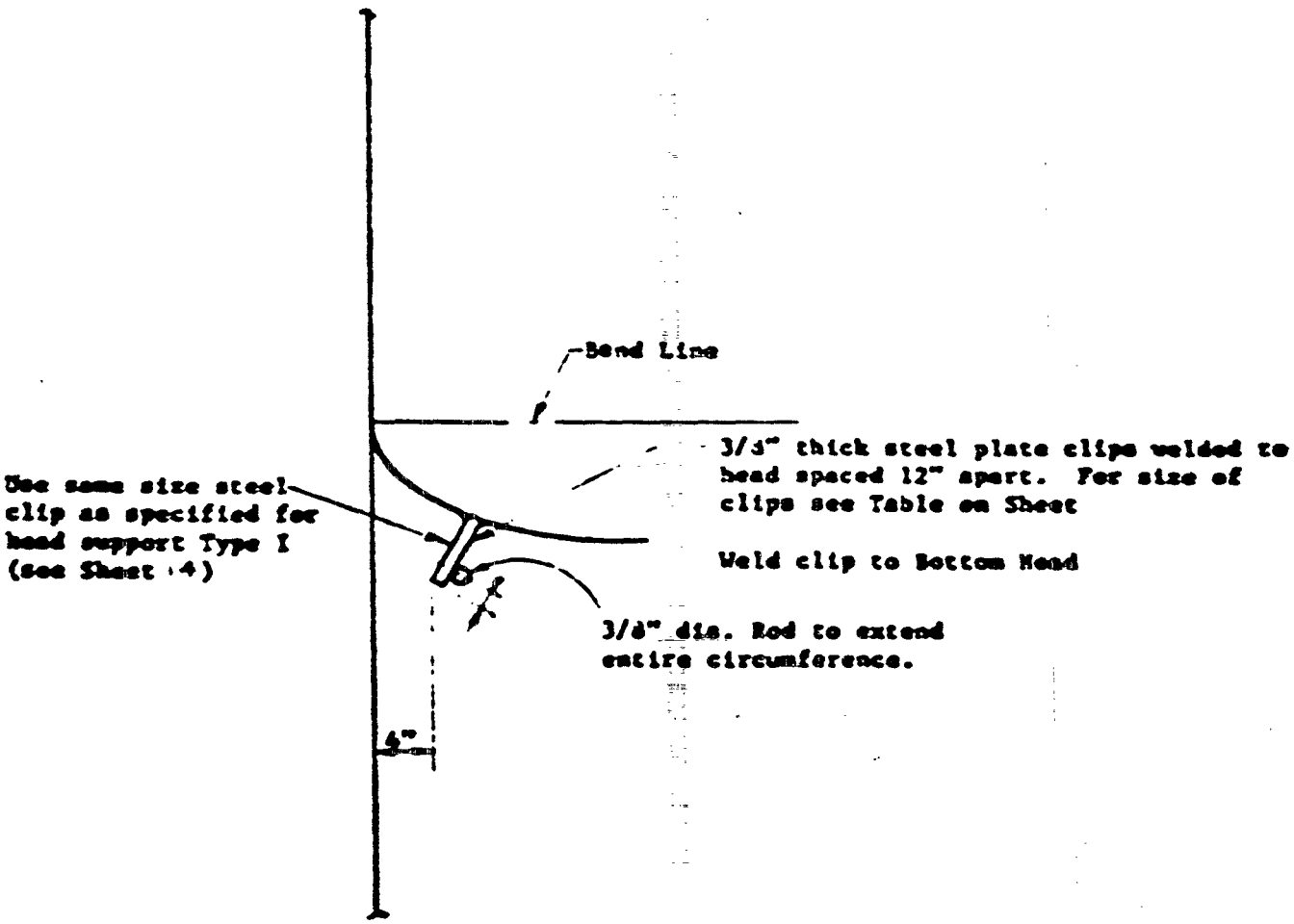
DETAIL OF HEAD SUPPORT TYPE II



NOTE: Insulation Supports by Vessel Fabricator

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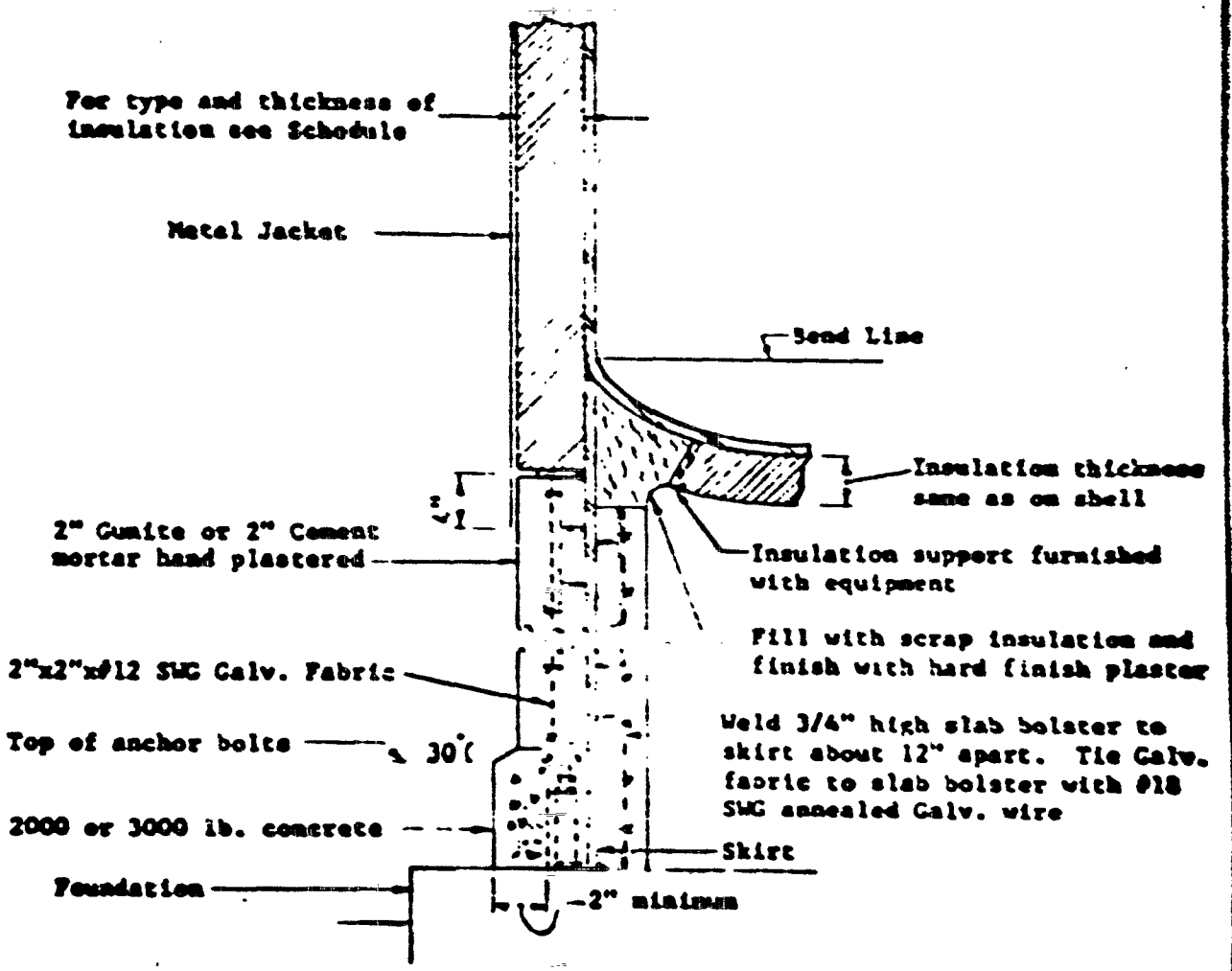
DETAIL OF SKIRT FIREPROOFING
HOT SERVICE



NOTE:
Fireproofing of skirts of vessels by Badger. Skirts 4'-0" O.D. and smaller will be fireproofed outside only.

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CAMBRIDGE 42, MASS.

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Insulation on heads shall be same thickness as on shell. Secure blocks with [illegible] gauge Type 304 St.Steel wire spaced 12" apart on circumference. Trowel on a 3/8" thick coat of quick setting finishing cement and weatherproof.

Over shell insulation apply .016" thick co aluminum jacket with moisture barrier atta

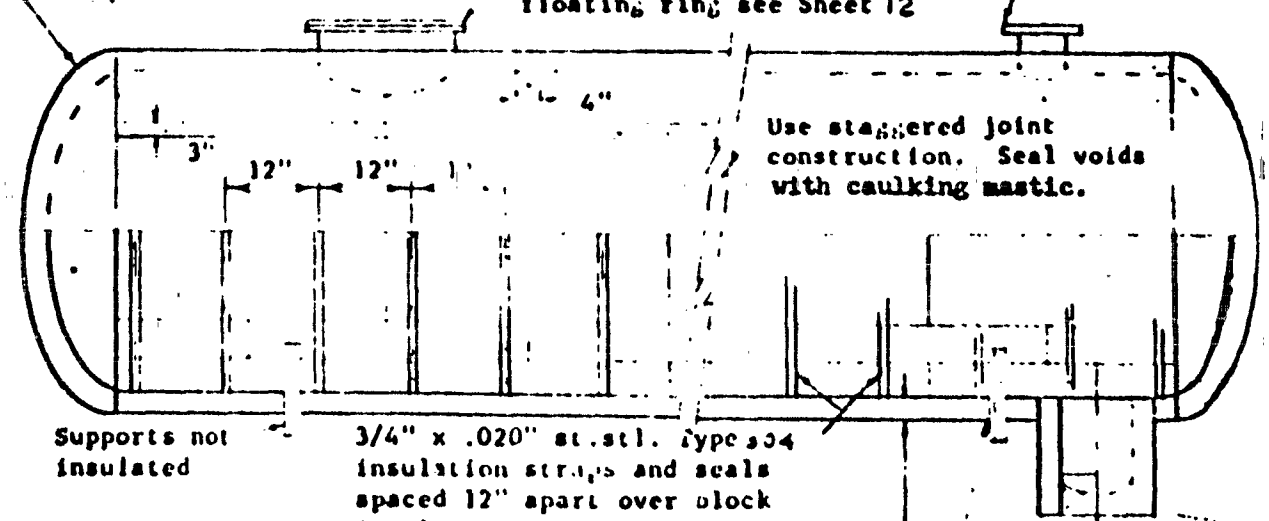
Laps in jacket shall be 4" on vertical sea on horizontal seams.

Apply jacket with No.8 x 1/2" long aluminu sheet metal screws spaced 6" apart on both and vertical laps.

For method of weatherproofing vessel heads see Sheet 12

Manholes will not be insulated. For detail of floating ring see Sheet 12

Nozzle insulat required, to b in piping insu



Supports not insulated

3/4" x .020" st.stl. Type 304 insulation straps and seals spaced 12" apart over block insulation.

For type and thickness of insulation, see Schedule

Fit metal jacket as as possible around projections. Seal heat resistant mast

Two layer insulation sha applied with joints stag longitudinally and circu Each layer shall be secu shown for single layer.

INSULATION DETAILS

HORIZONTAL TANKS OVER 30" DIA.

HOT SERVICE

11	9/9/66	Approved by Client Certified	
			WSK
			WSK

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CHOCOLATE BAYOU TEXAS

THE BADGER COMPANY, Inc.
CAMBRIDGE 42, MASS.

Sheet 17

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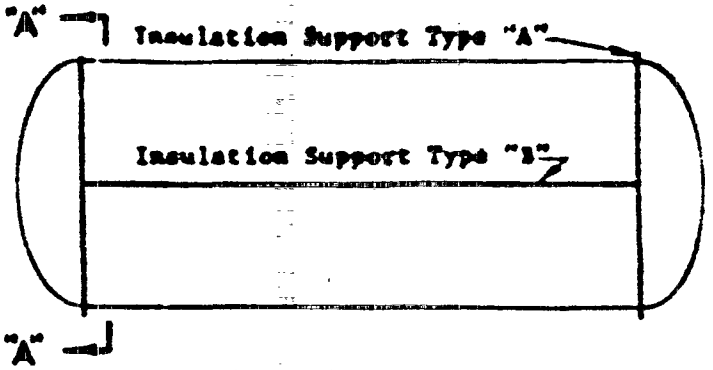
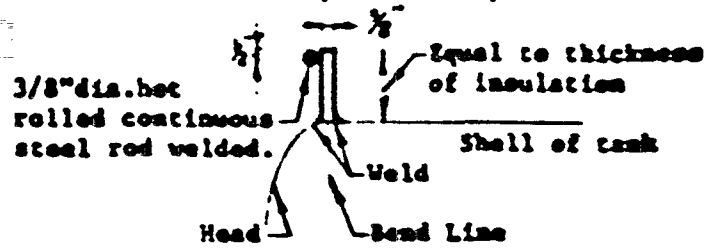
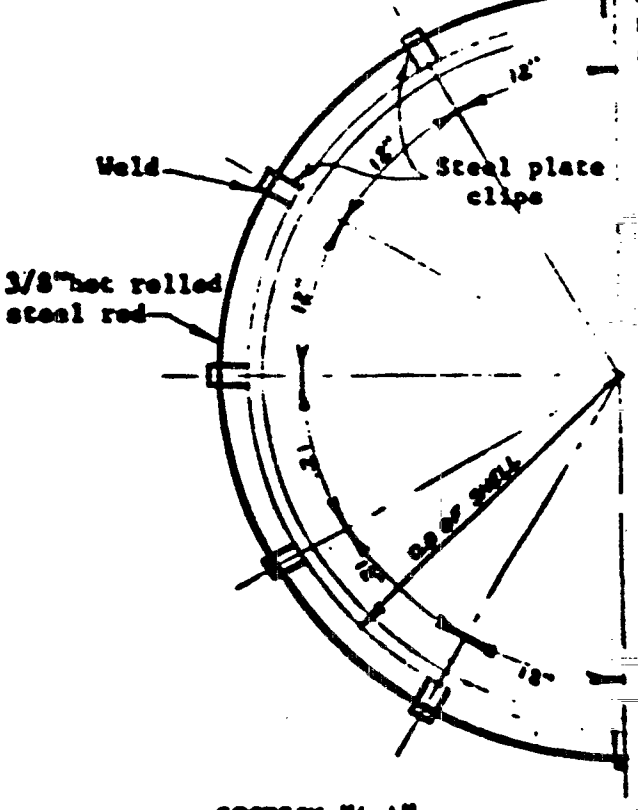


PLAN OF LOCATION - INSULATION SUPPORTS

Steel Plate Clips width equal to thick. of insulation spaced 12" apart.

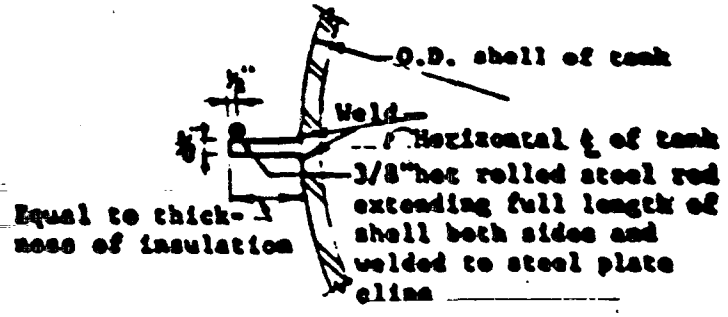


DETAIL OF INSUL. SUPPORT TYPE "A"



SECTION "A-A"

Steel plate clips width equal to thick. of insulation spaced 12" apart



DETAIL OF INSUL. SUPPORT TYPE "B"

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3251 B

Surfaces to be insulated shall be clean, dry and free from frost, rust, etc. Cement blocks to vessel surface with a coating of low temp adhesive.

Nozzles shall be insulated per piping insulation schedule.

Manholes shall be protected with built up insulation so installed that it is removable & replaceable with minimum damage to the insulation.

*Over roof insulation apply two layers of 15 lb. saturated felt and one layer of 55 lb. asbestos felt roofing in asphalt mopping.

Provide Type 302 St. Stl. floating ring at manholes, attachments, etc., where required to secure scrape

Block shall be laid up using joint sealer on all butt edges and ends of outer layer or single layer.

Apply a 1/16" thick (wet) coat of Seal Kote over the insulation. While still wet wipe in a layer of reinforcing membrane with not less than 3" overlap at all seams. Remove all wrinkles and air bubbles. Immediately spray or brush over the membrane a second coat, 1/3" thick (wet), of Seal Kote. Finish shall present a smooth, unbroken surface and completely hide the glass cloth.

3/4"x.020" st. stl. straps and seals spaced 9" o.c. shall be used to secure each course.

For type and thickness of insulation see schedule

Use staggered joint construction.

Projections through the insulation shall be insulated for a distance equal to four times the thickness of insulation or a minimum of 12 inches where possible.

For list of manholes see Sheet

For number and size of nozzles, see piping drawings.

Seal with joint sealer.

Provide contraction joints below insul. supports by packing tightly with Lion Oil Co. K-Kote.

Foundation

INSULATION DETAILS
STORAGE TANK
COLD SERVICE

* Roofing felt is to be applied over the vapor seal. Asphalt mopping material must be compatible with the vapor seal.

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CAMBRIDGE 42, MASS.

Sheet 18

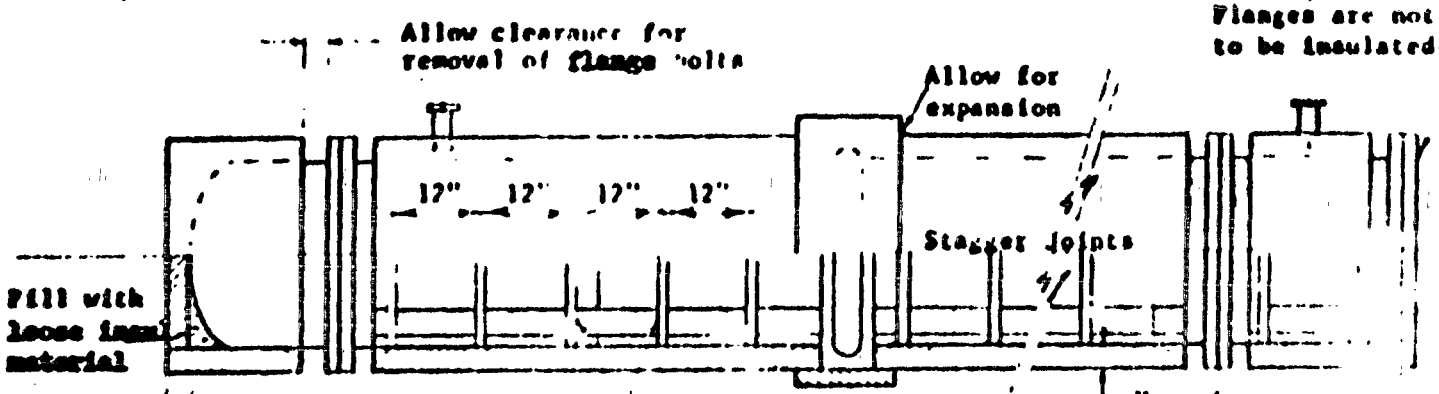
Jacket shall be cut to fit at nozzles & projections-seal with heat resistant mastic

For detail of flashing at flanges see Sht. 13

Over shell insulation apply .016" thick corrugated aluminum jacket with moisture barrier attached.

Laps in jacket to be 4" on vertical seams & 3" on horizontal seams

Apply jacket with No. 8 x 1/2" long aluminum alloy sheet metal screws spaced 6"o.c. on all seams.



Furnish 20 gauge aluminum jacketing with attached moisture barrier for insulated removable ends, outdoors.

Seal cracks & voids with caulking mastic.

Nozzles when required shall be insulated per piping schedule.

NOTE: Exchangers over 30" in dia. shall be insulated with beveled lags or curved blocks. Head insulation shall follow contour of the head.

INSULATION DETAILS

EXCHANGERS

HOT SERVICE

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KOPPERS CHEMICAL COMPANY
CHOCOLATE BAYOU TEXAS

THE BADGER COMPANY, Inc.
CAMBRIDGE 40, MASS.

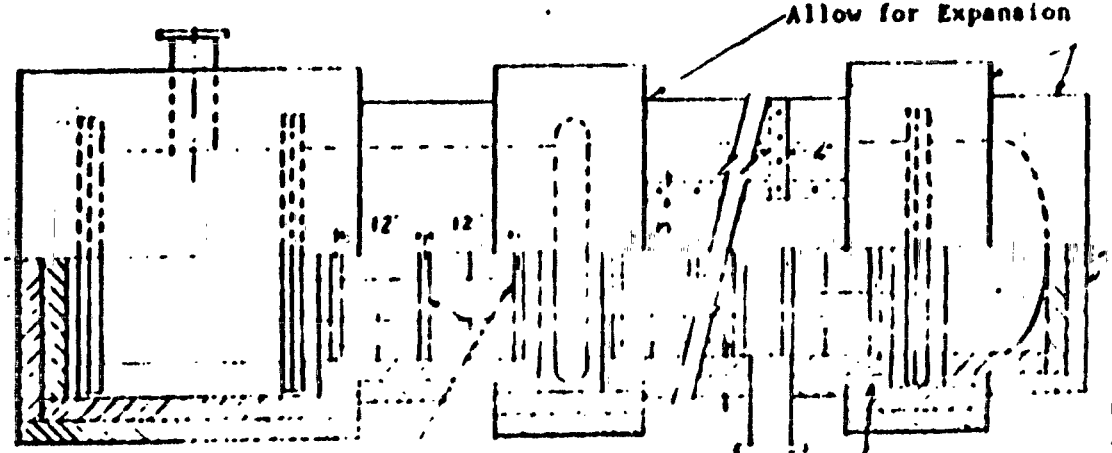
Jacket shall be cut to fit at all nozzles and projections. Seal with heat resistant mastic.

Nozzle insulation when required, to be included in piping insulation.

Over shell insulation apply .016" thick corrugated aluminum jacket with moisture barrier attached.

Laps in jacket shall be 4" on vertical seams and 3" on horizontal seams.

Apply jacket with No. 6 x ½" long aluminum alloy sheet metal screws spaced 6" apart on both horizontal and vertical laps.



Furnish removable covers using 20 gage aluminum for flanged head, channel end and expansion joint.

Cut flat block to suit. Insul. thickness same as on shell (insul. on tubulars over 30" dia. to follow contour of head and weatherproof same as vessel head.)

Allow clearance for removal of flange bolts

3/4" x .020" St.Steel T-304 insulation straps and seals spaced 12" apart over block insulation.

Build up with insulation to suit.

For type and thickness of insulation, see schedule

Use staggered joint construction. Seal voids and cracks with caulking mastic on outer layer only.

Use double layer insulation, each layer to be strapped on separately and all joints to be staggered.

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INSULATION DETAILS

EXCHANGERS OPERATING AT 800°F AND ABOVE

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8	4/7/66	Pup Client's Approval		

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CAMBRIDGE 42, MASS.
Sheet

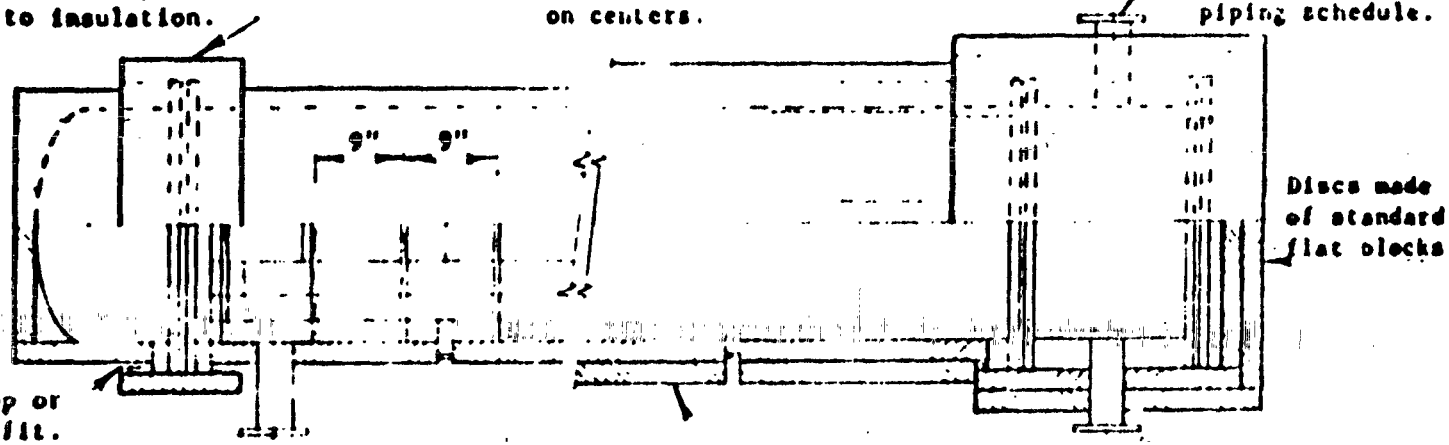
Surfaces to be insulated shall be clean, dry and free from frost, rust, etc.

Coat all butt edges and ends of outer layer (or single layer) of insulation with mastic joint sealer. Cement in place with a coating of low temp. adhesive.

Covering for flanged ends shall be removable and replaceable with minimum damage to insulation.

Secure insulation with 3/4" x .020" stainless steel bands & seals 9" on centers.

Nozzles shall be insulated under piping schedule.



Molded pipe covering up to 36" Dia. Use beveled lags on larger sizes.

Vapor barrier and membrane shall be carried onto metal shell, supports, etc., at ends of insulated sections to insure a complete seal.

Attachments & projections shall be insulated for a distance equal to four times the thickness of insulation or a minimum of 12" where possible.

Apply a 1/16" thick (wet) coat of Seal Kote over the insulation. While still wet, embed spirally wound reinforcing membrane with not less than 3" overlap at all seams. Remove all wrinkles and air bubbles. Immediately spray or brush over the membrane a second coat, 1/8" thick (wet), of Seal Kote.

INSULATION DETAILS

EXCHANGERS

COLD SERVICE

THE BADGER COMPANY, Inc.

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CHOCOLATE BAYOU
TEXAS

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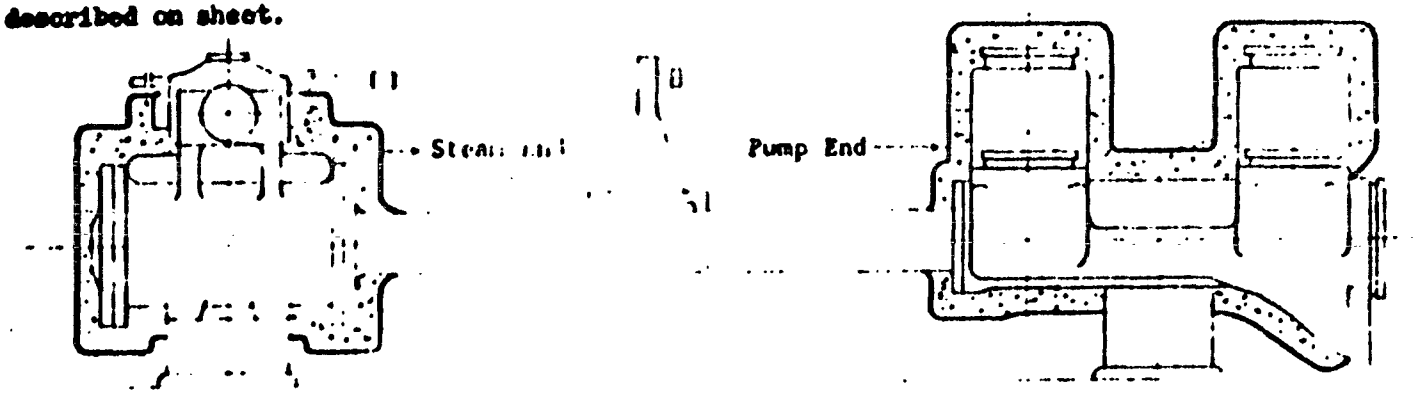
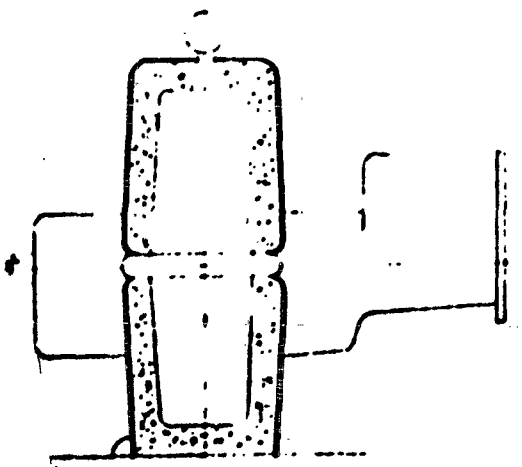
Insulating cement to be applied in layers not greater than 3/4" thick with a layer of 1" hex mesh #20 gauge galv. wire netting between layers. Each layer shall be dry before proceeding with the next.

Over insulation apply a 3/8" thick layer of hard finish plaster consisting of 4 parts finish cement to one part Portland cement. Weatherproof with reinforcing membrane and seal perm as described on sheet.

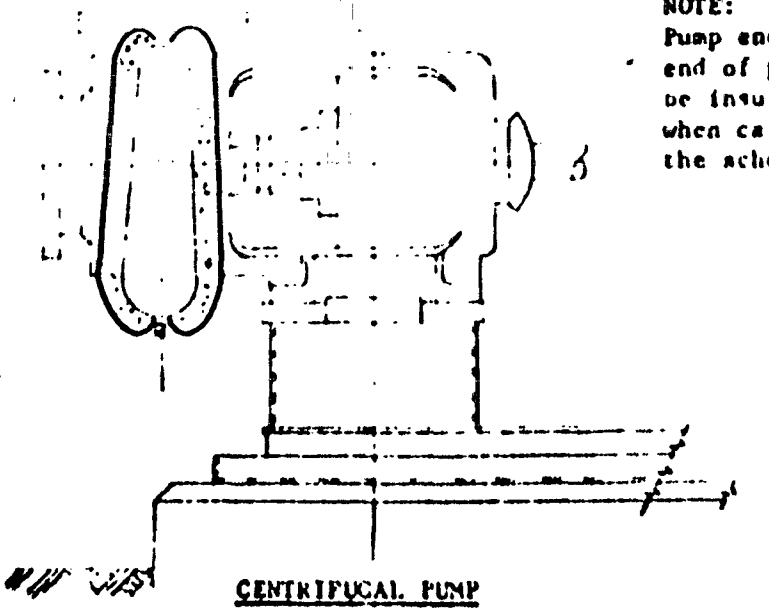


RECIPROCATING PUMP

NOTE:
Pump end or steam end of pump shall be insulated only when called for in the schedule.



TURBINE



CENTRIFUGAL PUMP

INSULATION DETAILS - HOT PUMPS AND TURBINES

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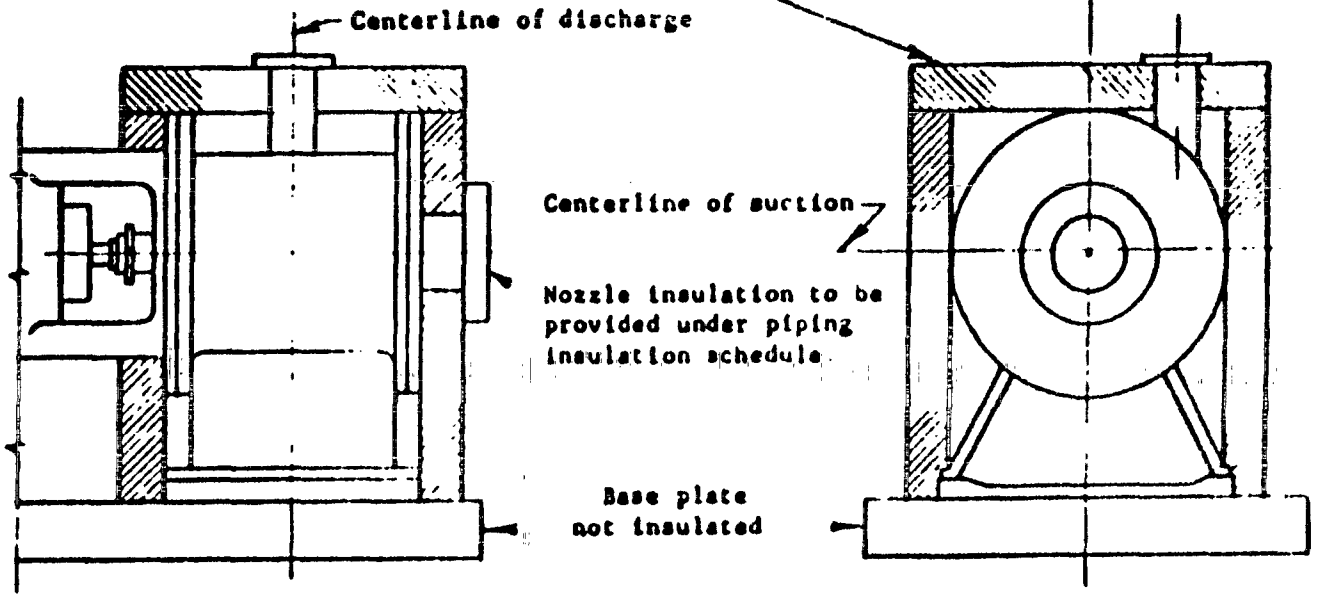
CAMBRIDGE 42, MASS. Sheet 23

Lay up 2" thick Foamglas Blocks coating all butt edges and ends of blocks with a buttered layer of joint sealer,

Band blocks in place with 3/4" x .020" stainless steel bands & seals 9" O.C.

Apply a 1/16" thick (wet) coat of Seal Kote over the insulation. While still wet wipe in a layer of reinforcing membrane with not less than 3" overlap at all seams. Remove all wrinkles and air bubbles. Immediately spray or brush over the membrane a second coat, 1/8" thick (wet), of Seal Kote.



DETAILS OF COLD PUMP INSULATION
NO SCALE

Approved by Client.

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CHOCOLATE BAYOU
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CAMBRIDGE 42, MASS.

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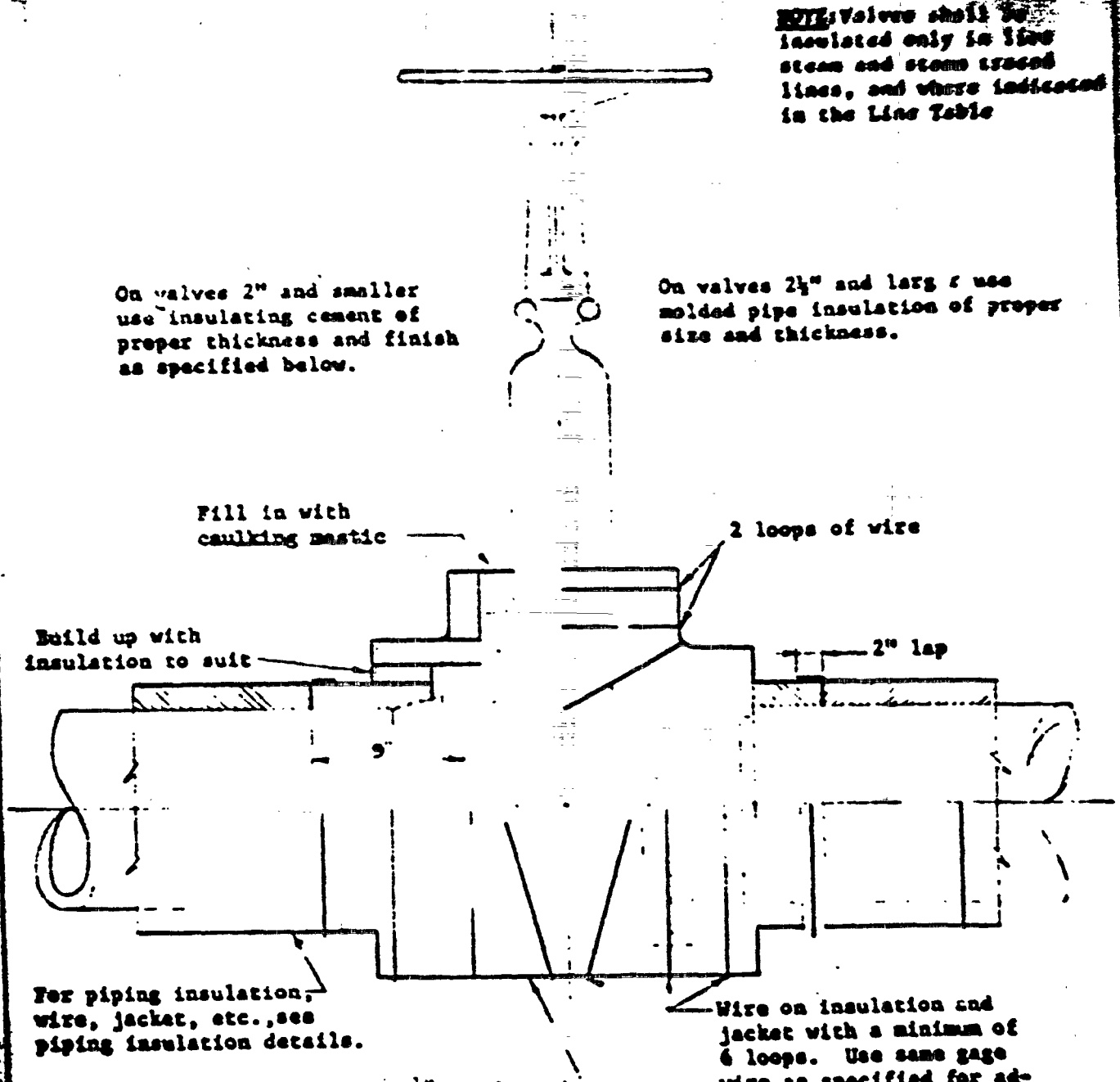
Sheet

NOTE: Valves shall be insulated only in line steam and steam traced lines, and where indicated in the Line Table



Over insulation apply a ¼" thick coat of hard finish cement and weatherproof with Seal Perm. On sizes 2" & larger reinforce the weatherproofing with a layer of reinforcing membrane.

TYPICAL VALVE INSULATION

NOT SERVICE

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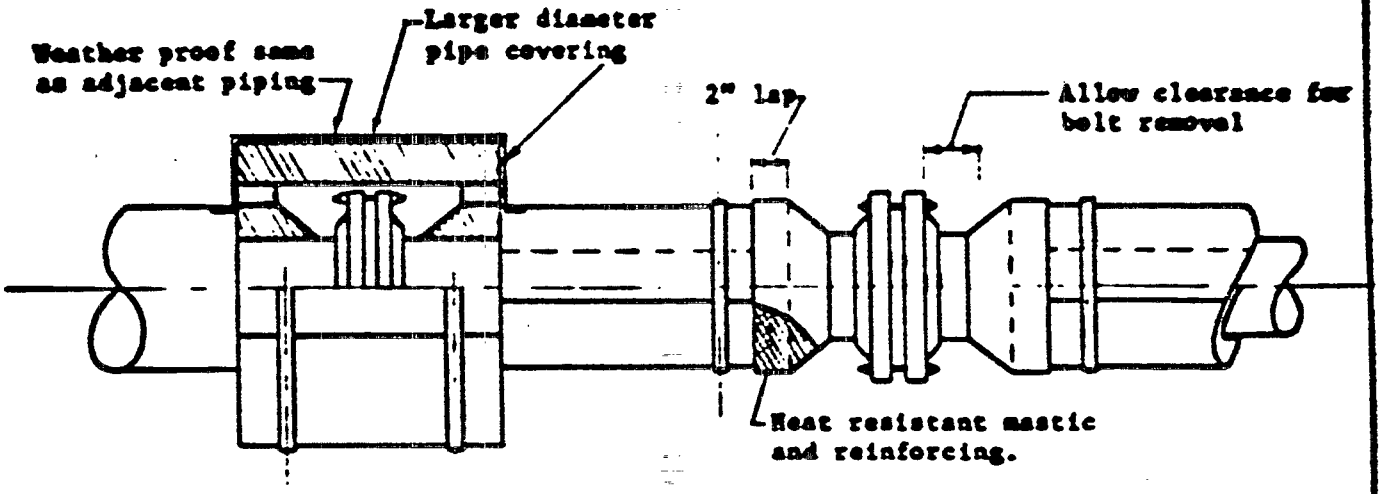
NOTE: Flanges are not to be insulated except in live steam and steam traced lines and where indicated in the Line Table.



INSULATED FLANGES

UNINSULATED FLANGES

For piping insulation, wire, jacket, etc., see piping insulation details.

INSULATION DETAILS
FLANGES
HOT SERVICE

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[illegible]	[illegible]	[illegible]	[illegible]	WEK

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CAMBRIDGE 42, MASS.

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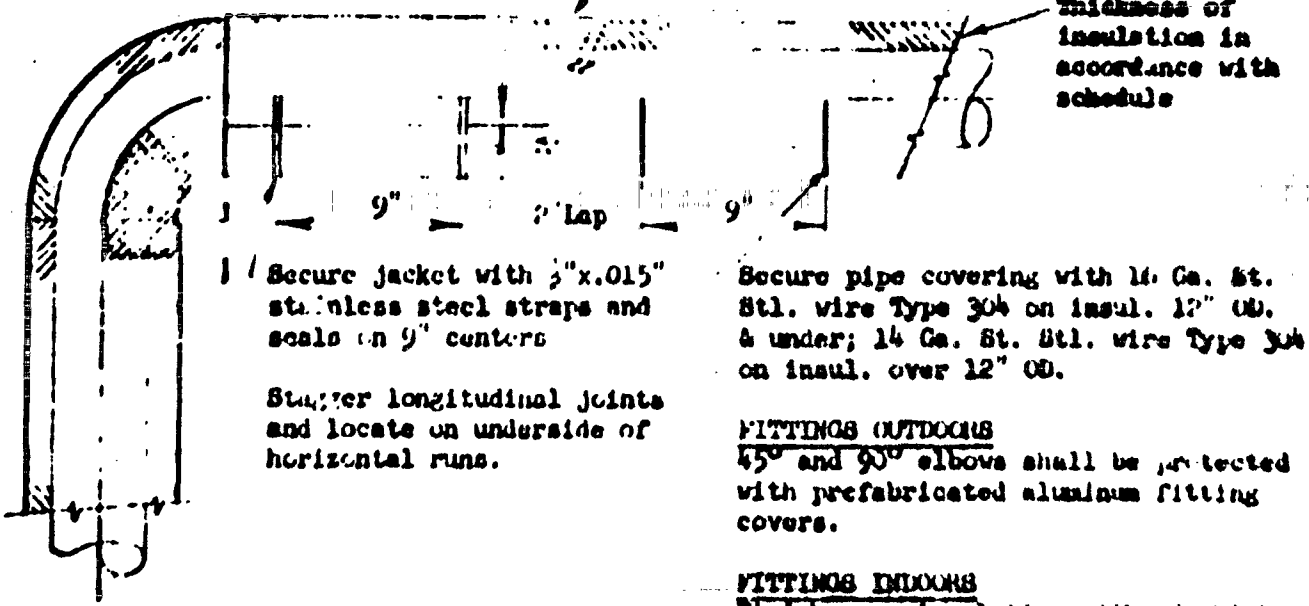
On fittings 4" and larger use molded pipe covering cut to fit of proper thickness.

On fittings under 4" build up with insulating cement to proper thickness.

Prefabricated fitting covers are acceptable for all sizes.

PIPE INDOORS
Where factory applied canvas is not furnished apply 6 oz. canvas lapped 3" each way and secured with lagging adhesive

* PIPE OUTDOORS (To Battery Limits)
Jacket straight pipe insulation with .016" corrugated aluminum sheet with moisture barrier attached. All laps to be at least 2".



Secure jacket with ½"x.015" stainless steel straps and seals on 9" centers

Stagger longitudinal joints and locate on underside of horizontal runs.

Secure pipe covering with 16 Ga. St. Stl. wire Type 304 on insul. 12" OD. & under; 14 Ga. St. Stl. wire Type 304 on insul. over 12" OD.

FITTINGS OUTDOORS
45° and 90° elbows shall be protected with prefabricated aluminum fitting covers.

FITTINGS INDOORS
Finish over insulation with ½" thick insul. cement hardened with Portland Cement. Trowel smooth.

* Off Battery Limits insulated piping shall be jacketed with 45 pound asbestos roofing felt.

TYPICAL PIPING INSULATION

HOT SERVICE

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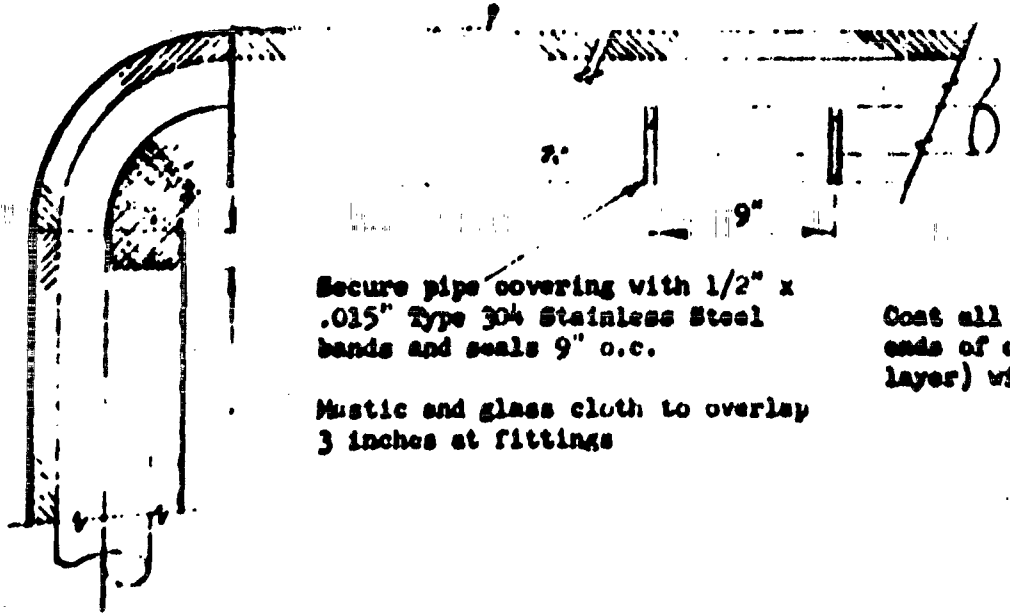
16728

Insulation contractor shall remove oil, grease, dirt, moisture and other contaminants from surfaces before applying insulation.

* Insulation for fittings, valves, flanges etc., shall be prefabricated using same material and thickness as adjacent piping.

Install fitting covers before pipe insulation. Seal joints with Seal Kote Joint Sealer.

Over insulation apply a 1/16" thick (wet) coat of Seal Kote Vapor Barrier. While still wet imbed spirally wound reinforcing membrane with not less than 3" overlap at all seams. Remove all wrinkles and air bubbles. Immediately spray or brush over the membrane a second coat, 1/8" thick (wet) of Seal Kote Vapor Barrier. Finish shall present a smooth uniform surface, completely hiding the glass cloth.



Secure pipe covering with 1/2" x .015" Type 304 Stainless Steel bands and seals 9" o.c.

Mastic and glass cloth to overlap 3 inches at fittings

Coat all butt edges and ends of outer layer (or single layer) with joint sealer.

* Fabrication shall be in accordance with FOAMGLAS Fitting Fabrication Manual.

TYPICAL PIPING INSULATION

COLD SERVICE

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HOT PIPING INSULATION

THICKNESS IN INCHES

Temperature Range °F.	151 to 450	451 to 600	601 to 750	751 to 900	901 to 1050	1051 to 1200
1" & Under	1"	1"	1½"	2"	2"	2½"
1¼"	1"	1½"	1½"	2"	2"	2½"
2"	1"	1½"	1½"	2"	2½"	2½"
3"	1"	1½"	1½"	2"	2½"	3"
4"	1½"	1½"	2"	2"	2½"	3"
6"	1½"	2"	2"	2½"	3"	3"
8"	1½"	2"	2"	2½"	3"	3½"
10"	1½"	2"	2½"	2½"	3"	3½"
12"	1½"	2"	2½"	2½"	3"	3½"
14"	1½"	2"	2½"	2½"	3"	3½"
16"	1½"	2"	2½"	3"	3"	3½"
18"	1½	2"	2½"	3"	3"	3½"
20"	1½"	2"	2½"	3"	3"	3½"
24"	1½"	2"	2½"	3"	3"	4"

Over 24" as specified in Line Table

SINGLE LAYER | DOUBLE LAYER

HOT VESSEL & EQUIPMENT INSULATION

Temperature Range	200 & Below	201 300	301 400	401 500	501 600	601 900	901 1000	1001 1100	1101 1200
Thickness Single Layer	1"	1½"	2"	2½"	3"				
Thickness Double Layer						3"	3½"	4"	4½"

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Pipe Size	Nominal Formation Thickness 1"	1½"	2"	2½"	3"	3½"	4"	4½"	5"	5½"	6"	6½"	7"	7½"	8"
½"	45	10	-25	-45	-95	-140	-275	-300	-335						
¾"	50	25	-10	-25	-70	-135	-225	-255	-300						
1"	50	25	-10	-25	-70	-130	-180	-235	-300						
1½"	50	30	15	-15	-45	-100	-120	-185	-235						
2"	50	30	15	-15	-45	- 90	-120	-175	-225	-290					
3"	50	30	15	-10	-35	- 60	-105	-135	-175	-235	-290				
4"	50	30	20	0	-30	- 55	- 85	-135	-160	-205	-255	-300			
6"	50	41	26	0	-25	- 45	- 70	-105	-125	-160	-195	-200	-290		
8"		41	26	0	-15	- 35	- 60	- 85	-115	-145	-175	-215	-255	-295	
10"		41	26	10	-10	- 25	- 50	- 70	-105	-125	-150	-185	-225	-265	-300
12"		41	26	15	- 5	- 25	- 45	- 65	- 95	-115	-140	-170	-205	-245	-285
14"		41	26	15	0	- 25	- 40	- 55	- 80	-105	-130	-160	-190	-225	-260
16"		41	26	20	0	- 25	- 35	- 55	- 75	-105	-125	-150	-180	-210	-250
18"		41	26	20	0	- 25	- 35	- 50	- 70	-105	-115	-140	-175	-200	-235
20"		41	26	20	0	- 25	- 35	- 45	- 65	- 95	-110	-135	-165	-190	-225
24"		41	26	20	0	- 25	- 35	- 45	- 65	- 85	-105	-130	-155	-180	-205
30"		41	26	20	5	- 10	- 25	- 40	- 60	- 75	-105	-120	-140	-170	-190
36"		41	26	20	10	- 5	- 25	- 40	- 55	- 75	-105	-115	-135	-160	-185
Vessel O.D.															
48"		41	26	20	10	-5	-20	-35	-50	-70	-90	-110	-125	-145	-170
60"		41	26	20	10	-5	-20	-30	-50	-65	-85	-105	-125	-140	-165
72"		41	26	20	10	0	-15	-30	-50	-65	-80	-105	-115	-135	-155
96"		41	26	20	10	0	-15	-30	-45	-65	-80	-105	-115	-130	-150
120"		41	26	20	10	0	-15	-30	-45	-60	-75	-105	-110	-130	-145
144"		41	26	20	10	0	-15	-30	-45	-60	-75	- 95	-110	-125	-145
Over 144" Dia:	ca	41	26	20	15	0	-10	-25	-40	-55	-65	- 80	-105	-115	-130

SINGLE LAYER

MULTIPLE LAYER

Figures in table are Degrees Fahrenheit and are minimum temperatures for thickness stated.

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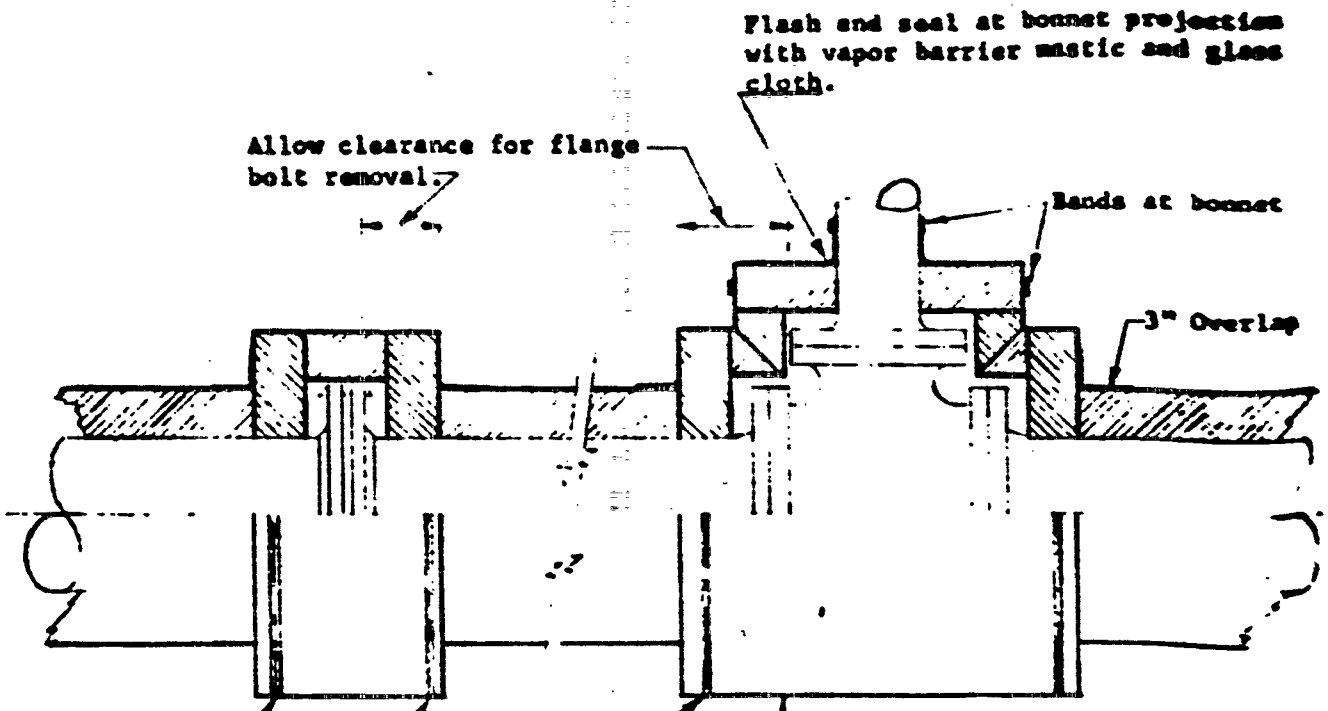
Insulation for Fittings, Valves, Flanges, etc., shall be prefabricated using same material and thickness as adjacent piping. Fabrication shall be in accordance with Foamglas Fitting Fabrication Manual.

Install covers before pipe insulation.

Seal joints with joint sealer.



INSULATION DETAILS
VALVES AND FLANGES
COLD SERVICE

MONSANTO CHEMICAL COMPANY
CHOCOLATE BAYOU, TEXAS

6113
16732

EQUIPMENT SCHEDULE

Item	MCC No.	Dwg. No.	No. Req.	Insul. Thick.	Dimensions A	B	C
AS-101	30Q1	11A	1	1½" Prot.	For Dimensions see Sheet 34		
AS-102	30D1	12A	1	1½"	4'0½"	40'0"	12"
AS-103	30D2	13A	1	1½" FG	12'1"	110'0"	3'0"
AS-104	30D3	14A	1	1½"	For Dimensions see Sheet 32		
AS-105	30D4	15A	1	1½"	9'7"	127'2"	2'6"
AS-106	30D5	16A	1	1"	4'7½"	80'6"	13"
AS-107	30D6	17A	1	1"	5'7"	103'0"	17"
AS-108	30D7	18A	1	1"	7'1"	88'6"	1'9"
AS-109	30D8	19A	1	1½"	3'0-5/8"	46'6"	9"
* MR-101 A thru F	30R1 Thru-R6	41A	6	3" (2-Layers)	12'1½"	49'0"	6'1"
MS-102A&B	30T1&2	42A	2	1½" Prot.	For Dimensions see Sheet 3[illegible]		
MS-103	30S1	43A	1	2½"	9'3-5/8"	25'0"	2'3"
MS-105 Stm.Traced	30T4	45A	1	2"	6'0"	6'0"	-
MS-112 Stm.Traced	30T6	45A	1	2"	6'0"	6'0"	-
MS-126	30T20	49A	1	1" FG	4'6"	6'0"	-
MS-127	30S7	67A	1	1½" Prot.	2'6"	4'0"	5"
MF-128	30T13	68A	1	1½" FG	12'0"	20'0"	12"
MS-129	30S8	69A	1	1½" Prot.	4'6"	11'0"	10"
MS-131	30S15	76A	1	1½" FG	5'2"	21'0"	15"
MS-132	30S16	75A	1	3" FG	5'6"	6'0"	11"
MS-133,134 & 135	30T22, T23,T24	52A	3	1½"Prot.	2'0"	2'10"	4"
MS-136	30S17	77A	1	1½" FG	3'1-1/8"	4'0"	9"
MS-137	30S20	79A	1	1½" Prot.	2'6-5/8"	8'0"	7½"
MS-139	30T28	81A	1	2" FG	5'1-1/4"	19'0"	15"
MS-140	30T29	81A	1	1½" FG	5'1-1/4"	19'0"	15"
MS-303	30T1	71A	1	1"	3'0"	6'6"	6"
MS-304	30S12	72A	1	1½" Prot.	For Dimensions see Sheet		
MF-405	320T305	66A	1	1½" FG	For Dimensions see Sheet		
MS-411	320S302	46A	1	1½" FG	2'-6'5/8"	4'0"	5"

* = Allow for circumferential expansion. See Sheet 8.

FG = Foamglas

CENTRAL FILE

MONSANTO CHEMICAL COMPANY
CHOCOLATE BAYOU TEXAS

THE BADGER COMPANY, Inc.
CAMBRIDGE 42, MASS.

Sheet 34

Minor Revisions
Added & Certified

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EQUIPMENT SCHEDULE

Item	MCC No.	Dwg. No.	No. Req'd.	Insul. Thick.	Dimens A	B	C
TT-101A-F	30E1-1-6	D'Town EN-950	6	3" (2-Layers)	For Dimensions see Sh		
TT-102A-F	30E2-1-6	D'Town EN-950	6	2½"	For Dimensions see Sh		
TT-106	30E6	H/T 1333	1	2" FG	45½"	25'2"	2
TT-107	30E7	H/T 1334	1	2" FG	44½"	25'2"	2
TT-108A&B	30E8-1&2	H/T 1335A&B	2	2" FG	38"	18'4"	3
TT-112A&B	30E11-1&2	H/T 1338A&B	2	1½"	27"	20'7"	2
TT-114	30E12	H/T 1340	1	2"	14"	17'7"	2
TT-119	30E16	D'Town EN-943	1	2"	49"	8'0"	24
TT-120	30E17	EFCO 12951	1	1½" FG	28-3/4"	12'0"	23
TT-121	30E18	H/T 1342	1	1½" FG	20"	16'4"	24
TT-123	30E20	D'Town EN-944	1	1½" FG	18"	4'0"	10
TT-124	30E21	D'Town EN-945	1	2"	49"	12'0"	2
TT-126A&B	30E23-1&2	D'Town EN-946	2	2"	49"	12'0"	3'
TT-128	30E25	D'Town EN-947	1	1½" FG	16"	4'0"	6'
TT-139A&B	30E37-1&2	H/T 1345A&B	2	2½" FG	60½"	25'6"	2'

CENTRAL FILE

V 10/14/64 Minor Revisions
IV 7/14/64 Added & Certified

MONSANTO CHEMICAL COMPANY
CHOCOLATE BAYOU TEXAS

THE BADGER COMPANY, Inc.
CAMBRIDGE 42, MASS.

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LIST OF MANHOLES AND STIFFENER RINGS

	No. Req'd.	Manholes	Stiffener Rings	Insulation
)1	1	1-24" 150 Lb.	4-6x3½x3/8"	-
		2-18" 150 Lb.		
)1	1	3-18" 150 Lb.	4-3x2½x5/16"	-
)2	1	8-18" 150 Lb.	7-5x3x7/16"	1½" Foamglas
)3	1	8-18" 150 Lb.	4-3½x2½x3/8"	-
			6-5x3x5/16"	-
)4	1	7-18" 150 Lb.	10-4x3x3/8"	-
)5	1	6-18" 150 Lb.	-	-
)6	1	6-18" 150 Lb.	3-4x4x5/16"	-
			10-3x3x3/8"	-
)7	1	6-18" 150 Lb.	10-4x4x3/8"	-
)8	1	3-18" 150 Lb.	3-2½x2½x¼"	-
)9	6	2-24" 150 Lb.	2-6x1¼"	2" Kaylo
		1-48" 175 Lb.	-	2" Kaylo
1-1,2	2	2-18" 150 Lb.	4-6x4x3/4"	-
1	1	1-24" 300 Lb.	-	-
7	1	1-18" 150 Lb.	-	-
13	1	2-20" Special	-	1½" Foamglas
8	1	1-18" 150 Lb.	-	-
15	1	1-18" 150 Lb.	-	1½" Foamglas
16	1	1-18" 150 Lb.	-	3" Foamglas
17	1	1-18" 300 Lb.	-	1½" Foamglas
20	1	1-18" 150 Lb.	1-3/8x2"	-
28	1	1-18" 300 Lb.	-	2" Foamglas
29	1	1-18" 300 Lb.	-	1½" Foamglas
16	1	1-18" 150 Lb.	-	-
lo	1	1-18" 300 Lb.	-	2" Foamglas
7	1	1-18" 300 Lb.	-	2" Foamglas
37-1,2	2	1-18" 300 Lb.	-	2½" Foamglas
20T305	1	2-20" 300 Lb.	-	1½" Foamglas
: Sec :	1	1-18" 150 Lb.	-	1½" Foamglas

101A-F shall be insulated with removable metal jacketed (20 Ga. Type 304) covers. Covers shall be readily removable and replaceable.
on MR-101A-F and AS-103 shall be insulated & weatherproofed. Other stiffener be insulated but shall be boxed in with aluminum.
mglas insulated vessels shall be insulated as described on application sketches.

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PUMP SCHEDULE

Item	MCC No.	No. Req.	Type & Size	Insul. Thick.	Manufacturer
PP-102A,B,C	P1-1-3	3	Centrifugal 12 x 17 HVC	1½" Prot.	Pacific Pumps
* PP-106A&B	P3-1&2	2	Centrifugal 1½ x 1 x 6/46	1½"	Duriron Co.
PP-114A&B	P11-1&2	2	Centrifugal 8 x 10 x 20 PR	1½" PC	Peerless Pump
* PP-119	P16	1	Centrifugal 1½ x 1 x 6/44	1½"	Duriron Co.
PP-141A&B	P35-1&2	2	Centrifugal 10 x 17 DS	1½" PC	Pacific Pumps
PP-147	P40	1	Centrifugal 1½ x 1 x 6/43	1½" PC	Duriron Co.
PP-408A&B	320P308-1&2	2	Centrifugal	2½" PC	

* = Steam Traced

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LEVEL GAUGES

	No. Req.	Location	MCC No.		Type	Dim. "A"	Insul. Thick.	Remarks
4	3	MS-103	30S1		T	57"	2½"	For details
4	1	MS-103	30S1		T	42-7/8"	2½"	see Sheet 43
7	1	MS-105	30T4		R	57"	2"	
16	1	AS-102	30D1		R	42-7/8"	1½"	
20	1	AS-103	30D2	(Bot.)	R	42-7/8"	1½" FG	
22	1	AS-103	30D2	(Top)	R	28-3/4"	1½" FG	
28	2	AS-104	30D3		R	42-7/8"	1½"	
35	2	AS-105	30D4		R	57"	1½"	
39	1	AS-106	30D5		R	42-7/8"	1½"	
46	1	AS-107	30D6		R	42-7/8"	1½"	
50	1	AS-108	30D7		R	42-7/8"	1½"	
54	1	AS-109	30D8		R	42-7/8"	1½"	
63	1	MS-126	30T20		R	57"	1½" FG	
66	1	MS-133	30T22		T	28-3/4"	1½"	
67	1	MS-134	30T23		T	28-3/4"	1½"	
68	1	MS-135	30T24		T	28-3/4"	1½"	
74	1	MS-132	30S16		R	42-7/8"	1½" FG	
75	1	MS-136	30S17		R	28-3/4"	1½" FG	
79	3	MS-131	30S15		R	57"	1½" FG	
28	1	AS-104	30D3		R	57"	1½"	

LEVEL CONTROLLERS

LC-9	1	AS-101	30Q1			38"	1½"	For details
LC-15	1	AS-102	30D1			38"	1½"	see Sheet 44
LC-19	1	AS-103	30D2			38"	1½" FG	
LC-21	1	AS-103	30D2			20"	1½" FG	
LC-27	1	AS-104	30D3			126"	1½"	
LC-34	1	AS-105	30D4			102"	1½"	
LC-38	1	AS-106	30D5			38"	1½"	
LC-45	1	AS-107	30D6			38"	1½"	
LC-49	1	AS-108	30D7			38"	1½"	
LC-53	1	AS-109	30D8			38"	1½"	
LC-62	1	MS-133	30T22			20"	1½"	
LC-64	1	MS-134	30T23			20"	1½"	
LC-65	1	MS-135	30T24			20"	1½"	
LC-78	1	MS-131	30S15			138"	1½" FG	
LC-83	1	MS-[illegible]	30S12			[illegible]"	1½"	

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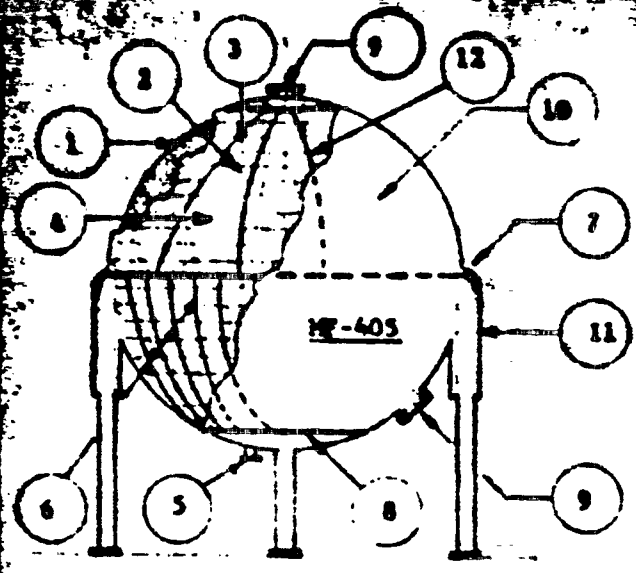
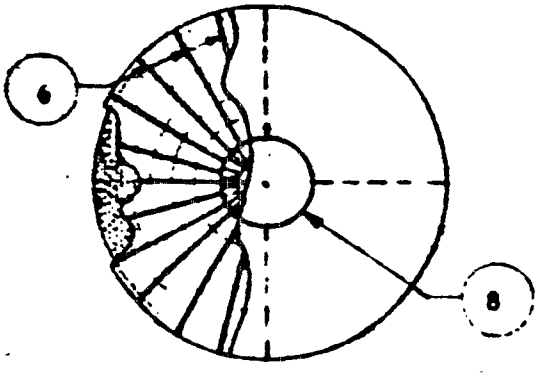


ELEVATION



BOTTOM VIEW

54'-9" I.D. SPHERE

1. Surfaces to be insulated shall be clean, dry, free from frost, rust, etc.
2. Coat all butt edges and ends of Foamglas blocks with joint sealer.
3. Cement blocks to surfaces of sphere with a coating of low temp. adhesive.
4. Use staggered joint construction. Fill minor voids with caulking mastic.
5. Nozzles shall be insulated per piping insulation schedule.
6. 3/4" x .020" stainless steel straps and seals spaced 2'-0" apart around support ring at equator and attached to 8'-0" diameter floating ring at bottom of sphere.
7. For detail at support ring see Sheet 42
8. 8'-0" diameter floating ring of 1/2" stainless steel rod. Support insulation within ring by criss-crossing 3/4 x .020" bands.
9. Manholes shall be insulated with prefabricated cover, so installed that it is removable and replaceable with minimum damage to the insulation.
10. Apply a 1/16" thick (wet) coat of Seal Kote over the insulation. While still wet wipe in a layer of reinforcing membrane with not less than 3" overlap at all seams. Remove all wrinkles and air bubbles. Immediately spray or brush over the membrane a second coat, 1/8" thick (wet), of Seal Kote. Finish shall present a smooth, unbroken surface and completely hide the glass cloth.
11. For insulation of supports see Sheet 42
12. 3/4" x .020" stainless steel straps and seals spaced not more than 6'-0" apart at equator and attached to floating ring at top of sphere.

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MONSANTO CHEMICAL COMPANY
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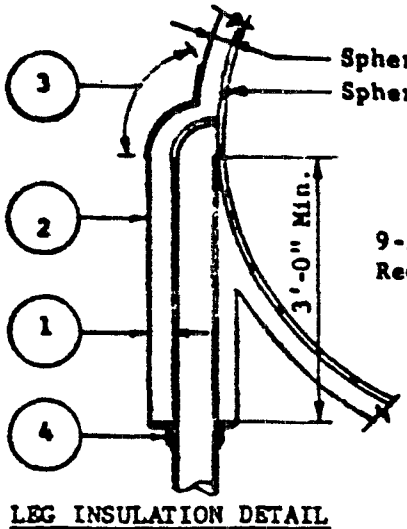
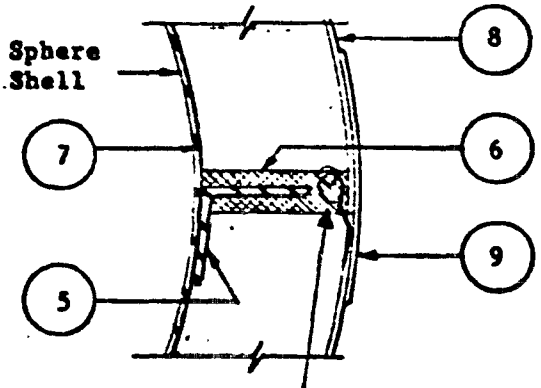
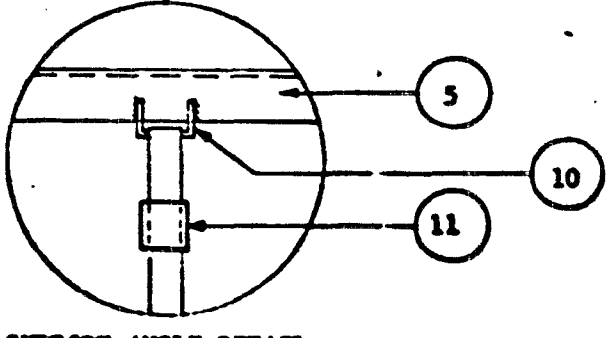
THE BADGER COMPANY, Inc.

INSULATION DETAILS
AMMONIA STORAGE TANK - COLD SERVICE
MF-405



LEG INSULATION DETAIL





SUPPORT ANGLE DETAIL

1. Leg insulation same thickness as on shell.
2. Seal Kote and membrane finish as specified for sphere.
3. Additional layer of finish.
4. Flash finish to angle ring supports. Supports by sphere erectors.
5. 1" x 1" x 1/4" angle ring at equator by sphere erectors.
6. Expansion joint to be packed with resilient glass fiber fill.
7. Low temp. adhesive.
8. Finish as specified.
9. Additional layer of finish, 12" minimum width.
10. 1/4" steel bars welded to angle by insulation contractor to attach insulation straps.
11. 3/4" x .020" stainless steel straps and seals.

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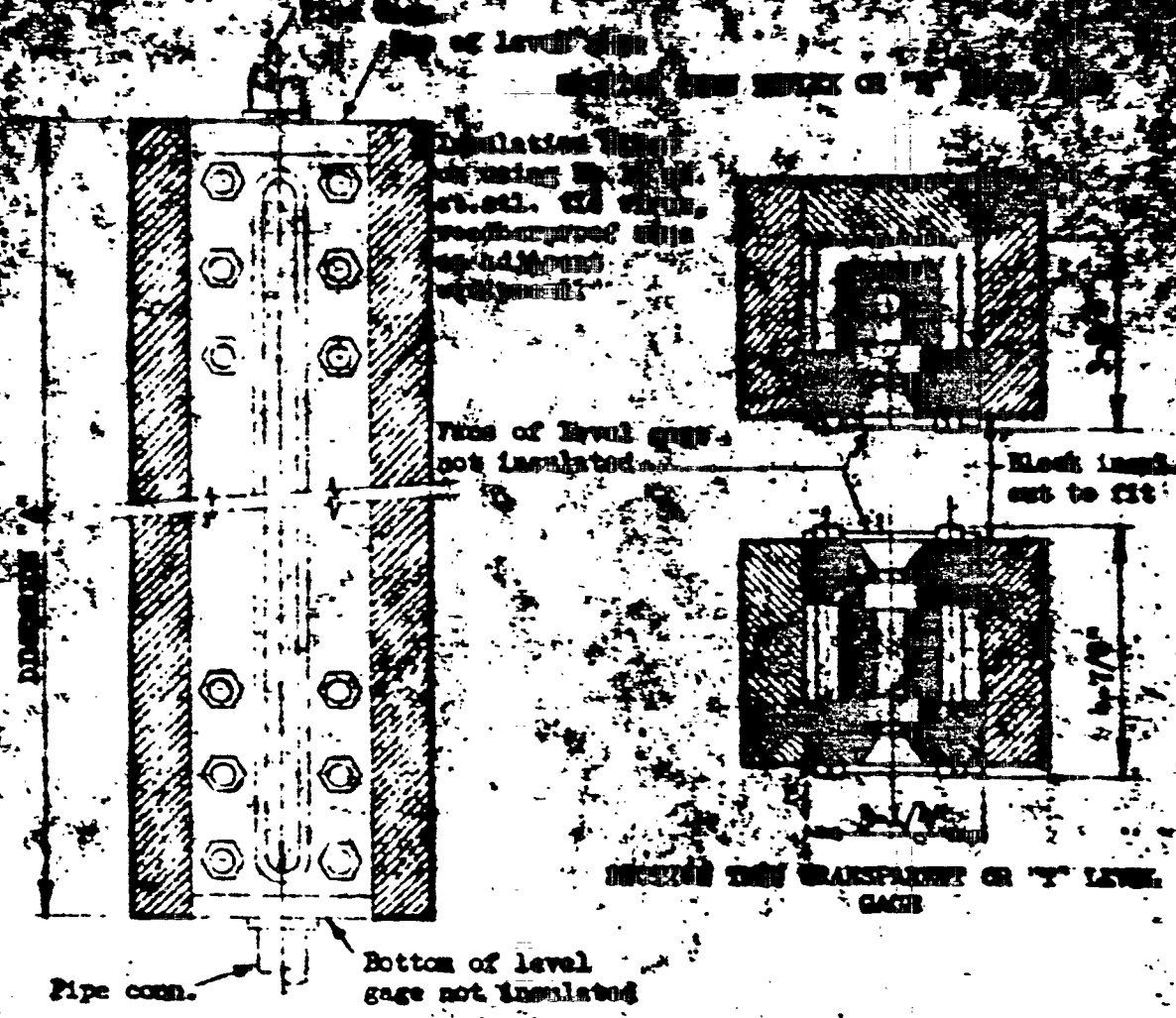
		Added No. & Size of Legs		
		Added & Certified		



INSULATION DETAIL FOR LEVEL GAGES

Piping between level gage and vessel shall be insulated.

For piping to level gages see piping drawings.

For schedule of level gages see Sheet [illegible].

Level gages [illegible] specified [illegible] by including [illegible] connecting piping. Cut a [illegible] insulated [illegible]

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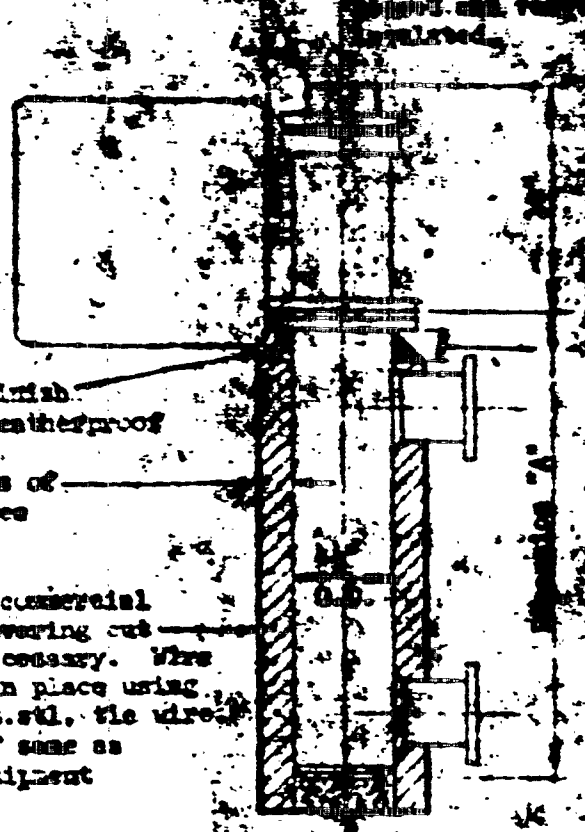

Piping between level controller and vessel shall be insulated.

For piping connections see piping drawings.

INSULATION DETAILS

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PIPING INSULATION DESIGNATION TABLE

NOTES

1. "Pipe Line No." specifies lines to be insulated. All branches and smaller or larger sections shall be insulated. This includes all fittings, strainers, separators, expansion joints, etc., in these lines. It also includes valves and flanges in steam and steam traced lines, in low temperature lines and where required for personnel protection. See note below.

2. Abbreviations in this table are as follows:

   "Prot." = Insulation only where required for personnel protection. (where less than 7 feet above or 3 feet from the edge of a platform or walkway.)
   "IPS" = Iron Pipe Size
   "STM" = Steam
   "ST" = Steam Traced
   "FG" = Foamglas

VI 3. For steam tracing details see SPF76-C06 and piping drawings.

4. Sub-contractor shall provide suitable expansion joints in the insulation and weatherproofing of hot pipe and fittings to allow for linear and circumferential expansion where warranted by the operating temperature.

NOTE:
No. GY-104 (Z2) silencer in Line P-3 shall be insulated with J-M No. 102 Banroc blanket, or approved equal, and weatherproofed with .016" thick aluminum jacketing. Silencer is 6'-0" diameter by 13'-6" B.L. to B.L. with elliptical heads and 30" flanged connections. Insulate approximately 3'-C" long top connection and 6'-0" long bottom connection. For details see Piping Dwg. No. P76-214F.

CENTRAL FILE

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VI · Added new PARA. 3