PLAINTIFF'S
EXHIBIT
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NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

AND

E. I. DU PONT DE NEMOURS AND COMPANY

CONFERENCE ON THERMAL INSULATING MATERIAL (INCLUDING ASBESTOS)

MAY 29-30, 1974

COURSE LOCATION:
Holiday Inn North #1
4000 Concord Pike, Wilmington, Delaware

COURSE DIRECTOR:
Robert B. Weidner
(513) 684-3254

DAY AND TIME	SUBJECT	SPEAKER
WEDNESDAY, MAY 29, 1974		
8:30 - 9:00	Introduction	J. Zapp, Jr. - Du Pont J. Morgan - Du Pont R. Weidner - NIOSH
9:00 - 10:30	Statistics of Sampling	K. Busch - NIOSH
10:30 - 10:45	Non-Asbestos Thermal Insulating Materials	G. Lang, III - Du Pont
10:45 - 12:00	Particulates (Including Nuisance Dusts, Asbestos, and Non-Asbestos Thermal Insulating Materials)	J. Ferguson - NIOSH
12:00 - 1:00	Lunch	
1:00 - 2:00	Particulate Sampling Equipment	J. Ferguson - NIOSH
2:00 - 3:00	Fibrous Glass Dust	J. Lynch - NIOSH
3:00 - 4:00	Respiratory Protective Devices	J. Lynch - NIOSH
4:00	Panel Discussion	NIOSH Personnel and F. Fuller - Du Pont G. Lang, III - Du Pont J. Morgan - Du Pont
THURSDAY, MAY 30, 1974		
8:30 - 9:30	OSHA Standards on Asbestos	R. Weidner - NIOSH
9:30 - 10:30	OSHA-NIOSH Liaison and Accreditation of Industrial Hygiene Laboratories	R. Weidner - NIOSH
10:30	Panel Discussion - Du Pont Personnel Only	T. Nelson R. Hubiak F. Fuller G. Lang, III J. Morgan

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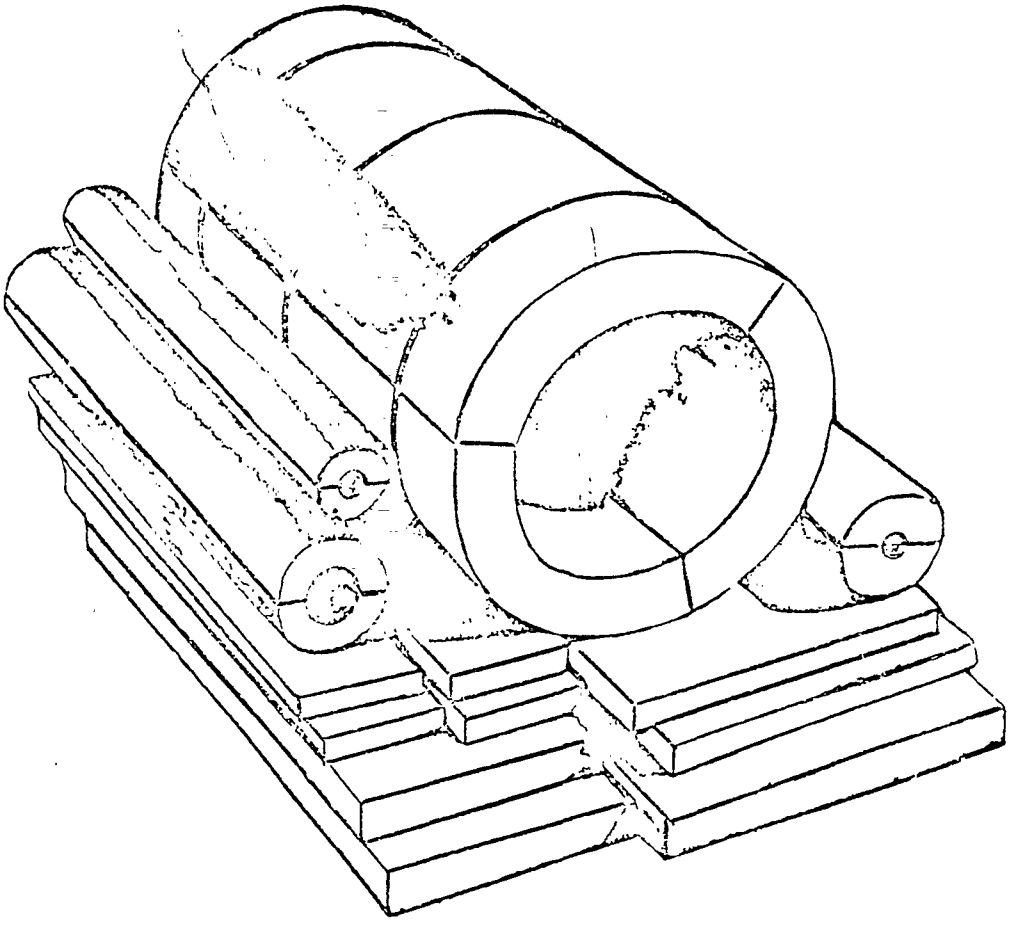
LESSON TEXT

TOPIC: THERMAL INSULATION MATERIALS



GOALS

A. Mechanic Must Learn:

1. Why insulation is used.
2. Common materials used as insulation.
3. Factors on which to base insulation selection.

B. Mechanic Must Develop These Skills:

1. Identifying insulation materials.
2. Selecting insulation materials.

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Why Insulation is Used

Insulation may be defined as the process of applying a material to a surface to prevent or slow down the flow of heat through that surface.

Pipe and equipment are insulated for one or more of the following reasons:

1. To prevent heat loss from lines or equipment.
   Example: steamlines

2. To more accurately control process temperatures.
   Example: C.P. process equipment

3. To prevent heat entrance into cold rooms, lines or equipment.
   Example: chilled water lines

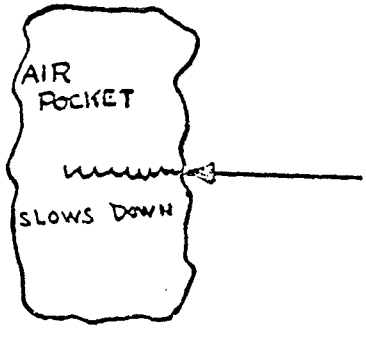
4. To minimize exposure of personnel to burns resulting from contact with high temperature lines.

5. To prevent condensation from forming on cold lines or equipment.
   Example: domestic water lines

How Insulation Works

It is a commonly known factor that heat naturally flows from a hot place to a cooler one. Heat flows by a combination of three different methods: radiation, conduction, and convection.

Insulation works because air is a poor conductor of heat. Whenever heat hits air, the heat slows down.



On this premise the material used for insulation is made with many small air pockets which prevents the heat from flowing.

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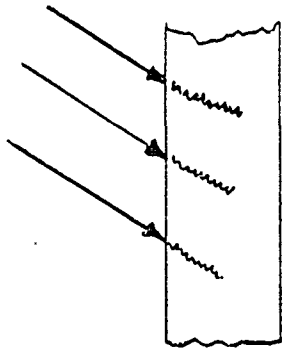
The measure of the flow of heat through a material is the "Coefficient of Thermal Conductivity". In insulation practice this measure is more often referred to as the "K" factor. The greater the heat flow, the higher the "K" factor will be. A material with a low "K" factor is a good insulating material.

Below is a list of some of the more common insulating materials used by Du Pont along with their corresponding "K" factors:

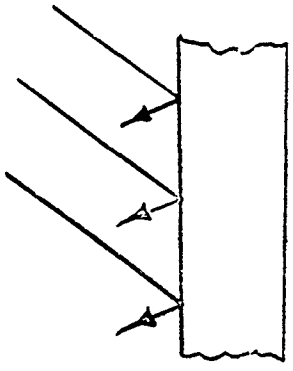
Calcium Silicate	0.40
Cellular Glass	0.41
Glass Fiber	0.25
85% Magnesia	0.36
Orethane Foam (Ridged)	0.18
Vegetable Cork	0.29

Color is also used for insulation -

Dark surfaces absorb heat



Light surfaces reflect heat



Forms of Insulation

There are many different insulation materials on the market today. They are manufactured in various forms to suit special needs. The most common forms are:

1. Preformed Block and Pipe Insulation

   Insulation is supplied in block form; blocks are easy to apply and are particularly suited for plane or large radius curved surfaces. Pipe insulation is manufactured in various thicknesses for the different pipe sizes.

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2. Blanket and Batt Insulation

Blanket and batt insulation is supplied in rolls or large rectangular shapes. They are easily applied to large plane or curved surfaces, are not subject to breakage in handling, and can be cut on the job to fit around obstructions and irregular equipment.

3. Loose Fill Insulation

Loose fill insulation consists of small particles of the insulation material and is usually supplied in bags for hand pouring into partitions, over horizontal surfaces, and into recesses and voids.

4. Fluid or Plastic Insulation

These insulations are supplied in the fluid or plastic state and can either be sprayed or hand applied.

5. Finish Coatings and Coverings

These materials are applied over insulations to protect them from exposure to weather, chemicals, mechanical shock, abrasion, etc.

Insulation Materials

A complete list of all insulation materials is beyond the scope of this lesson; only the principal materials used by Du Pont will be described.

1. 85% Magnesia

85% magnesia has been for many years the standard molded insulation for temperatures between 70°F. and 500°F.

It is available in blocks up to 4 inches x 12 inches x 36 inches size, and as pipe insulation in sections 3 feet long and up to 3 inches thick. For 12-inch pipe and over, the insulation is furnished in segments cut from 4-inch thick block.

85% magnesia shall not be used on stainless steel - if it gets wet, soluble chlorides may leach out and concentrate on the surface of stainless steel causing stress corrosion cracking.

It also shall not be used on aluminum because of corrosive effects.

85% magnesia must be protected from water and other liquids.

2. Calcium Silicate

Calcium silicate is useful for temperatures between 70°F. and 1200°F. It is light weight material of a cellular fine clay base with good mechanical and insulating properties.

Molded blocks are available in sizes 36 inches long x 6 inches wide and thicknesses up to 3 inches. Pipe coverings are available in sections 3 feet long and with nominal thicknesses of 1, 1-1/2, and 2 inches for standard pipe sizes up to 17 inches in diameter. Two layers of standard pipe covering can be applied to obtain thicknesses of 3 and 4 inches on pipe sizes up to 12 inches in diameter.

3. Glass Wool (Fiberglas)

Glass wool is furnished either bonded or plain in batt or blanket form. With a resin binder, it is applicable in the temperature range from 110°F. to 400°F. Pure glass wool batts or rolls with no binder are applicable up to 1100°F.

This is a good temporary insulation for use at moderately hot temperature because it can be quickly applied.

4. Cellular Glass (Foamglas)

Cellular glass is a rigid light weight block of glass so fused that it contains countless sealed cells. This cellular construction of glass provides its unique resistance to moisture, vapor and acid atmospheres, fire and vermin. When properly used, it is unusually free from costly maintenance requirements. Its primary use is in the low temperature range, between minus 180°F. and 150°F.

It is available in block form in sizes up to 12 inches x 18 inches x 5 inches thick, as curved segments up to 4 inches thick for vessels over 12 inches in diameter, and as pipe coverings up to 6 inches thick (by using multiple layers) for pipe sizes up to 36 inches in diameter.

5. Urethane Foam Insulation (Isofoam, Polyurethane Foam)

Foam insulation is available in the liquid state, and when the two components are mixed, expand about 30 fold. Resulant foam has excellent physical properties and good insulation efficiency. It is applicable in the temperature range of minus 200°F. to 212°F. A form is necessary around the equipment to be insulated in order to contain the foam as it expands.

Urethane foam insulation is available in ridged form for pipe covering.

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6. Vegetable Cork

Vegetable cork is available in sectional and segmental pipe covering, blocks and in board form. This material is normally used on cold surfaces operating from -180°F. to 100°F.

7. Diatomaceous Earth

Diatomaceous earth insulation is normally used on hot surfaces operating from 500°F. to 1300°F. as the inner layer of double-layer application in combination with 85% magnesia, or calcium silicate. It is available in sectional and segmental pipe covering and in blocks.

8. Others

See Standard Engineering Specifications - Thermal Insulation.

Selection of Material

Of course, no one insulation is best for all purposes. Such things as -

- temperature
- type of surface
- weather exposure
- shock and wear exposure
- shape of surface
- cost of insulation

- are all considered when an insulating material is selected.

The following pages, Standard Engineering Specification SN1D present recommended insulation materials for piping and equipment.

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DESIGN

APPLICATION SELECTION CHART
PIPE AND EQUIPMENT

THERMAL INSULATION
STANDARD ENGINEERING SPECIFICATION

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PIPE

Temp Range °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
-200 to +100	Vegetable Cork	110	SN100.27A Reinforced Mastic	SN100.27A Reinforced Mastic	SN100.06A Reflecting Paint	SN100.27A Reinforced Mastic	SN100.27A Reinforced Mastic	SN100.06A Reflecting Paint
				SN100.31A Mastic	SN100.31A Mastic	SN100.31A Mastic	SN100.31A Mastic	SN100.31A Mastic
	Cellular Glass	111	SN100.23A Reinforced Mastic	SN100.23A Reinforced Mastic	SN100.06A Reflecting Paint	SN100.23A Reinforced Mastic	SN100.23A Reinforced Mastic	SN100.06A Reflecting Paint
				SN100.30A Mastic		SN100.30A Mastic	SN100.30A Mastic	
	Mineral Wool Molded	115			SN100.29A Factory-App Vapor Barrier			SN100.29A Factory-App Vapor Barrier
-200 to +100	Cellular Glass over Asbestos Paper	206 over 724		SN100.36A Reinforced LT Vapor Barrier Mastic			SN100.36A Reinforced LT Vapor Barrier Mastic	
40 to 200	Glass Fiber	112	SN100.34A	SN100.34A	SN100.34A	SN100.33A	SN100.33A	SN100.33A
100 to 350	85% Magnesia	101	SN100.20A Roofing Felt (Factory)	SN100.20A Roofing Felt (Factory)	SN100.20A Roofing Felt (Factory)	SN100.20A Roofing Felt (Factory)	SN100.02A 8-oz Canvas (Factory)	SN100.01A 3.8-oz Canvas (Factory)
			SN100.21A Roofing Felt	SN100.21A Roofing Felt		SN100.21A Roofing Felt	SN100.03A 8-oz Canvas	
						SN100.02A 8-oz Canvas (Factory)	SN100.21A Roofing Felt	
						SN100.03A 8-oz Canvas		
	Calcium Silicate	102	SN100.20A Roofing Felt (Factory)	SN100.20A Roofing Felt (Factory)	SN100.20A Roofing Felt (Factory)	SN100.20A Roofing Felt (Factory)	SN100.02A 8-oz Canvas (Factory)	SN100.01A 3.8-oz Canvas (Factory)
			SN100.21A Roofing Felt	SN100.21A Roofing Felt		SN100.21A Roofing Felt	SN100.03A 8-oz Canvas	
			SN100.25A Aluminum Jacket	SN100.25A Aluminum Jacket		SN100.02A 8-oz Canvas (Factory)	SN100.25A Aluminum Jacket	

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PIPE

emp ange °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
	Calcium Silicate (cont)	102				SN100.03A 8-oz Canvas	SN100.21A Roofing Felt	
						SN100.25A Aluminum Jacket		
00 to 50· cont)	Asbestos and Diatomaceous Earth Molded	106					SN100.05A 8-oz Canvas	SN100.23A Roofing Felt
			SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.26A Aluminum Jacket	
			SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket			SN100.23A Roofing Felt	
						SN100.05A 8-oz Canvas		
						SN100.26A Aluminum Jacket		
	Corrugated Asbestos Preshrunk	109*	SN100.24A Roofing Felt	SN100.24A Roofing Felt	SN100.24A Roofing Felt	SN100.24A Roofing Felt	SN100.01A 3.8-oz Canvas (Factory)	SN100.01A 3.8-oz Canvas (Factory)
500 to 700	Asbestos and Diatomaceous Earth Molded	106	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt
			SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket		SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket	
						SN100.05A 8-oz Canvas	SN100.05A 8-oz Canvas	
	Asbestos Sponge	107	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt
			SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket		SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket	
						SN100.05A 8-oz Canvas	SN100.05A 8-oz Canvas	
	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt
							SN100.04A 8-oz Canvas	

* Temp Limit 400°F

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Temp Range °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
PIPE								
700 to 1200	Calcium Silicate	102	SN100.21A Roofing Felt	SN100.21A Roofing Felt	SN100.21A Roofing Felt	SN100.21A Roofing Felt	SN100.21A Roofing Felt	SN100.21A Roofing Felt
			SN100.25A Aluminum Jacket	SN100.25A Aluminum Jacket		SN100.25A Aluminum Jacket	SN100.25A Aluminum Jacket	
						SN100.03A 8-oz Canvas	SN100.03A 8-oz Canvas	
	Calcium Silicate over Diatomaceous Earth	102 103					SN100.07A 8-oz Field-Applied Canvas	
	Asbestos and Diatomaceous Earth Molded	106	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt	SN100.23A Roofing Felt
			SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket		SN100.26A Aluminum Jacket	SN100.26A Aluminum Jacket	
						SN100.05A 8-oz Canvas	SN100.05A 8-oz Canvas	
	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt	SN100.22A Roofing Felt
							SN100.04A 8-oz Canvas	
EQUIPMENT								
-200 to +100	Vegetable Cork	110	SN100.70A Reinforced Mastic	SN100.70A Reinforced Mastic	SN100.69A Reflecting Paint	SN100.70A Reinforced Mastic	SN100.70A Reinforced Mastic	SN100.69A Reflecting Paint
				SN100.72A Mastic	SN100.72A Mastic	SN100.72A Mastic	SN100.72A Mastic	SN100.72A Mastic
	Cellular Glass	111	SN100.70A Reinforced Mastic	SN100.70A Reinforced Mastic	SN100.69A Reflecting Paint	SN100.70A Reinforced Mastic	SN100.70A Reinforced Mastic	SN100.69A Reflecting Paint
				SN100.72A Mastic	SN100.72A Mastic	SN100.72A Mastic	SN100.72A Mastic	SN100.72A Mastic
	Cellular Glass over Glass Fiber and Asbestos Paper	111 206 724		SN100.65A LT Vapor Barrier Mastic			SN100.65A LT Vapor Barrier Mastic	

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EQUIPMENT

Temp Range °F	Insulation	Code	Outdoor Service			Indoor Service		
			Severe Exposure	Normal Exposure	Temporary Construction	Severe Exposure	Normal Exposure	Temporary Construction
40 to 150	Glass Fiber Board – Factory-Applied Neoprene Finish	112.81					SN100.73A	
	Glass Fiber Board – Factory-Applied Vapor-Barrier Finish	112.71		SN100.79A			SN100.78A	
	Glass Fiber Blanket – Factory-Applied Neoprene Finish	207					SN200.69A	
	Granulated Cork Asphalt Mixture	501		SN500.62A Reflecting Paint			SN500.62A Reflecting Paint	
							SN500.63A No finish	
100 to 250	Foam Blanket	208		SN200.71A HT Breathing Mastic			SN200.71A HT Breathing Mastic	
40 to 350	Plain Glass Fiber Flex Blanket	206					SN200.66A No finish	
	Glass Fiber Flex Blanket Finish as Specified	206					SN200.67A Finish as Specified	
	Glass Fiber Flex Blanket High Temp Breathing Mastic	206		SN200.70A Mastic			SN200.70A Mastic	
100 to 350	85% Magnesia	101	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
							SN100.63A 8-oz Canvas	

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Temp Range °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
100 to 350 (cont)	Calcium Silicate	102	SN100.63A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
			SN100.63A Aluminum Jacket	SN100.63A Aluminum Jacket		SN100.63A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.63.1A AL Jacket with Lead Flashing	SN100.63.1A AL Jacket with Lead Flashing				
	Asbestos and Diatomaceous Earth Molded	106	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.63A Aluminum Jacket	SN100.63A Aluminum Jacket		SN100.63A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.63.1A AL Jacket with Lead Flashing	SN100.63.1A AL Jacket with Lead Flashing				
	Corrugated Asbestos Preshrunk	109*	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
							SN100.63A 8-oz Canvas	
	Glass Fiber	112	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	Mineral Wool	114	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				

* Temp Limit 400°F

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Temp Range °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
350 to 500	85% Magnesia	101	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
							SN100.63A 8-oz Canvas	
	Calcium Silicate	102	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	Asbestos and Diatomaceous Earth Molded	106	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	Mineral Wool	114	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
500 to 700	Calcium Silicate	102	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				

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EQUIPMENT

Temp Range °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
500 to 700 (cont)	Asbestos and Diatomaceous Earth Molded	106	SN100.63A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.63A Aluminum Jacket		SN100.63A Aluminum Jacket	SN100.63A 8-oz Canvas	
	Asbestos Sponge	107	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
							SN100.63A 8-oz Canvas	
	Mineral Wool	114	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
100 to 800	Insulation Cement	502		SN500.61A High Temp Breathing Mastic			SN500.61A High Temp Breathing Mastic	
	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.62A Asbestos Cement	SN100.62A Asbestos Cement
							SN100.60A 8-oz Canvas	
700 to 1200	Calcium Silicate	102	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.61A Asbestos Cement	SN100.61A Asbestos Cement
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	Asbestos and Diatomaceous Earth Molded	106	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				

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Page 8

APPLICATION SELECTION CHART
PIPE AND EQUIPMENT

NOVEMBER 1954

Rev May 1959

112

EQUIPMENT

Temp Range °F	Insulation	Code	Outdoor Service: Severe Exposure	Outdoor Service: Normal Exposure	Outdoor Service: Temporary Construction	Indoor Service: Severe Exposure	Indoor Service: Normal Exposure	Indoor Service: Temporary Construction
700 to 1200 (cont)	Mineral Wool	114	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.62A Asbestos Cement	SN100.62A Asbestos Cement
							SN100.60A 8-oz Canvas	
1200 to 1500	Mineral Wool	114	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.62A Asbestos Cement	SN100.62A Asbestos Cement
							SN100.60A 8-oz Canvas	
1500 to 1700	Mineral Wool	114	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic	SN100.64A Mastic
			SN100.68A Aluminum Jacket	SN100.68A Aluminum Jacket		SN100.68A Aluminum Jacket	SN100.63A 8-oz Canvas	
			SN100.68.1A AL Jacket with Lead Flashing	SN100.68.1A AL Jacket with Lead Flashing				
	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.62A Asbestos Cement	SN100.62A Asbestos Cement
							SN100.60A 8-oz Canvas	
1700 to 1800	85% Magnesia over Diatomaceous Earth	101 and 103	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.71A Mastic	SN100.62A Asbestos Cement	SN100.62A Asbestos Cement
							SN100.60A 8-oz Canvas	

(OVER)

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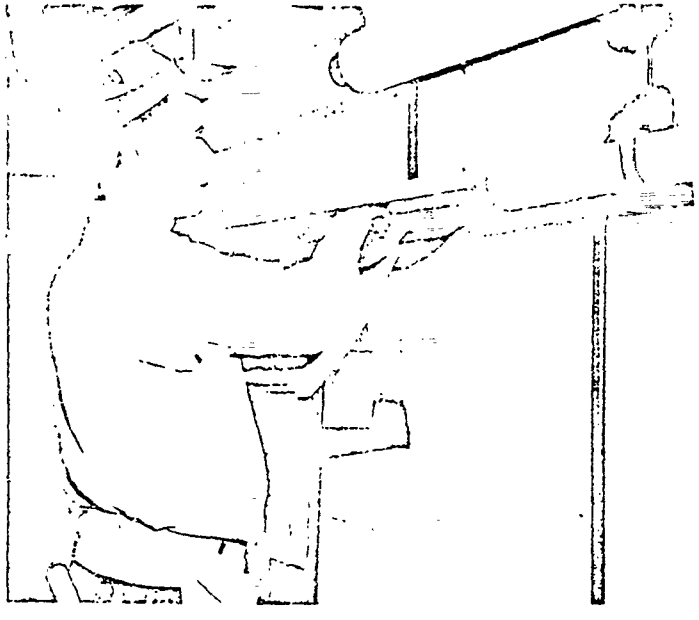
LESSON TEXT

TOPIC: INSTALLATION OF THERMAL PIPE INSULATION



GOALS

A. Mechanic Must Learn:

1. The procedure for installing thermal pipe insulation.

B. Mechanic Must Develop These Skills:

1. Installing thermal pipe insulation.

MECHANIC MUST ALREADY HAVE

A. Knowledge of:

1. Basic insulation materials.
2. Accessory insulation materials.
3. Pipe sizes.

B. Skill in:

1. Selecting basic insulation.
2. Selecting insulation accessories.

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APPLICATION PROCEDURES

The application procedures for thermal pipe insulation that follow prescribe the methods to be observed. Generally each procedure will be divided into the following headings:

1. Scope - defines application of procedure.

2. Materials - lists basic and accessory insulation materials included in procedure.

3. Pipe - Insulation Application - describes position of butt joints (staggered or nonstaggered) and position of longitudinal joints.

4. Wires and Bands - Specifies number and position of wires and bands required to hold basic insulation.

5. Insulation of Pipe Hangers - prescribes method for insulating hangers.

6. Pipe - Finish Application - states finish to be used and method of application.

7. Fittings - Insulation Application - describe method for insulating fittings by the following types:

   a. Screwed fittings
   b. Welded fittings
   c. Flanged fittings
   d. Line flanges

8. Fittings - Finish Application - gives finish to be used and method of application.

9. Flashing - where applicable flashing is specified.

SAFETY PRECAUTIONS

The installation of thermal pipe insulation presents several safety hazards.

1. Ladders and scaffolds -

   a. Check ladders and scaffolds daily.
   b. Tie ladders as required by plant requirements.
   c. Handling insulation material.

2. Tools - hazards of cuts from saws and knives.

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3. Equipment and hot lines -

   a. Have operating equipment that may present hazard to work shutdown and locked out.

   b. Burns from hotlines - observe caution and wear gloves.

4. Housekeeping - keep work area clean to prevent slipping or tripping.

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APPLICATION SERIES 100 – PIPE AND FITTINGS CORRUGATED ALUMINUM JACKET ON PIPE AND HIGH-TEMP MASTIC FINISH FOR FITTINGS	THERMAL INSULATION STANDARD ENGINEERING SPECIFICATION	
	ISSUED OCTOBER 1954	SN 100.25 A
	REVISED JULY 1957	Page 1 of 5

1. SCOPE

1.1 This Specification covers application of Molded Block and Pipe Insulation listed below, with Corrugated Aluminum Jacket on all pipe. Fittings and Valves shall have High-temperature Breathing Mastic Finish plus Reflecting Aluminum Paint.

2. MATERIALS

2.1 All materials shall be in accordance with the SN–M Section of the Standard Engineering Specifications governing.

2.2 **Basic Insulation Materials – Molded***

Code 102 – Calcium Silicate
Code 104 – Inorganic Silicas and Asbestos Fiber
Code 112.01 – Glass Fiber

2.3 **Basic Insulation Materials – Fluid and Plastic**

Code 502* – Insulation Cement
Code 502.1 – Insulation and Finishing Cement (Limited to 800°F)

2.4 **Accessory Materials**

Code 706 – High-temperature Breathing Mastic
Code 714 – Poultry Netting
Code 716.1 – Aluminum Jacket
Code 721 – Reflecting Paint
Code 807 – Flashing Compound
Code 920 Series – Stainless Steel Wires and Bands*
Code 930 Series – "Monel" Wires and Bands*
Code 955 – Aluminum Bands
Code 971.3 – Aluminum Metal Screws

3. PIPE – INSULATION APPLICATION

3.1 Pipe insulation shall be applied snugly on pipe with joints tightly butted together. Pipe insulation 2½ inches or less in thickness shall be applied in a single layer. All pipe insulation over 2½ inches in thickness shall be double-layer construction. **Exception:** Double-layer insulation shall be installed on all "Dowtherm" piping in sizes 2 inches and larger.

3.2 Pipe insulation on chased lines shall be of a size large enough to enclose both pipeline and chaser. The insulation shall be a snug fit to the pipe and chaser or its ring spacer. See Figure 1.

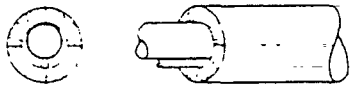

FIGURE 1

*Where Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed 800°F.

SUBCOMMITTEE NO 25

3.3 **Single-layer Construction.** Single-layer sectional pipe insulation shall be applied with longitudinal joints vertical whenever possible. The butt joints of sectional or segmental pipe shall be staggered. The insulation shall be held firmly in place by wires or bands installed in accordance with paragraph 4.1.

3.4 **Double-layer Construction.** The first or inner layer of sectional pipe insulation shall be applied with longitudinal joints horizontal whenever possible. The butt joints shall be staggered. The second or outer layer of sectional or segmental insulation shall be applied so that all joints of the first layer are covered by the second layer. Each layer shall be held firmly in place by wires or bands installed in accordance with paragraph 4.1.

4. WIRES AND BANDS

4.1 Each layer of insulation shall be applied to the pipe and secured with wire or bands as specified in Table 1. Wire shall be applied with at least four separate loops per section, twisted, bent, and hammered into the insulation. Bands shall be applied four per section of insulation, tightened and held with band seals. Wire or bands shall be located 1 inch from the ends of the section. See Figure 2.

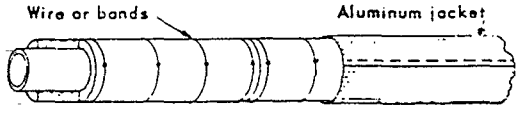

FIGURE 2

5. INSULATION AT PIPE HANGERS

5.1 Pipe hangers attached to the pipe shall be insulated. Where possible, the pipe insulation should be cut out to fit snugly over the hanger with the outer surface of the insulation unbroken and free from bulging. Where the shape of the hanger does not permit this procedure, the pipe insulation can be butted up to the hanger and the void filled with Insulation Cement, Code 502, until flush with the pipe insulation. See Figures 3 and 4. The insulation around the hanger clamp and rod shall be sealed with Finish Cement, Code 712. When the pipe hanger is attached directly to the pipe, a watershed cone should be installed as shown in Figure 11.

*Selection specified on project or job specification index.
For sizes, see Table 1, Wir

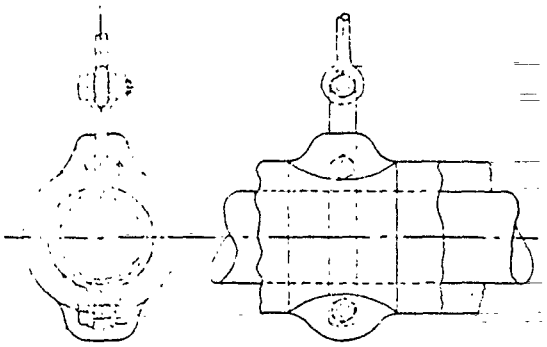

FIGURE 3

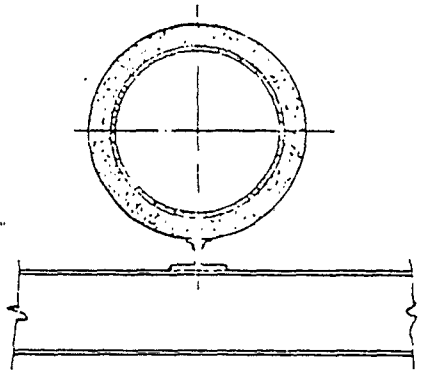

FIGURE 4

6. PIPE – FINISH APPLICATION

6.1 Finish shall consist of field-applied aluminum jacket, Code 716.1 (thickness 0.016-inch minimum with 0.005-inch thickness acceptable only with the approval of the operating department) over insulation fastened with bands, Code 956, or metal screws.

6.2 All chipped edges, cracks, or imperfections of each layer of insulation shall be filled in and smoothed with Insulation Cement, Code 502.

6.3 The aluminum jacket shall be cut to fit the circumference of the insulation with longitudinal lap 2 inches minimum. Each section of jacket shall overlap adjacent jacket a minimum of 2 inches. Each section of jacket shall be drawn snugly around the pipe insulation and pressed into place. The lap shall be secured with bands on 8-inch centers along the longitudinal joint. Aluminum screws, Code 971.3, may be used if they are of the hardened self-tapping type. Flashing compound, Code 807, should be daubed over them. For outdoor service flashing compound shall also be applied to the butt lap on horizontal installations and to the longitudinal lap on vertical piping as a weather seal. The longitudinal lap shall be situated to form maximum water shed and be least visible. A minimum of two screws per butt lap shall also be used on vertical piping to prevent vertical movement of jacket.

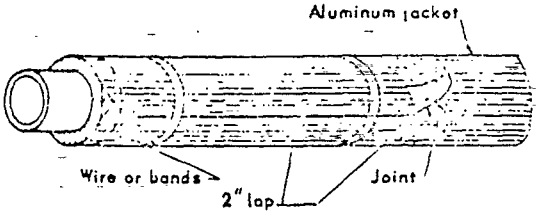

FIGURE 5

7. FITTINGS – INSULATION APPLICATION

7.1 Welded fittings and valves 2 inches and smaller shall be insulated with Insulation Cement, Code 502, to a thickness equal to the adjacent pipe insulation. See Figure 7. Screwed fittings and valves shall also be insulated with Code 502 Insulating Cement as shown in Figure 6.

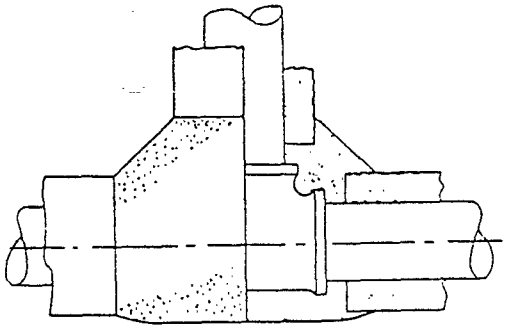

FIGURE 6

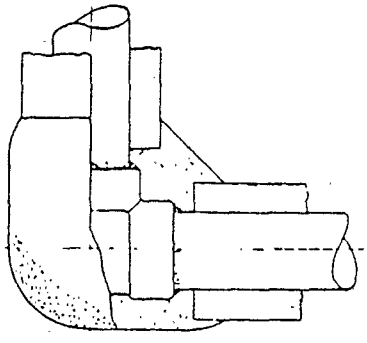

FIGURE 7

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7.2 Welded fittings and valves 2 inches and lower shall be insulated with block or pipe insulation at least equal in thickness and in same number of layers as adjacent pipe insulation. See Figure 8.

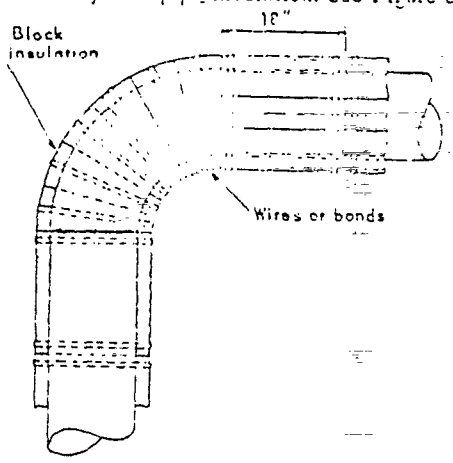


FIGURE 8

7.3 Flanged fittings and flanged valves shall be insulated with block or pipe insulation equal in thickness to the adjacent pipe insulation or 2 inches, whichever is less. The fitting insulation shall overlap the adjacent pipe insulation 2 inches or equal the pipe insulation thickness, whichever is greater. See Figures 9 and 10.

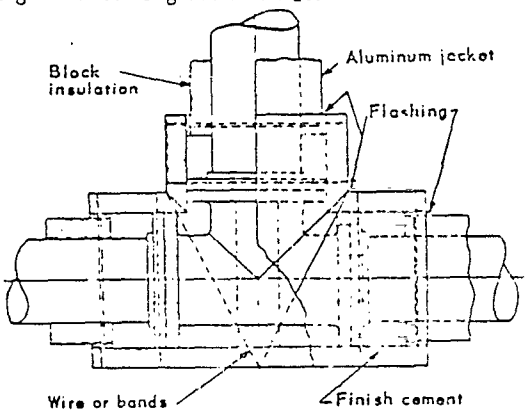


FIGURE 9

7.4 Line flanges shall be insulated with block or pipe insulation equal in thickness to the adjacent pipe covering or 2 inches, whichever is less. The length to be in accordance with Figure 12 and Table 2.

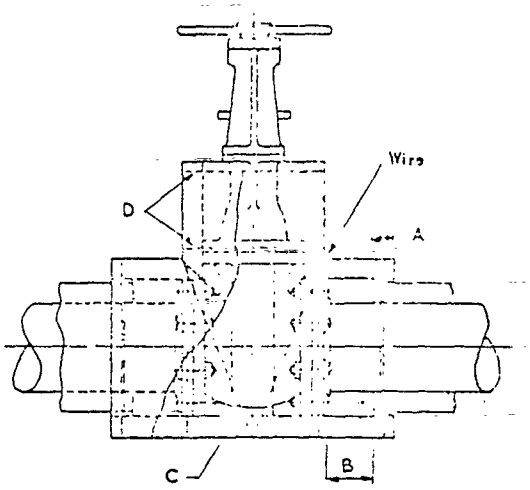


FIGURE 10

Legend Figure 10

A – Not less than 2 inches
B – Clearance to remove bolts
C – Block support for cover
D – Bands not over 8-inch centers

7.5 Each section or segment of block or pipe insulation used for insulation of fittings shall be held securely by wires or bands as specified in Table 1.

7.6 All chipped edges, cracks, or imperfections of each layer of insulation shall be filled in and smoothed with Insulation Cement, Code 502 or Code 502.1.

7.7 For valves, fittings, and line flanges with insulation diameter exceeding 13 inches, Poultry Netting, Code 714, shall be applied and laced tight over the insulation.

8. FITTINGS – FINISH APPLICATION

8.1 Finish shall consist of a prime coat of Insulation Primer Paint,*Code 707, applied by brushing or spraying. Trowel over the surface of the insulation two 1/8-inch coats of High-temperature Breathing Mastic, Code 706. After breather mastic has thoroughly dried, apply Code 721 Aluminum Reflecting Paint.

9. FLASHING

9.1 Flashing Compound, Code 807, shall be applied at all possible sources of moisture penetration such as the intersections of insulation at piers, nozzles, building walls, valve bonnets, supports, hangers, and other parts protruding through the surface of the finish. Prior to application, wipe down surfaces of talc-coated felts or other dusty

*No primer required on Code [illegible]

surfaces with a damp cloth and allow to dry to gain maximum adhesion. The Flashing Compound, Code 807, shall be applied to provide a watershed in a 1/4-inch coating extending over all intersecting surfaces without feathering of edges.

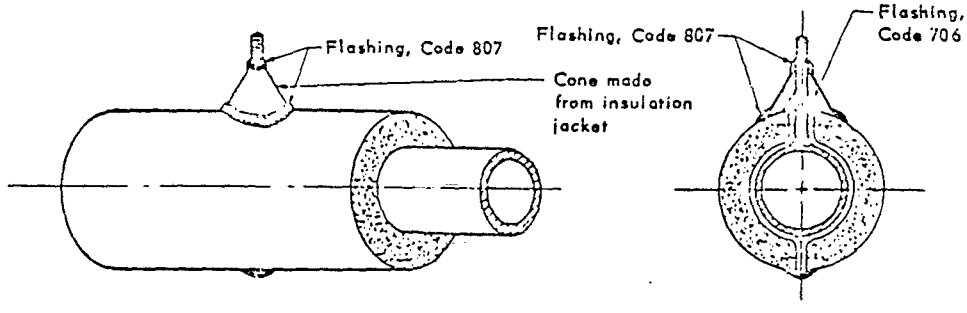


FIGURE 11

TABLE 1

WIRES AND BANDS					
Pipe Insulation Diameter (In.)		920 Series Stainless Steel	930 Series "Monel"	950 Series Copper	955 Series Aluminum
Minimum	Maximum				
-	6 1/4	921	931		956
Over 6 1/2	12 3/4	922	932		
13		926	936		

LENGTH OF 1-INCH NOMINAL THICKNESS INSULATION COVERS FOR LINE FLANGES

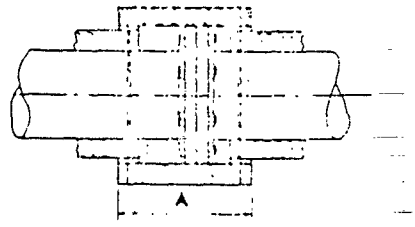


FIGURE 12

TABLE 2

Nominal Pipe Size (Inches)	Length A (In.)									
	Flanges									
	150-lb.		300-lb.		600-lb.		900-lb.		1500-lb.	
	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD
1/2	9	3 1/2	9	3 3/4	12	3 3/4	12	4 3/4	12	4 3/4
3/4	9	3 7/8	9	4 5/8	12	4 5/8	12	5 1/8	12	5 1/8
1	9	4 1/4	9	4 7/8	12	4 7/8	12	5 7/8	12	5 7/8
1 1/4	9	4 5/8	9	5 1/4	12	5 1/4	12	6 1/4	12	6 1/4
1 1/2	9	5	9	6 1/8	12	6 1/8	18	7	18	7
2	9	6	9	6 1/2	12	6 1/2	18	8 1/2	18	8 1/2
2 1/2	9	7	12	7 1/2	12	7 1/2	18	9 5/8	18	9 5/8
3	12	7 1/2	12	8 1/4	12	8 1/4	18	9 1/2	18	10 1/2
3 1/2	12	8 1/2	12	9	18	9	-	-	-	-
4	12	9	12	10	18	10 3/4	18	11 1/2	18	12 1/4
5	12	10	12	11	18	13	18	13 3/4	24	14 3/4
6	12	11	12	12 1/2	18	14	18	15	24	15 1/2
8	12	13 1/2	18	15	18	16 1/2	24	18 1/2	24	19
10	12	16	18	17 1/2	24	20	24	21 1/2	30	23
12	12	19	18	20 1/2	24	22	24	24	36	26 1/2
14 OD	18	21	18	23	24	23 3/4	24	25 1/4	36	29 1/2
16 OD	18	23 1/2	18	25 1/2	24	27	24	27 3/4	36	32 1/2
18 OD	18	25	18	28	24	29 1/4	30	31	-	-
20 OD	18	27 1/2	18	30 1/2	24	32	30	33 3/4	-	-
24 OD	18	32	24	36	30	37	36	41	-	-

1. [illegible]

1.1 This Specification [illegible] of molded [illegible] insulation [illegible]

2. [illegible]

2.1 All materials shall be in accordance with the [illegible] specifications [illegible]

2.2 [illegible] — Molded

Code 101 — 85% Magnesia
Code 102 — Calcium Silicate
Code 104 — [illegible] Asbestos Fiber
Code 112.01 or 112.02 — Glass Fiber

2.3 [illegible] — Fluid and Plastic

Code 502* — Insulation Cement
Code 502.1 — Insulation and Finishing Cement [illegible]

2.4 Accessory Materials

Code 704 — 8-oz. Canvas
Code 705 — Rosin-sized Paper
Code 712 — Finish Cement
Code 714 — Poultry Netting
Code 802 — Lagging Adhesive
Code 932 — Laggers Staples
Code 920 Series — Stainless Steel Wires and Bands*
Code 930 Series — "Monel" Wires and Bands*

3. PIPE – INSULATION APPLICATION

3.1 Pipe insulation shall be applied snugly on pipe with joints tightly butted together. Pipe insulation 2 1/2 inches or less in thickness shall be applied in a single layer. Pipe insulation over 2 1/2 inches in thickness shall be double-layer construction. Exception: Double-layer insulation shall be installed on all "Dowtherm" piping in sizes 2 inches and larger.

3.2 Pipe insulation on chased lines shall be of a size large enough to enclose both pipeline and chaser. The insulation shall be a snug fit to the pipe and chaser or its ring spacer. See Figure 1.

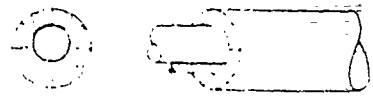


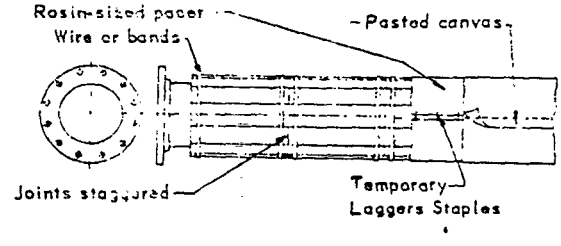
FIGURE 1

3.3 Single-layer Construction. Single-layer sectional pipe insulation shall be applied with longitudinal [illegible] joints [illegible] or segmental insulation shall be [illegible] in accordance [illegible]

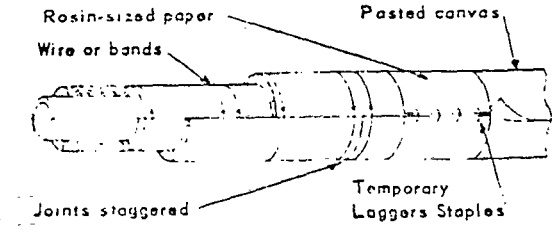
3.4 [illegible] Construction. The first or inner [illegible] insulation shall be applied [illegible] horizontal whenever possible. [illegible] the second or [illegible] and/or segmental insulation [illegible] all joints of the first layer are covered by the second layer. Each layer shall be held [illegible] in place by wires or bands installed in accordance with Sec. 4.1

4. WIRES AND BANDS

4.1 Each layer of insulation shall be applied to the pipe and secured with wire or bands as specified in Table 1. Wire shall be applied with at least four separate loops per section, twisted, bent and hammered into the insulation. Band shall be applied four per section of insulation, tightened, and held with band seals. Wire or bands shall be located 1 inch from the ends of the section. See Figures 2 and 3.



PLAN VIEW – FIGURE 2



PLAN VIEW – FIGURE 3

*Where Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed 500 degrees F.

*Selection specified on project or job specification index. Sizes – See Table 1, Wires and Bands

5. [illegible] AT PIPE [illegible]

5.1 The bands attached to the pipe shall be in- [illegible]

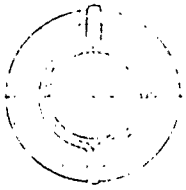


FIGURE 4

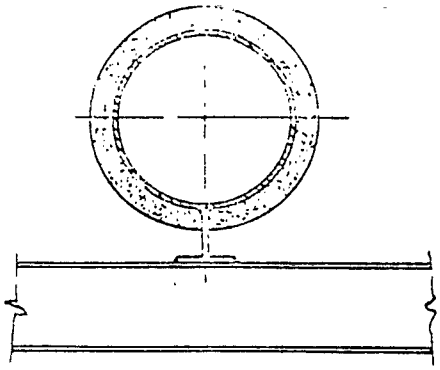


FIGURE 5

6. PIPE – FINISH APPLICATION

6.1 Finish shall consist of field-applied 8-ounce Canvas, Code 704, over Rosin-sized Paper, Code 705.

6.2 All chipped edges, cracks or imperfections of each layer of insulation shall be filled in and smoothed with Insulation Cement, Code 502.

6.3 The pipe insulation shall be wrapped with Rosin-sized Paper, Code 705, cut to fit, drawn tight, and held temporarily in place with Lagger's Staples, Code 962. 8-ounce Canvas, Code 704, shall be drawn snugly over the Rosin-sized Paper, Code 705. The canvas shall have laps that are 2 inches [illegible]. The staples shall [illegible] as the canvas is applied. The canvas laps shall be banded with [illegible] Code 702. The canvas shall be [illegible] and free of wrinkles and ragged edges. The longitudinal lap shall be located on the top or bottom [illegible] ever is least visible. See Figure [illegible].

7. FITTINGS – INSULATION APPLICATION

7.1 Welded [illegible] screwed fittings and valves 2 inches and smaller shall be insulated with Insulation Cement, Code 502, to a thickness equal to the adjacent pipe insulation. See Figures 6 and 7. Where screwed piping is over 2 inches the above procedure is to be followed.

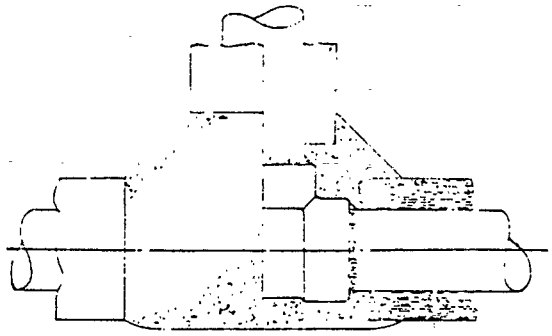


FIGURE 6

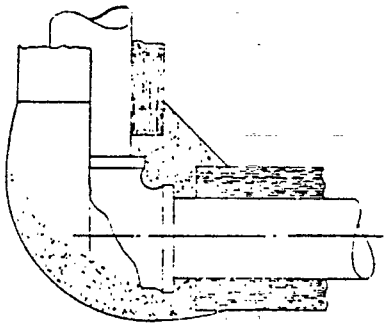


FIGURE 7

7.2 Welded fittings 3 inches and larger shall be insulated with block or pipe insulation at least equal in thickness and in same number of layers as adjacent pipe insulation. See Figure 8.

7.3 Flanged fittings and flanged valves shall be insulated with block or pipe insulation equal in thickness to the adjacent pipe insulation or 2 inches, whichever is less, in accordance with Figures 9 and 10. The fitting insulation shall overlap the adjacent pipe insulation 2 inches or equal the pipe insulation thickness, whichever is greater. See Figures 9 and 10.

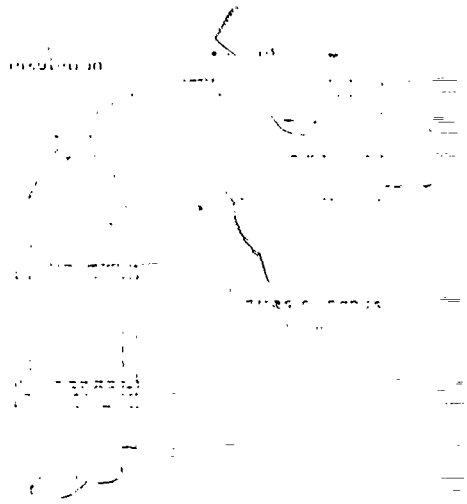


FIGURE 8

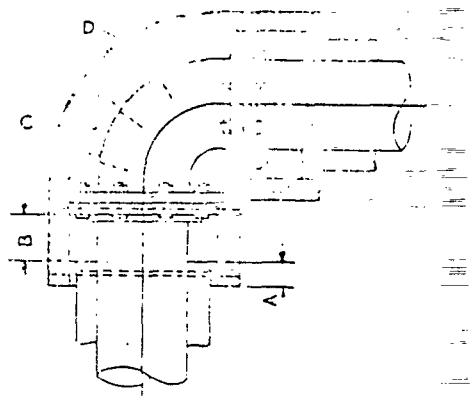


FIGURE 9

Legend Figures 9 and 10

A – Not less than 2 inches
B – Clearance to remove bolts
C – Block support for cover
D – Wires or bands not over 6-inch centers

For fittings over 12 inches in diameter, apply poultry netting over insulation to reinforce the Finish Cement, Code 712.

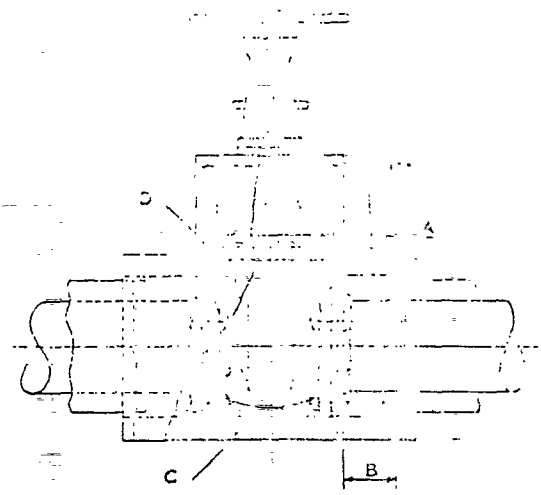


FIGURE 10

7.6 The outside of the insulation on all fittings, valves and line flanges shall be given a 1/4-inch trowel coat of Finish Cement, Code 712, to present a smooth surface. For valves and fittings with insulation diameter exceeding 13 inches, apply two coats of finish cement reinforced with Poultry Netting, Code 714.

8. FITTINGS – FINISH APPLICATION

8.1 Finish shall consist of field-applied 8-ounce Canvas, Code 704, over the Finish Cement, Code 712, using Lagging Adhesive, Code 502, to completely cover the fittings smoothly and snugly.

DUP 1012106

[illegible] OR LINE FLANGES

[illegible]	[illegible]									
	150-lb.		300-lb.		600-lb.		900-lb.		1500-lb.	
[illegible]	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD
1/2	9	3 1/2	9	[illegible]	12	[illegible]	12	4 3/4	12	4 3/4
3/4	9	3 7/8	9	4 5/8	12	4 5/8	12	5 1/8	12	5 1/8
1	9	4 1/4	9	4 7/8	12	4 7/8	12	5 7/8	12	5 7/8
1 1/4	9	4 5/8	9	5 1/4	12	5 1/4	12	6 1/4	12	6 1/4
1 1/2	9	5	9	6 1/8	12	6 1/8	18	7	18	7
2	9	6	9	6 1/2	12	6 1/2	18	8 1/2	18	8 1/2
2 1/2	9	7	12	7 1/2	12	7 1/2	18	9 5/8	18	9 5/8
3	12	7 1/2	12	8 1/2	12	8 1/4	18	9 1/2	18	10 1/2
3 1/2	12	8 1/2	12	9	12	9	-	-	-	-
4	12	9	12	10	18	10 3/4	18	11 1/2	18	12 1/4
5	12	10	12	11	18	13	18	13 3/4	24	14 3/4
6	12	11	12	12 1/2	18	14	18	15	24	15 1/2
8	12	13 1/2	12	15	18	16 1/2	24	18 1/2	24	19
10	12	16	16	17 1/2	24	20	24	21 1/2	30	23
12	12	19	16	20 1/2	24	22	24	24	36	26 1/2
14 OD	12	21	[illegible]	22	24	23 3/4	24	25 1/4	36	29 1/2
16 OD	12	23 1/2	16	25 1/2	24	27	24	27 3/4	36	32 1/2
18 OD	16	25	16	28	24	29 1/4	30	31	-	-
20 OD	16	27 1/2	16	30 1/2	24	32	30	33 3/4	-	-
24 OD	16	32	20	36	30	37	36	41	-	-

DUP 1012107

DU 053401

1. [illegible]

[illegible] covers application of [illegible] shall [illegible]

2. [illegible]

[illegible] in accordance with the [illegible] of the Standard Engineering Specifications [illegible]

2.2 [illegible] Insulation Materials – Molded*

Code [illegible] – [illegible]
Code [illegible] – Calcium Silicate
Code [illegible] – Diatomaceous Earth
Code [illegible] – Diatomite Silica and Asbestos Fiber
Code 712.01 – Glass Fiber

2.3 [illegible] Insulation Materials – Fluid or Plastic

Code 502* – Insulation Cement
Code 502.1 – Insulation and Finishing Cement (Limited to 600°F)

2.4 Accessory Materials

Code 701 – Asbestos Roofing Felt
or
Code 702 – Rag Felt
Code 706 – High-temperature Breathing Mastic
Code 712 – Finish Cement
Code 713 – Poultry Netting
Code [illegible] – Lap Adhesive
Code 907 – Flashing Compound
Code 920 Series – Stainless Steel Wires and Bands*
Code 930 Series – "Monel" Wires and Bands*
Code [illegible] – Gun-type Staples

3. PIPE – INSULATION APPLICATION

3.1 Pipe insulation shall be applied snugly on [illegible] joints tightly butted together. Pipe insulation [illegible] inches or less in thickness shall be applied in a single layer. Pipe insulation over [illegible] inches in thickness shall be double-layer construction.

3.2 Pipe insulation on chased lines shall be of a [illegible] enough to enclose both pipeline and chaser. The insulation shall be a snug fit to the [illegible] chaser. See Figure 1.

[illegible]

3.3 Single [illegible] Construction. The single or sectional pipe insulation [illegible] with [illegible] joints vertical whenever possible. The butt joints of sectional or segmental pipe shall be staggered. The insulation shall be held firmly in place by wires or bands installed in accordance with paragraph 4.1.

3.4 Double-layer Construction. The first or inner layer of sectional pipe insulation shall be applied with longitudinal joints horizontal whenever possible. The butt joints shall be staggered. The second or outer layer of sectional or segmental insulation shall be applied so that all joints of the first layer are covered by the second layer. Each layer shall be held firmly in place by wires or bands installed in accordance with paragraph 4.1.

4. WIRES AND BANDS

4.1 Each layer of insulation shall be applied to the pipe and secured with wire or bands as specified in Table 1. Wire shall be applied with at least four separate loops per section, twisted, bent, and hammered into the insulation. Bands shall be applied four per section of insulation; tightened and held with band seals. Wire or bands shall be located 1 inch from the ends of the section. See Figures 2, 3, and 4.

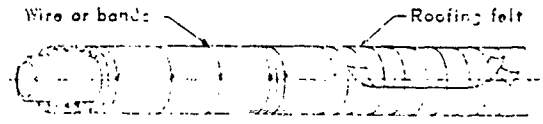


FIGURE 2

FIGURE 3

* Where Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed [illegible]

Vendors and merchandise designations are given to describe materials and they not include all acceptable products. Substitutions are to be made only [illegible] approval [illegible]

For [illegible], see Table 1 [illegible]

DUP 1012108

DU 053402

[illegible]

[illegible] Code 702 or Code 702, over insulation [illegible] or insulation.

[illegible] Code 702 or

[illegible] with [illegible] of [illegible]

[illegible] may be secured [illegible] longitudinal [illegible] wire [illegible] strips [illegible] 2-in. centers [illegible] 1. [illegible] 4. [illegible] where [illegible]

7. [illegible] — [illegible]

7.1 [illegible] and screwed fittings and valves 2 [illegible] insulation. [illegible] to be applied over the insulation. See [illegible] 7 and 8. [illegible] screwed piping is over 2 in. [illegible] procedure is to be followed.

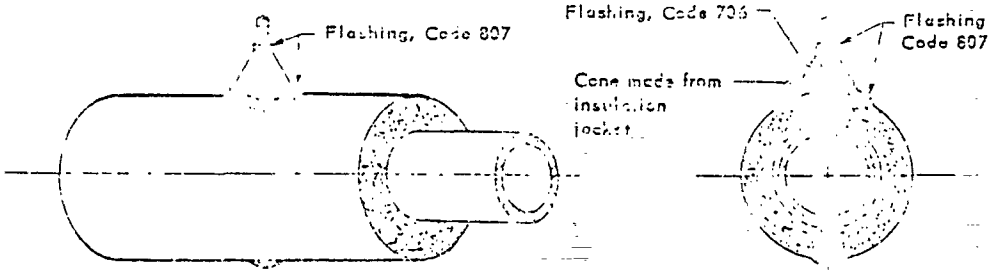


FIGURE 5

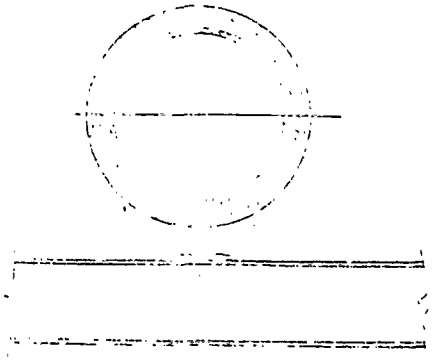


FIGURE 6

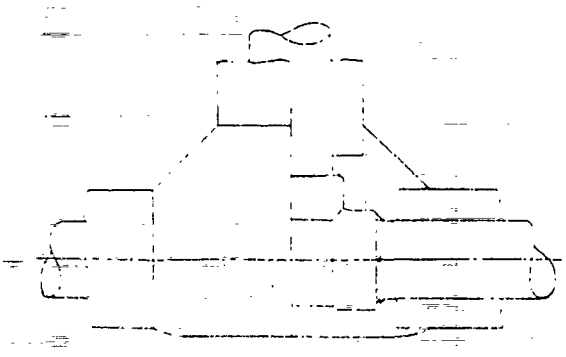


FIGURE 7

DUP 1012109

DU 053403

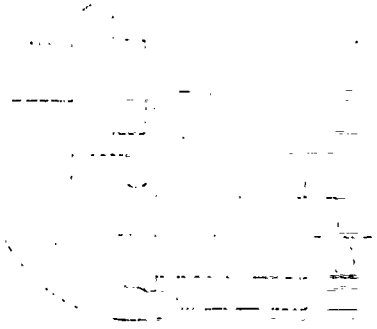


FIGURE 8

[illegible] 3 inches and [illegible] or pipe insulation [illegible] number of [illegible] fire insulation. See Figure 9.

[illegible] and flanged valves shall be [illegible] or pipe insulation equal in [illegible] to [illegible] pipe insulation or 2 [illegible] over in [illegible] fitting insulation [illegible] 2 inches [illegible] thickness, whichever [illegible] 10 and 12.

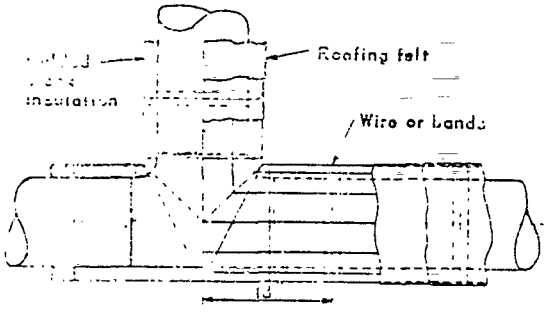


FIGURE 9

[illegible] Figures 10 and 11

A — Not less than 2 inches

B — Clearance to remove bolts

C — [illegible] for cover

D — Wires or bands not over 6-inch centers

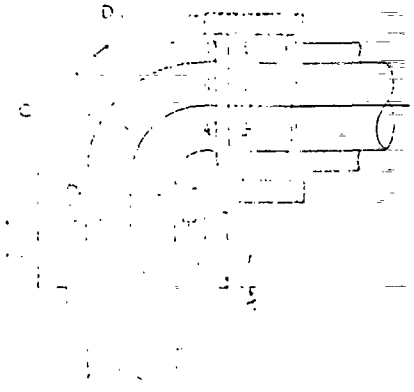


FIGURE 10

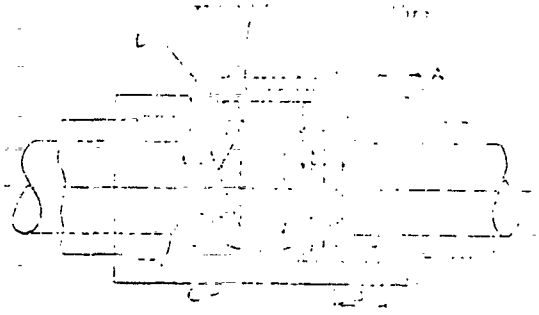


FIGURE 11

7.4 [illegible] flanges shall be insulated [illegible] pipe insulation equal in thickness to the [illegible] pipe insulation or 2 inches, whichever is less. The length to be in accordance with Figure 13 and Table 2.

7.5 Each section or segment of block or pipe insulation used for insulation of flanges shall be held securely by wires or bands as specified in Table 1.

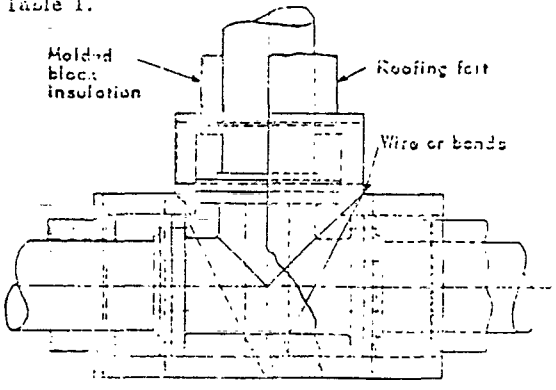


FIGURE 12

7.6 All chipped edges, cracks, or imperfections of each layer of insulation shall be filled in and smoothed with Insulation Cement, Code 502, or Code 502.1.

7.7 For valves, fittings, and line flanges with insulation diameter exceeding 13 inches, Poultry Netting, Code 714, shall be applied and laced tight over the insulation.

8. FITTINGS – FINISH APPLICATION

8.1 Finish shall consist of a prime coat of Insulation Primer Paint, Code 700, applied by [illegible] or spraying. (Primer can be eliminated over Code 112 material.) Trowel over the surface of the [illegible] coats of Hydraulic Cement Insulation Mastic, Code 700.

	[illegible]		[illegible]		[illegible]		[illegible]		[illegible]	
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Flange [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	12	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	12	[illegible]
1	9	4¼	9	[illegible]	12	[illegible]	12	3⅞	12	5⅞
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	12	[illegible]	12	[illegible]
[illegible]	9	5	9	[illegible]	[illegible]	[illegible]	18	7	18	7
[illegible]	9	6	9	[illegible]	[illegible]	[illegible]	18	8½	18	9½
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18	[illegible]
[illegible]	12	7½	12	[illegible]	[illegible]	[illegible]	18	9½	18	10½
[illegible]	[illegible]	[illegible]	12			[illegible]	-	-	-	-
[illegible]	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18	11½	18	12¾
[illegible]	12	[illegible]	12	[illegible]	[illegible]	13	18	13¾	24	14¾
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	18	[illegible]	24	15½
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	19½	24	19
	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	24	21½	30	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	24	[illegible]	[illegible]
[illegible]	[illegible]	21	[illegible]	[illegible]	[illegible]	[illegible]	24	25¼	36	25½
		[illegible]		[illegible]		[illegible]	[illegible]	[illegible]	36	32½
								[illegible]	-	-
	[illegible]	[illegible]	[illegible]			[illegible]	30	33¾	-	-

1. SCOPE

1.1 This Specification covers application of Molded [illegible] Pipe Insulation listed below, with Field-applied Roofing Felt on all pipe, Fittings and [illegible] Will Have High-temperature Breathing Mastic Finish.

2. MATERIALS

2.1 All materials shall be in accordance with the [illegible] Section of the Standard Engineering Specifications governing.

2.2 Basic Insulation Materials – Molded*

Code 106 – Asbestos and Diatomaceous Earth Molded

Code 107 – Asbestos Sponge

2.3 Basic Insulation Materials – Fluid and Plastic

Code 502* – Insulation Cement
Code 502.1 – Insulation and Finishing Cement (Limited to 800°F)

2.4 Accessory Materials

Code 701 – Asbestos Roofing Felt
or
Code 702 – Rag Felt
Code 706 – High-temperature Breathing Mastic
Code 712 – Finish Cement
Code 714 – Poultry Netting
Code 801 – Lap Adhesive
Code 907 – Flashing Compound
Code 920 Series – Stainless Steel Wire and Bands*
Code 950 – "Monel" Wires and Bands*
Code 962 – Lagger's Staples
Code 963 – Gun-type Staples

3. PIPE – INSULATION APPLICATION

3.1 Pipe insulation shall be applied snugly on pipe with joints tightly butted together. All pipe insulation shall be applied in single thickness.

3.2 Pipe insulation on chased lines shall be of a size large enough to enclose both pipeline and chaser. The insulation shall be a snug fit to the pipe and chaser or its ring spacer. See Figure 1.

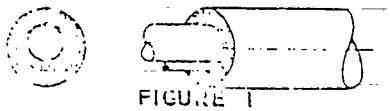


FIGURE 1

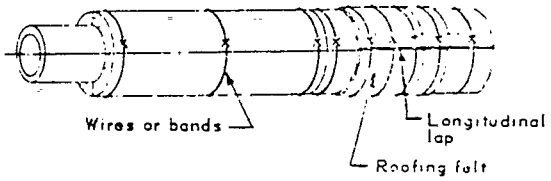
* When Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed 800°F.

* Applies only to basic insulation material listed.

3.3 Insulation shall be applied to the pipe and butted tightly against the adjacent section of insulation. See Figure 2. If the butt joints of the insulation are torn or damaged, they shall be squared off and the damaged part discarded. If the insulation is torn or damaged in areas other than the ends, and if it is Code 107, and not more than 10 layers, it may be patched by filling the damaged area with Insulation Cement, Code 502 or Code 502.1. Where insulation is 2 inches or more in thickness, and pipe temperature does not exceed 750 degrees F, expansion joints in the insulation shall be installed midway between fixed joints of the insulation: e.g., between two hangers on a straight run of pipe or between a hanger and a fitting, limiting the accumulative movement of the pipe covering at each expansion joint to 3 inches maximum. Adjacent sections of pipe covering between expansion joints shall be stapled together with 3-inch x 1-inch Lagger's Staples, Code 962, placed approximately every 4 inches around the circumferential joint. The insulation shall be held firmly in place by wires or bands installed in accordance with par. 4.1.

4. WIRES AND BANDS

4.1 The insulation shall be applied to the pipe and secured with wire or band as specified in Table 1. Wires shall be applied with at least three separate loops per section, twisted, bent, and hammered into the insulation. Bands shall be applied three per section of insulation, tightened and held with band seals. Wire or bands shall be located 1 inch from the end of the section. See Figure 2.



ELEVATION VIEW
FIGURE 2

5. INSULATION AT PIPE HANGERS

5.1 Pipe hangers attached to the pipes shall be insulated. Wherever possible, the pipe insulation shall be cut out to fit snugly over the hangers with the outer surface of the insulation unbroken and free from bulging. Where the shape of the hanger does not permit this procedure, the pipe insulation can be butted up to the hanger and the void filled with Insulation Cement, Code 502, until flush with the

* Selection specification project or job specification index. Sizes – See Table 1 [illegible] and Codes.

3. FLASHING

[illegible] Compound, Code 807, shall be applied [illegible] valve bonnets, supports, [illegible] Code [illegible] Code [illegible] [illegible] fastening of edges. See Figures [illegible] 14.

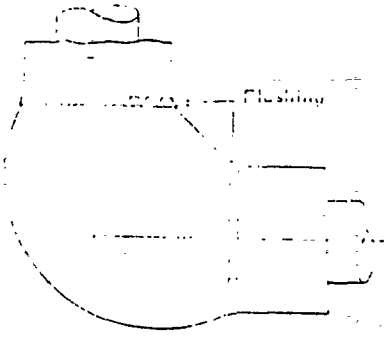


FIGURE 12

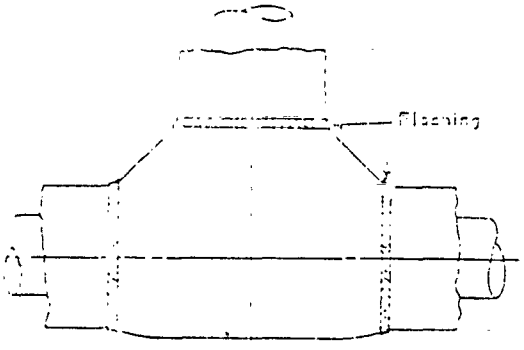


FIGURE 11

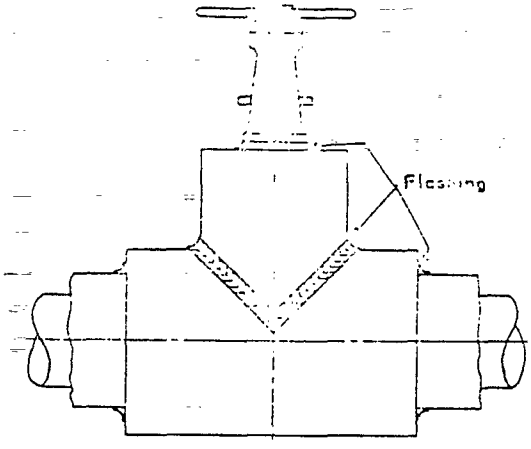
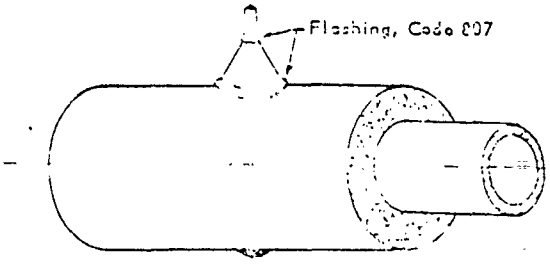


FIGURE 13



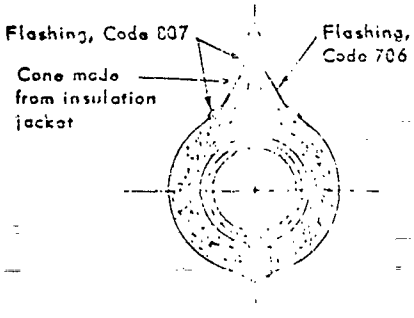


FIGURE 14

TABLE 1

[illegible]	[illegible]	[illegible]	930		
[illegible]	[illegible]	[illegible]	[illegible]		
[illegible] 6 1/4 13	[illegible]	[illegible]	930		

LENGTH OF [illegible] COVERS FOR LINE FLANGES

FIGURE 15

TABLE 2

Nominal Pipe Size (Inches)	[illegible] (Inches)									
	Flanges									
	[illegible]-lb.		[illegible]-lb.		[illegible]-lb.		[illegible]-lb.		[illegible]-lb.	
	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD
1/2	9	3 1/2	9	3 3/4	12	3 3/4	12	4 3/4	12	4 3/4
3/4	9	3 7/8		4 5/8	12	4 5/8	12	5 1/8	12	5 1/8
1	9	4 1/4	9	4 7/8	12	4 7/8	12	5 7/8	12	5 7/8
1 1/4	[illegible]	4 5/8	9	5 1/4	12	5 1/4	12	6 1/4	12	6 1/4
1 1/2	9	5	9	6 1/8	12	6 1/8	18	7	18	7
2	9	6	9	6 1/2	12	6 1/2	18	8 1/2	18	8 1/2
2 1/2	9	7	12	7 1/2	12	7 1/2	18	9 5/8	18	9 7/8
3	12	7 1/2	12	8 1/4	12	8 1/4	18	9 1/2	18	10 1/2
3 1/2	12	8 1/2	12	9	18	-	-	-	-	-
4	12	9	12	10	18	10 1/4	18	11 1/2	18	12 1/4
5	-	10	12	11	18	13	18	13 3/4	24	14 3/4
6	12	11	12	12 1/2	18	14	18	15	24	15 1/2
8	12	13 1/2	12	15	18	15 1/2	24	18 1/2	24	19
10	12	16	18	17 1/2	24	20	24	21 1/2	30	23
12	12	19	18	20 1/2	24	22	24	24	36	26 1/2
14 OD	18	21	18	23	24	23 3/4	24	25 1/4	36	29 1/2
16 OD	18	23 1/2	18	25 1/2	24	27	24	27 3/4	36	32 1/2
18 OD	18	25	18	28	24	29 1/4	30	31	-	-
20 OD	18	27 1/2	18	30 1/2	24	32	30	33 3/4	-	-
24 OD	18	32	24	36	30	37	36	41	-	-

Vendors and merchandise [illegible] are given to describe materials [illegible] only, [illegible] specification.

DUP 1012114

DU 053408

[illegible]

[illegible]

[illegible] — Molded

[illegible]

[illegible]

[illegible] — Mineral Wool

[illegible] — Fluid [illegible]

[illegible] — [illegible] Cement

[illegible] — [illegible] and Finishing Cement (Optional to [illegible])

[illegible] Accessory Materials

Code 7[illegible] — Glass Canvas
Code 712 — Finish Cement
Code 7[illegible] — Poultry Netting
Code [illegible]2 — [illegible] Adhesive
Code [illegible] — Fibrous Adhesive
Code 910 Series — Stainless Steel Wires and Bands*
Code 920 Series — "Monel" Wires and Bands*
Code 9[illegible] — Spindle Anchors
Code 965 — Fiberglass Cloth

3. CURVED OR CYLINDRICAL EQUIPMENT INSULATION APPLICATION

3.1 Insulation on equipment shall be applied snugly with joints tightly butted together. Insulation 2½ inches or less in thickness shall be applied in a single layer. Where [illegible] the 2½-inch thickness will not readily conform to the surface being insulated, or where [illegible] one layer may be [illegible] over 2½ inches in thickness shall be done in two-layer construction.

3.2 Single-Layer Construction. Single-layer block, [illegible] or segmental block insulation shall be applied with [illegible] tightly butted and lateral joints [illegible] shall be staggered over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of [illegible]

Pipe insulation [illegible] drawn tight and laced [illegible] Figure 1.

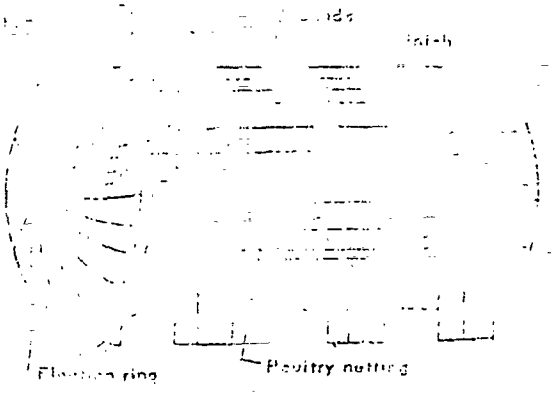


FIGURE 1

3.3 Two-layer Construction. The first or inner layer [illegible] shall be applied with joints staggered [illegible] joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer shall be applied so that all joints are staggered with the first layer and tightly butted together. Bands shall be placed over second layer of blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place, see Figure 1.

3.4 The insulation on heads or ends of cylindrical equipment shall be secured by tight bands, that are not over 6 inches apart and fastened to [illegible] an iron [illegible] or steel bands encircling the tank behind the [illegible] heads or circumferential [illegible] welds. See Figure 1. The insulation on the heads of cylindrical tanks shall be held in place at the center of the

*Where Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed [illegible] degrees F.

*Selection specified on project or job specification index.
Size — See Table I, Bands

Vendor's [illegible] merchandise designations [illegible] to describe materials [illegible] insulation.

DUP 1012115

DU 053409

[illegible] to clips

[illegible]

[illegible]

[illegible]

[illegible] Corner bend Corner angles

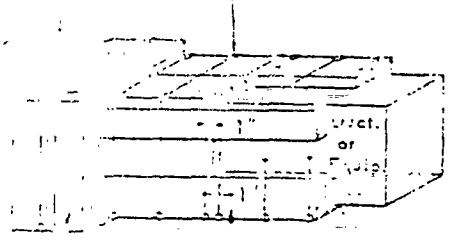


FIGURE 2

4.3 [illegible] specified on project or job specification, [illegible]

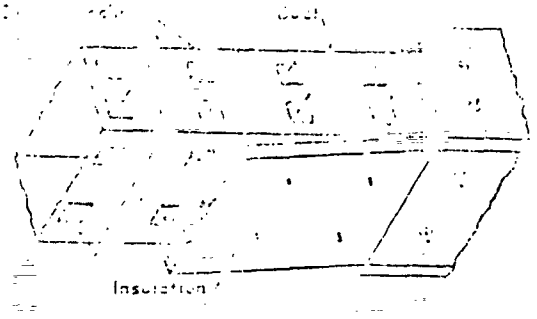


FIGURE 3

4.4 Studs, anchors, clips, rods, or bars may be welded or spot welded to the metal surfaces of equipment or duct work only with the written approval of Design, Construction, and Operations.

4.5 When the method of fastening is not specified on the project or job specification index, the applicator may choose the most economical or convenient method. However, written approval of welded fastenings must be obtained as outlined in par. 4.4.

5. FINISH

5.1 All chipped edges, cracks, or imperfections shall be filled and smoothed with Insulation Cement, Code 502.

5.2 Finish shall consist of 1/4-inch Finish Cement, Code 712, troweled smoothly over insulation, bands, and Poultry Netting. See Figure 1.

5.3 After the finish cement has dried, 8-ounce canvas shall be securely drawn over the finish and shall have the laps sealed with Lagging Adhesive, Code 802.

BANDS TABLE 1

Distance Around Outside Surface of Insulation		920 Series Stainless Steel	930 Series Monel
Minimum (Ft.)	Maximum (Ft.)		
	4	922	932
4	8	926	936
	12	927	937
12		[illegible]	[illegible]

DUP 1012116

DU 053410

1. [illegible]

1.1 [illegible] exceed [illegible] of [illegible]

2. [illegible]

2.1 All materials shall be in accordance with the [illegible] Specifications covering [illegible]

2.2 [illegible] materials [illegible]:

Code 112.61 — Plain Glass Fiber Bonded Board

2.3 Accessory [illegible]:

Code 501 — Granular Cork Asphalt Mix
Code 709 — Low-Temperature Vapor-barrier Mastic
Code 710 — Glass Cloth, Open Weave
Code 717 — "Paymesh" Cloth
Code 721 — Reflective Paint
Code 807 — Flashing Compound
Code 810 — Water-Resistant Adhesive, Rubber Base, Low Viscosity
Code 817 — Spindle Anchor Adhesive
Code 926 — Stainless Steel Bands
Code 964.2 — Spindle Anchors
Code 979 — Graham Pins

3. SQUARE-CORNERED DUCTS — INSULATION APPLICATION

3.1 Insulation. Glass Fiber, Code 112.61, shall be applied to the exterior of the duct surface in a single layer with joints tightly butted together (see Figure 1). Before insulation is installed, all angles, seams or edges that will project through the insulation must be coated with Code 501, Granular Cork Asphalt Mixture. Coating shall be applied to a minimum thickness of 3/8 inch and extend 1 inch on either side of angles or seams. Either of the following application methods are acceptable, but the method described in paragraph 3.2 should be used where practical.

3.2 Application Method using Spindle Anchors. [illegible] Board, Code 112.61, shall [illegible] Bottom [illegible] Provision [illegible] will be cut off approximately 1/8 inch [illegible] the washers.

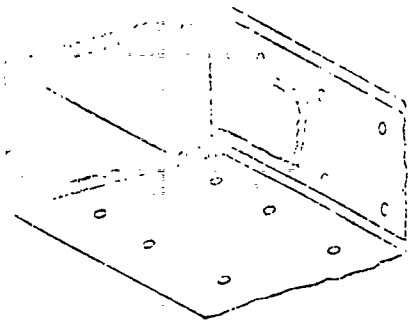


Figure 1

3.3 Application Method using Adhesive and Metal Bands. Glass Fiber Bonded Board, Code 112.61, shall be cut so that top and bottom insulation will lap the side pieces. Pieces shall be attached with dabs or brush strips of Adhesive, Code 810, and further fastened with Bands, Code 926, on 24-inch centers. Where sides or bottom of ducts exceed 36 inches, the insulation shall be impaled over Spindle Anchors, Code 964.2, or welded pins, and affixed to duct with Adhesive, Code 817, as described in

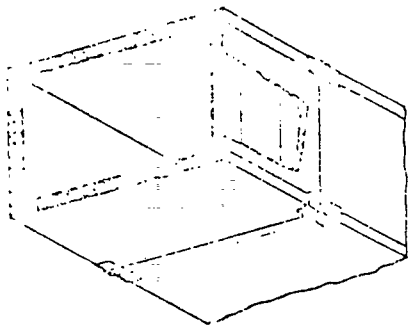


Figure 2

DUP 1012117

[illegible]

DU 053411

[illegible]

4. FINISH

[illegible] of [illegible] Vapor-[illegible] [illegible] Code [illegible] mastic, [illegible] [illegible] 1/8 [illegible] around [illegible] completely [illegible] all transverse [illegible] inches. [illegible] shall be covered where possible [illegible] expansion joints.

4.2 All butt and corner joints shall be given a heavy coat of Vapor-Barrier Mastic, Code [illegible], worked into the joints and carried out at least [illegible] inches on contiguous surfaces. Strips of open-weave [illegible] Cloth, Code 790, shall be embedded in the mastic to reinforce the vapor barrier.

4.3 On the top surface of rectangular ducts, a water seal shall be provided by the application of [illegible] Mastic, Code 591, [illegible] so that the center of duct is the high point.

5. FLASHING

5.1 Flashing Compound, Code 607, shall be applied at intersections of the insulation at building walls, supports, hangers, and other parts protruding through the surface of the finish. Flashing compound shall be applied in a 1/4-inch coating, extending several inches over all intersecting surfaces without feathering of edges.

[illegible]

[illegible] — Brushrunk

[illegible] — Ceramic Fiber

[illegible] — Metal and Plastic

Code 502* — Insulation Cement

Code 502.1 — Insulation and Finishing Cement (Limited to 800°F)

2.4 Accessory Materials

Code 706 — High-temperature Breathing Mastic

Code 707 — Insulation Primer Paint

[illegible] — Plastic Adhesive

Code 707 — Flashing Compound

Code 600 Series — Stainless Steel Wires and Bands*

Code 650 series — "Monel" Wires and Bands*

Code 704 — Studle Anchors

Code 714 — Chicken Netting

3. CURVED OR CYLINDRICAL [illegible] — INSULATION APPLICATION

3.1 Insulation on equipment shall be applied [illegible] joints tightly butted together. Insulation [illegible] thickness shall be applied in [illegible] layer except where the 1-1/2-inch thickness [illegible] face being in[illegible] layer may be [illegible] 2-inch thickness [illegible] construction.

3.2 Single-layer Construction. Single-layer block, [illegible] insulation shall be

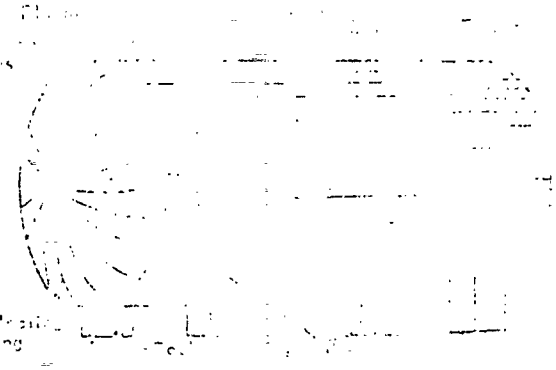


Fig. No. 1

3.3 Double-layer Construction. The first or inner layer of curved block or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer shall be applied so that all joints [illegible] with the first layer and tightly butted together. Bands shall be placed over second layer of blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, [illegible] shall be filled and smoothed with Insulation Cement, Code [illegible]. Over the insulation [illegible] apply Poultry [illegible], Code [illegible], drawn tight and fixed into place. See Figure 2.

*Where Code 502 is specified herein, Code 502.1 can be substituted [illegible] temperatures do not exceed [illegible] degrees F.

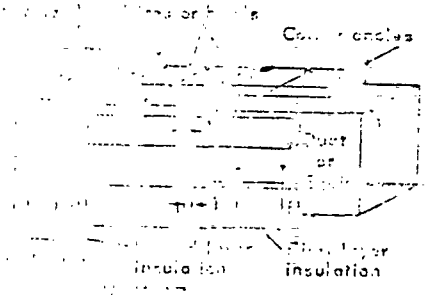
*Selection specified on project or job specification index.

Sizes — See Table 1, [illegible].

Vendor [illegible] are [illegible] materials

DUP 1012119

DU 053413



DUP 1012120

DU 053414

TABLE 1 – BANDS

Surface of Insulation		920 Series Stainless Steel	930 Series Monel		
Minimum (Ft.)	Maximum (Ft.)				
	4	922	932		
4	8	926	936		
8	20	927	937		
20		928	938		

DUP 1012121

DU 053415

1. SCOPE

1.1 This Specification covers insulation in Pipe [illegible]

2. MATERIALS

2.1 [illegible] of the Standard Construction Specifications [illegible]

2.2 Basic Insulation Materials – Molded [illegible]

Code 110 – Vegetable Cork

2.3 Accessory Materials

Code 701 – Granulated Cork
Code 709 – Low-Temperature Vapor Barrier Mastic
Code 710 – Glass Cloth
Code 717 – "Glyptal" Cloth
Code 808 – Seam Filler
Code [illegible] – Flashing Compound
Code [illegible] – Water Resistant Adhesive – Rubber* Base – High Viscosity
Code 810 – Water Resistant Adhesive – Rubber* Base – Low Viscosity
Code 811 – Water Resistant Adhesive – Asphalt* Base
Code 920 Series – Stainless Steel Wires and Bands*
Code 930 Series – "Monel" Wires and Bands*
Code 950 Series – Copper Wire General*
Code 961 – Skewers

3. PIPE – INSULATION APPLICATION

3.1 Pipe insulation shall be applied snugly on pipe with joints tightly butted together. All pipe insulation shall be applied in a single thickness.

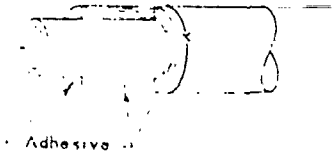


FIGURE 1

* Selection specified [illegible] specification [illegible]

[illegible] – See Table 1, Wires and Bands

3.2 [illegible]

4. WIRES AND BANDS

4.1 The insulation shall be applied to the [illegible] The wires shall be applied with at least [illegible] per section, [illegible] band seals. See Figure 2.

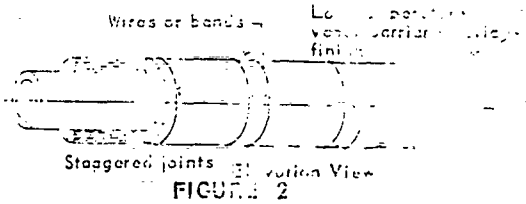


FIGURE 2

5. INSULATION AT PIPE HANGERS

5.1 Pipe hangers shall not be attached to the pipe but shall be placed over the insulation and have a protective finish as shown in Figure 3. The insulation under the hanger clamp shall be protected by a piece of roofing felt and a metal shield of 0.140 inch (No. 10 ga) galvanized iron extending for a distance equal to one half the diameter of the insulation on either side of the hanger, and shall extend up the sides of the insulation to the center line of the pipe. See Figures 3 and 4.

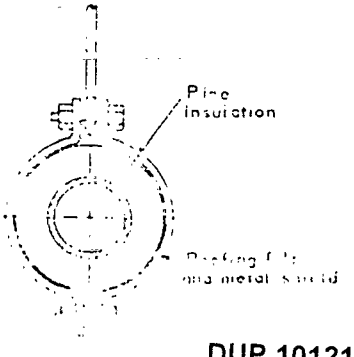


FIGURE 3

DUP 1012122

DU 053416

7.2 [illegible] fittings, [illegible] to the adjacent [illegible] insulation thickness, whichever is greater [illegible] figures 8, 9, and 10.

7. FITTINGS — INSULATION APPLICATION

[illegible] welded and screwed fittings shall be insulated [illegible] insulation snugly fitted to the surface

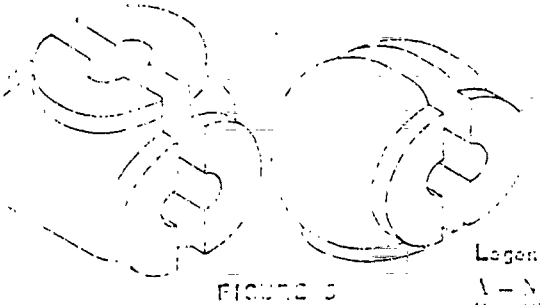
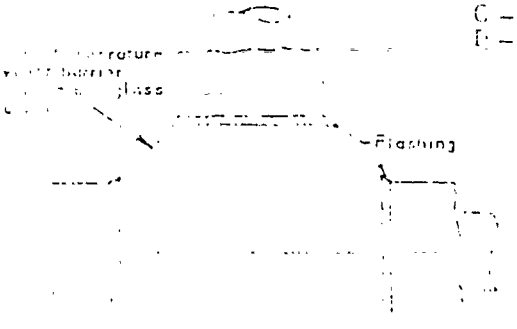


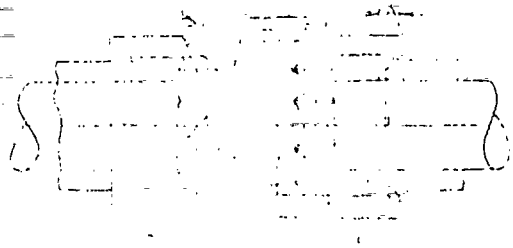
FIGURE 8

FIGURE 9

Legend Figures 8 and 9

A — Not less than 2 in [illegible]
B — Clearance to remove bolts [illegible]
C — [illegible]
D — [illegible] over [illegible] 6-inch centers





DUP 1012123

DU 053417

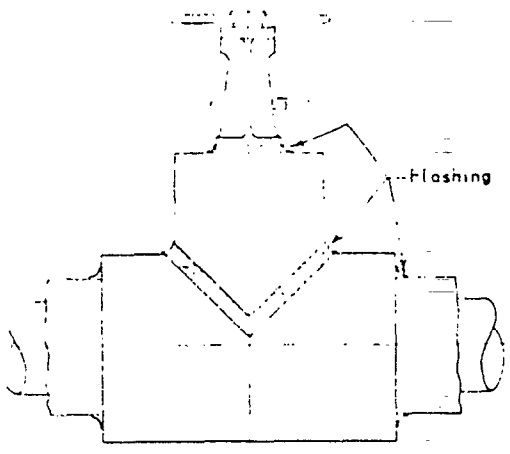


FIGURE 10

7.3 Line flanges shall be insulated with block or pipe insulation equal in thickness to the adjacent pipe insulation. The length to be in accordance with Figure 11 and Table 2.

7.4 The insulation of all screwed, welded, and flanged fittings, valves, and line flanges shall be made in sections so as to be readily applied.

7.5 Each half of the insulation cover shall be applied to the pipe using an adhesive, coating the full contact faces of the insulation, and secured with wires or bands as covered by Table 1.

7.6 All voids between the insulation and the fittings or valves shall be filled with Code 110, Granulated Cork fill material.

7.7 All chipped edges, cracks or imperfections shall be filled in and smoothed with Seam Filler, Code 999.

8. FITTINGS – FINISH APPLICATION

8.1 Finish shall consist of two coats, totaling 3/16 inch sprayed or hand-applied Low-Temperature Vapor Barrier Mastic, Code 709, to provide a uniform protective coating of 1/8 inch minimum thickness when dry. After the first coat of Low-Temperature Vapor Barrier Mastic has been applied, Glass Cloth, Code 710, or "Raymesh," Code 717, shall be embedded in it, and a second coat shall applied over the cloth.

9. FLASHING

9.1 Flashing Compound, Code 807, shall be applied at all possible sources of moisture penetration such as the intersections of insulation at piers, nozzles, building walls, valve bonnets, supports, hangers, and other parts protruding through the surface of the finish. Prior to application, wipe down surfaces of talc-coated felts or other dusty surfaces with a damp cloth and allow to dry to gain maximum adhesion. The Flashing Compound, Code 807, shall be applied to provide a watershed in a 1/4-inch coating extending over all intersecting surfaces without feathering of edges. See Figures 6, 7, and 10.

TABLE 1

WIRES AND BANDS					
Pipe Insulation Diameter (in.)		920 Series Stainless Steel	930 Series Metal		
Minimum	Maximum				
–	6¼	921	931		
Over 6¼	12¾	922	932		
13	–	926	936		

LENGTH OF 1-INCH NOMINAL THICKNESS INSULATION COVERS FOR LINE FLANGES

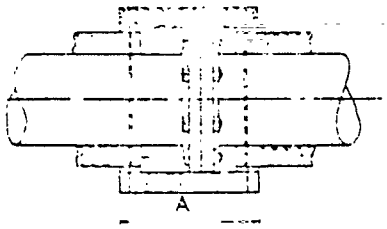


FIGURE 11

TABLE 2

Nominal Pipe Size (inches)	Length A (in.) Flanges									
	150-lb.		300-lb.		600-lb.		900-lb.		1500-lb.	
	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD
½	9	3½	9	3¾	12	3¾	12	4¾	12	4¾
¾	9	3⅞	9	4⅝	12	4⅝	12	5⅛	12	5⅛
1	9	4¼	9	4⅞	12	4⅞	12	5⅞	12	5⅞
1¼	9	4⅝	9	5¼	12	5¼	12	6¼	12	6¼
1½	9	5	9	6⅛	12	6⅛	18	7	18	7
2	9	6	9	6½	12	6½	18	8½	18	8½
2½	9	7	12	7½	12	7½	18	9⅝	18	9⅝
3	12	7½	12	8¼	12	8¼	18	9½	18	10½
3½	12	8½	12	9	18	9	-	-	-	-
4	12	9	12	10	18	10¾	18	11½	18	12¼
5	12	10	12	11	18	13	18	13¾	24	14¾
6	12	11	12	12½	18	14	18	15	24	15½
8	12	13½	18	15	18	16½	24	18½	24	19
10	12	16	18	17½	24	20	24	21½	30	23
12	12	19	18	20½	24	22	24	24	36	26½
14 OD	18	21	18	23	24	23¾	24	25¼	36	29½
16 OD	18	23½	18	25½	24	27	24	27¾	36	32½
18 OD	18	25	18	23	24	29¼	30	31	-	-
20 OD	18	27½	18	30½	24	32	30	33¾	-	-
24 OD	18	32	24	36	30	37	36	41	-	-

1. [illegible]

[illegible]

2. [illegible]

2.1 [illegible] shall be in accordance with the [illegible] following [illegible]

2.2 Basic insulation materials — [illegible]

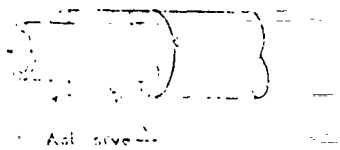
[illegible] — Vegetable Cork

2.3 [illegible]

[illegible] — Granulated Cork
[illegible] — Lowe[illegible] Vapor Barrier Mastic
[illegible] — [illegible]
[illegible] — Seam Filler
[illegible] — Water-Resistant Adhesive — Rubber* Base — [illegible] Viscosity
Code 610 — Water-Resistant Adhesive — Rubber* Base — Low Viscosity
Code 611 — Water-Resistant Adhesive — Asphalt* Base
Code 9[illegible] Series — Stainless Steel Wires and Bands*
Code 930 Series — "Monel" Wires and Bands*
Code 950 Series — Copper Wire General*
Code [illegible] — Skewers

3. PIPE — INSULATION APPLICATION

3.1 Pipe insulation shall be applied snugly on pipe with joints tightly butted together. All pipe insulation shall be applied in a single thickness.



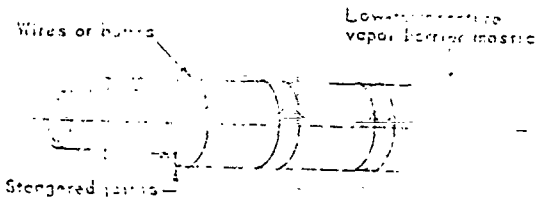
Adjacent [illegible]

FIGURE 1

3.2 [illegible] pipe insulation shall be applied with longitudinal joints vertical whenever possible. [illegible] joints shall be staggered [illegible] Figure 2. Each section shall be coated with an adhesive [illegible] Figure 1. The insulation shall be held firmly in [illegible]

4. [illegible]

4.1 The insulation shall be applied to the pipe and [illegible] Figure 1. The [illegible] shall be applied with at least [illegible] separate [illegible] wire, and hammered into the insulation. These shall be applied [illegible] section of insulation, [illegible] and held with [illegible] and seams. See Figure 2.



ELEVATION VIEW
FIGURE 2

5. INSULATION AT PIPE HANGERS

5.1 Pipe hangers shall not be attached to the pipe but shall be placed over the insulation and have a protective finish as shown in Figure 3.

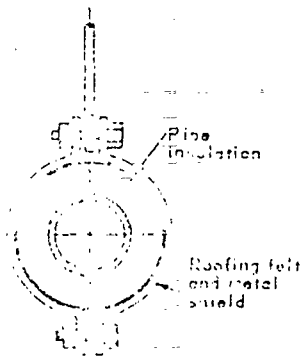


FIGURE 3

[illegible]

[illegible]

DUP 1012126

DU 053420

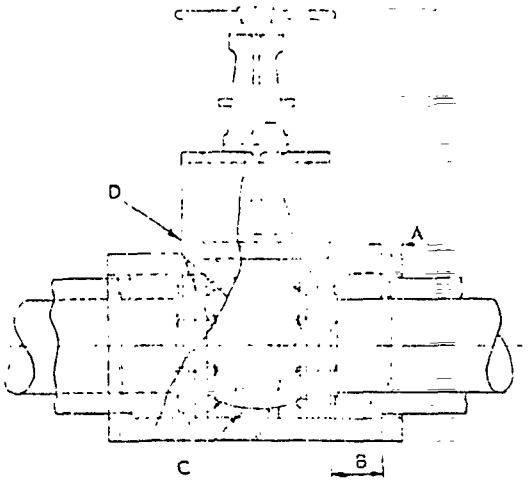


FIGURE 9

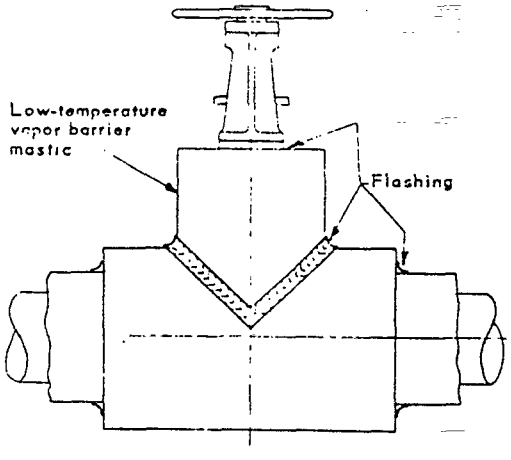


FIGURE 10

7.3 Line flanges shall be insulated with block or pipe insulation equal in thickness to the adjacent pipe insulation. The length to be in accordance with Figure 11 and Table 2.

7.4 The insulation of all screwed, welded, and flanged fittings, valves, and line flanges shall be made in sections so as to be readily applied.

7.5 Each half of the insulation cover shall be applied to the pipe using an adhesive, coating the full contact faces of the insulation, and secured with wires or bands as covered by Table 1.

7.6 All voids between the insulation and the fittings or valves shall be filled with Code 110, Granulated Cork Fill Material.

7.7 All chipped edges, cracks, or imperfections shall be filled in and smoothed with Seam Filler, Code 808.

8. FITTINGS – FINISH APPLICATION

8.1 Finish shall consist of one coat, totaling 3/16 inch, sprayed or hand applied, Low-temperature Vapor Barrier Mastic, Code 709, to provide a uniform protective coating of 1/8 inch minimum thickness when dry.

9. FLASHING

9.1 Flashing Compound, Code 807, shall be applied at all possible sources of moisture penetration such as the intersections of insulation at piers, nozzles, building walls, valve bonnets, supports, hangers, and other parts protruding through the surface of the finish. Prior to application, wipe down surfaces of talc-coated felts or other dusty surfaces with a damp cloth and allow to dry to gain maximum adhesion. The Flashing Compound, Code 807, shall be applied to provide a watershed in a 1/4-inch coating extending over all intersecting surfaces without feathering of edges. See Figures 6, 7, and 10.

TABLE 1

WIRES AND BANDS					
Pipe Insulation Diameter (in.)		920 Series Stainless Steel	930 Series Monel		
Minimum	Maximum				
–	6¼	921	931		
Over 6¼	12¾	922	932		
13	–	923	933		

LENGTH OF 1-INCH NOMINAL THICKNESS INSULATION COVERS FOR LINE FLANGES

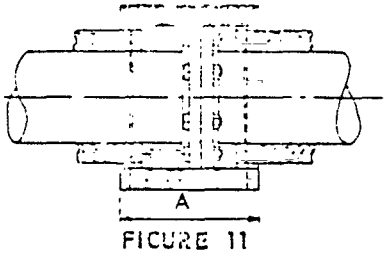


FIGURE 11

TABLE 2

Nominal Pipe Size (inches)	Length A (in.)									
	Flanges									
	150-lb.		300-lb.		600-lb.		900-lb.		1500-lb.	
	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD	A	Flange OD
½	9	3½	9	3¾	12	3¾	12	4¾	12	4¾
¾	9	3⅞	9	4⅝	12	4⅝	12	5⅛	12	5⅛
1	9	4¼	9	4⅞	12	4⅞	12	5⅞	12	5⅞
1¼	9	4⅝	9	5¼	12	5¼	12	6¼	12	6¼
1½	9	5	9	6⅛	12	6⅛	18	7	18	7
2	9	6	9	6½	12	6½	18	8½	18	8½
2½	9	7	12	7½	12	7½	18	9⅝	18	9⅝
3	12	7½	12	8¼	12	8¼	18	9½	18	10½
3½	12	8½	12	9	18	9	-	-	-	-
4	12	9	12	10	18	10¾	18	11½	18	12¼
5	12	10	12	11	18	13	18	13¾	24	14¾
6	12	11	12	12½	18	14	18	15	24	15½
8	12	13½	18	15	18	16½	24	18½	24	19
10	12	16	18	17½	24	20	24	21½	30	23
12	12	19	18	20½	24	22	24	24	36	26½
14 OD	18	21	18	23	24	23¾	24	25¼	36	29½
16 OD	18	23½	18	25½	24	27	24	27¾	36	32½
18 OD	18	25	18	28	24	29¼	30	31	-	-
20 OD	18	27½	18	30½	24	32	30	33¾	-	-
24 OD	18	32	24	36	30	37	36	41	-	-

1. SCOPE

[illegible] application of molded [illegible] applied [illegible] Canvas [illegible] equipment [illegible]

2. MATERIALS

2.1 All materials shall be in accordance with the [illegible] Section of the Standard Engineering Specifications [illegible]

2.2 Basic Insulation Materials – Molded

Code 101 – 85% Magnesia
and over
Code 103 – Diatomaceous Earth

2.3 Basic Insulation Materials – Fluid and Plastic

Code 702 – Insulation Cement

2.4 Accessory Materials

Code 704 – 8-oz. Canvas
Code 712 – Finish Cement
Code 714 – Poultry Netting
Code 802 – Lagging Adhesive
Code 920 Series – Stainless Steel Wires and Bands *
Code 930 Series – Monel Wires and Bands *
Code 964 – Spindle Anchors
Code 965 – Hardware Cloth

3. CURVED OR CYLINDRICAL EQUIPMENT – INSULATION APPLICATION

3.1 Insulation on equipment shall be applied snugly with joints tightly butted together. Two layers are required: the first Code 103, and the Second Code 101.

3.2 The first or inner layer of curved block, or segmental block insulation, Code 103, shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer, Code 101, shall be applied so that all joints are staggered with the first layer and tightly butted together. Bands shall be placed over second layer of block approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 702. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laid into place, see Figure 1.

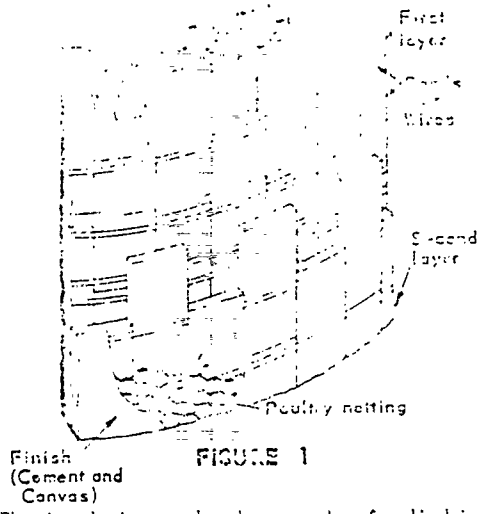


FIGURE 1

3.3 The insulation on heads or ends of cylindrical equipment shall be secured by tight bands, that are not over 4 inches apart and fastened to clips, angle iron bands or steel bands and circling the tank behind the rivet heads or circumferential head weld. See Figure 2. The insulation on the head of

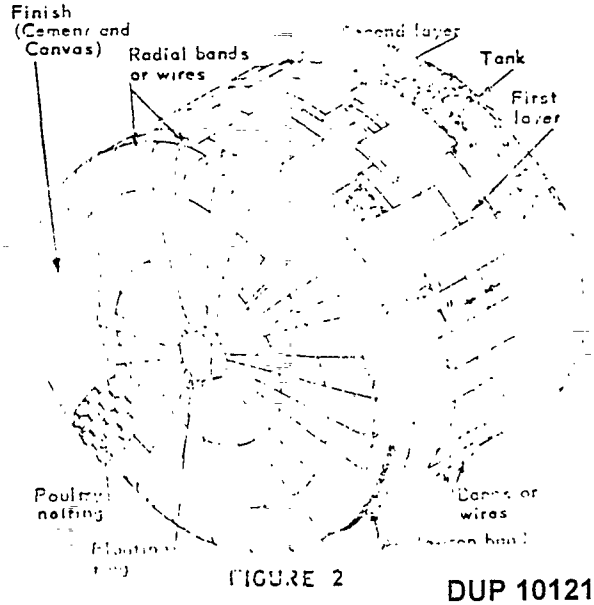


FIGURE 2

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* Sizes – See Table 1, Bands

DU 053423

[illegible] be applied [illegible] with joints [illegible].

[illegible] be applied [illegible] joints [illegible] and lateral joints staggered. [illegible] placed over [illegible] approximately [illegible] providing [illegible] for each 36-inch length of insulation. [illegible] the blocks must be [illegible] bands fastened to the clips that are [illegible] on the metal surfaces. For either vertical [illegible] horizontal surfaces facing up, the bands shall be spaced at 2-foot intervals. For horizontal surfaces facing down, the bands shall be spaced at [illegible] intervals. At square corners of insulation [illegible] metal corner angles or shields shall be placed under the bands to prevent cutting [illegible] insulation shall be applied [illegible] single layer with all joints tightly butted together. [illegible] insulation shall be applied over the first layer of Code 103 insulation with lateral [illegible] joints staggered with those of the [illegible] layer. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation [illegible]. Over the insulation and bands [illegible] Code 714, drawn tight and [illegible] as shown in Figure 3.

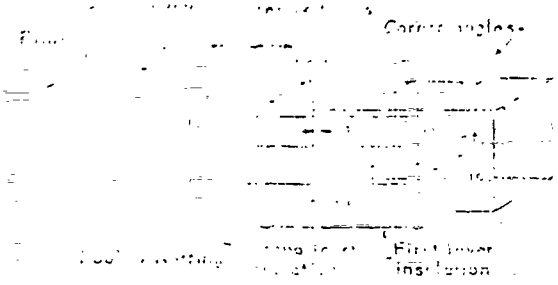

FIGURE 3

[illegible] specification, [illegible] anchors [illegible] welded [illegible] See Figure 4.

[illegible] rods, rails, or bars may be [illegible] to the metal surfaces of [illegible] ONLY with the written [illegible] construction and The Ind. Dept.

[illegible] is not specified under project or job specification index, the application [illegible] most economical or convenient [illegible] However, written approval of [illegible] must be obtained as outlined in paragraph 4.4.

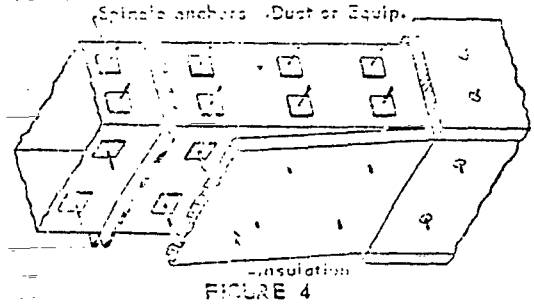

FIGURE 4

5. FINISH

5.1 Finish shall consist of 1/4 inch Finish Cement, Code 712, troweled smoothly over insulation, bands, and Poultry Netting. See Figures 1, 2, and 3.

5.2 After the Finish Cement has dried, 8-ounce canvas shall be securely drawn over the finish and shall have the laps sealed with Lagging Adhesive, Code [illegible].

TABLE 1 – BANDS

Distance Around Outside Surface of Insulation		920 Series Stainless Steel	920 Series Monel		
Minimum (Ft.)	Maximum (Ft.)				
[illegible]	[illegible]	[illegible]	922		
[illegible]	8	924	924		
[illegible]		9[illegible]	[illegible]		

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[illegible]

[illegible] — Asbestos Cloth

2.3 Flexible Insulation Materials — Fluid and Plastic

[illegible] — Insulation Cement

[illegible] Adhesives

[illegible] — Wire Cement

Code 714 — Poultry Netting

Code [illegible] — Fibrous Adhesive

Code [illegible] — Adhesive

Code 815 — Adhesive

Code 816 — Adhesive

Code 817 — Adhesive

Code 900 Series — Stainless Steel Wires and Bands*

Code 900 Series — "Monel" Wires and Bands*

Code 964 — Spindle Anchors

Code 965 — Hardware Cloth

3. CURVED OR CYLINDRICAL EQUIPMENT – INSULATION APPLICATION

3.1 Insulation on equipment shall be applied snugly with joints tightly butted together. Insulation 2½ inches or less in thickness shall be applied in a single layer except where the 2½-inch thickness will not readily conform to the surface being insulated. In such case, more than one layer may be used. Insulation over 2½ inches in thickness shall be double-layer construction.

3.2 Single-layer Construction. Single-layer block, curved, or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place. See Figure 1.

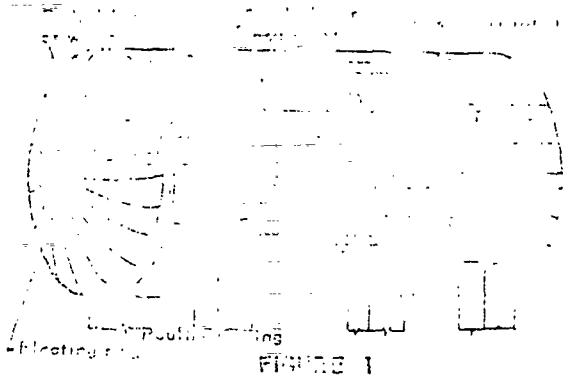

FIGURE 1

3.3 Double-layer Construction. The first or inner layer of curved block, or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over block approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer shall be applied so that all joints are staggered with the first layer and tightly butted together. Bands shall be placed over second layer of blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place. See Figure 2.

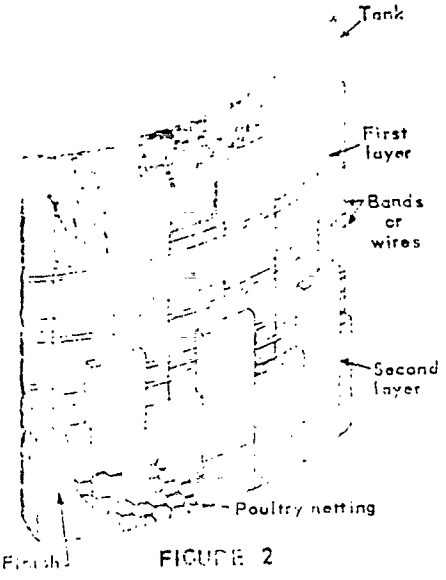

FIGURE 2

Vendors and merchandise designations are given to describe materials [illegible] the order by indicating the use of this specification.

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*Selection specified on project or job specification [illegible] See Table 1, Bands

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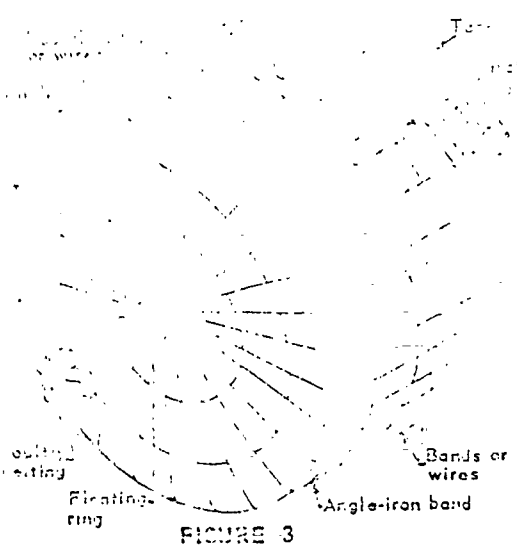

FIGURE 3

4. PLAIN OR SPIN-ANCHORED EQUIPMENT – INSULATION APPLICATION

.1 Insulation shall be applied snugly with joints [illegible]. The thickness of insulation shall be in accordance with paragraph 3.1.

.2 Block insulation shall be applied with joints [illegible] and longitudinal joints staggered. [illegible] shall be placed over blocks approximately [illegible] from each end of each block, thus providing [illegible] for each 36-inch length of insulation. [illegible] blocks may be [illegible] are tacked [illegible] surfaces. For [illegible] vertical surfaces [illegible] surfaces facing up, the bands shall

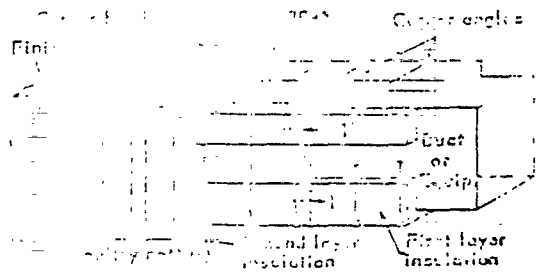

FIGURE 4

4.3 When specified on project or job specification, the [illegible] may be equipped by Spindle Anchors. Code [illegible], applied to the metal surface by cementing, welding, or spot-welding. See Figure 5.

4.4 Spindle Anchors, clips, rods, or bars may be welded or spot-welded to the metal surfaces of equipment or duct work ONLY with the written approval of Design, Construction and The Ind. Dept.

4.5 When the method of fastening is not specified on the project or job specification index, the applicator may choose the most economical or convenient method. However, written approval of welded fasteners must be obtained as outlined in paragraph 4.4.

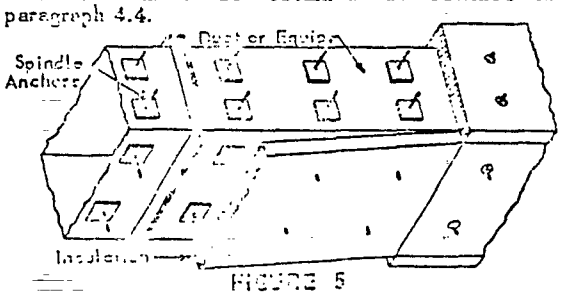

FIGURE 5

5. FINISH

5.1 Finish shall consist of ¼-inch Finish Cement, Code 712, troweled smoothly over insulation, bands, and Poultry Netting. See Figures 1, 2, 3, and 4.

TABLE 1 – [illegible]

Distance Around Outside of Insulation (Inches)		520 Stainless Steel	530 Steel		
Minimum (Inches)	Maximum (Inches)				
[illegible]	4	[illegible]	[illegible]		
4	8	[illegible]	[illegible]		
[illegible]	[illegible]	[illegible]	[illegible]		
2	[illegible]	[illegible]	[illegible]		

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[illegible]

[illegible]

[illegible] – Felt and Plastic

[illegible]

[illegible]

[illegible]

[illegible] – Adhesive

[illegible] – Stainless Steel Wires and Bands *

[illegible] – [illegible] Wires and Bands *

[illegible]

Code [illegible] – Hardware Cloth

3. CURVED OR CYLINDRICAL EQUIPMENT – INSULATION APPLICATION

3.1 Insulation on equipment shall be applied snugly with joints tightly butted together. Two layers are required; the first, Code 103, and the second, Code [illegible].

3.2 The first or inner layer of curved block, or segment of block insulation, Code 103, shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer, Code 101, shall be [illegible] and the joints are staggered with the first layer and tightly butted together. Bands shall be placed over the outer layer of block approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 702. Over the insulation and bands apply [illegible] Code 116, drawn tight and laced [illegible] See Figure 1.

* [illegible] specification

[illegible] See Table 1, Bands.

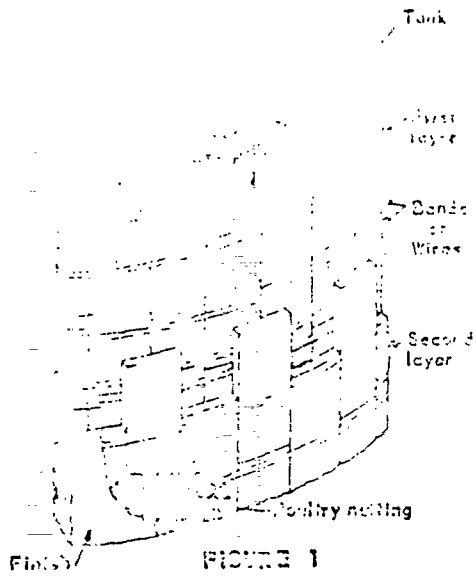

FIGURE 1

3.3 The insulation on heads or ends of cylindrical equipment shall be secured by tight bands that are not over 4 inches apart and fastened to clips, angle iron bands or steel bands encircling the tank behind the rivet heads or circumferential head weld. The insulation on the head of cylindrical tank shall be held in place at the center of the heads by radial

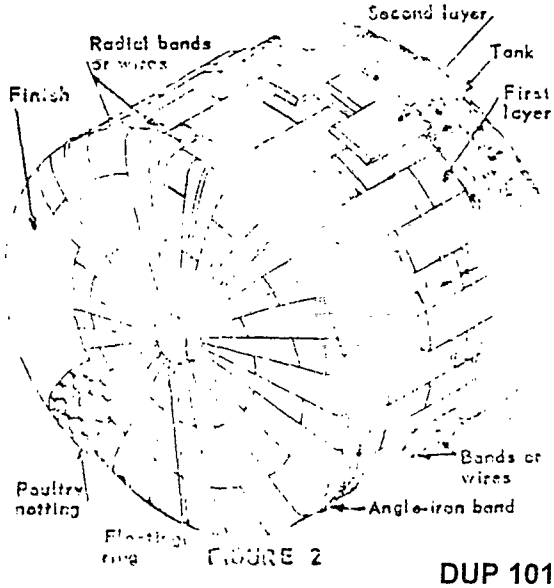

FIGURE 2

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[illegible] joints [illegible] together. All [illegible] first [illegible] of the first layer. All [illegible] Over [illegible] into place. See [illegible]

[illegible] APPLICATION

[illegible] applied snugly with joints [illegible].

[illegible] applied with joints [illegible] joints staggered. [illegible] approximately [illegible] block, thus providing [illegible] of insulation. [illegible] the blocks may be supported by bands fastened to the clips that are [illegible] surfaces. For either vertical [illegible] surfaces holding up the bands shall be spaced at 2-foot intervals. For horizontal surfaces facing down, the bands shall be spaced at 1-foot intervals. At square corners of insulation on flat surfaces, metal corner angles or shields shall be placed under the bands to prevent cutting of insulation. All Code 103 insulation shall be applied in a single layer with all joints tightly butted together. All Code 101 insulation shall be applied over the first layer of Code 103 insulation with lateral and vertical joints staggered with those of the first layer. All chipped edges, cracks and irregularities shall be filled and smoothed with Finish Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn [illegible] See Figure 3.

Corrugated [illegible]

[illegible] Duct [illegible]

[illegible] first layer [illegible] insulation

FIGURE 3

4.3 [illegible] surface of project or [illegible] fabrication [illegible] Spindle anchors, [illegible] be by cementing, welding [illegible] Figure 4.

4.4 [illegible] anchors, clips, rods, or bars may be welded [illegible] surfaces of equipment [illegible] with the written approval of [illegible] the Dept.

4.5 [illegible] the method of fastening is not specified on the project or [illegible] specifications [illegible], the applicator may [illegible] most economical or convenient [illegible] Written approval of welded fastenings must be obtained as outlined in paragraph 4.4.

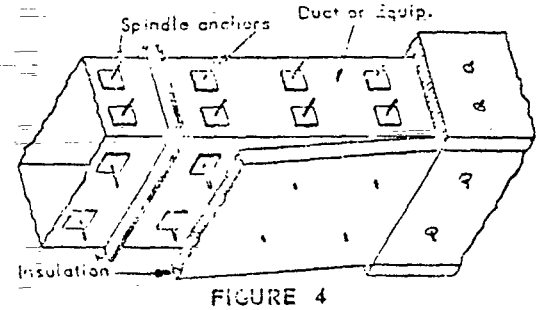

FIGURE 4

5. FINISH

5.1 Finish shall consist of 1/4 inch Finish Cement, Code 712, troweled smoothly over insulation, bands, and Poultry Netting. See Figures 1, 2, and 3.

TABLE 1 – BANDS

Distance Around Outside Surface of Insulation		920 Series	930 Series		
Minimum (Ft.)	Maximum (Ft.)	Stainless Steel	Monel		
[illegible]	4	922	932		
4	[illegible]	926	936		
8	20	927	937		
20	[illegible]	928	[illegible]		

DUP 1012134

DU 053428

E. I. DU PONT DE NEMOURS & COMPANY
INCORPORATED
WILMINGTON, DELAWARE 19898

TEXTILE FIBERS DEPARTMENT

cc: J. A. Sigman
G. E. Lang - Louviers

June 3, 1977

A. F. WELCH - Cape Fear
W. C. LOONEY - Camden
E. L. LONG - Kinston
W. G. ROBERTS - Old Hickory
W. T. SMITH - Martinsville
N. C. HRNJEZ - Seaford
A. V. EPISCOPO - Chestnut Run
E. M. O'DONNELL - Waynesboro
R. P. COON - Cooper River
T. J. HAMPTON - Spruance
J. H. WRIGHT - Chattanooga

- Maint

INSULATION

For your information, I am attaching an article which I consider thought provoking. I suggest routing through Engineering Supervisors, Design, and Power.

ENGINEERING DIVISION

J. G. Plasky
Engineering Assistant

JGP/mhb
Attachment

DUP 1012135

BW 226

DU 053429

L05906

LESSON TEXT

TOPIC: THERMAL INSULATION OF EQUIPMENT AND DUCT WORK

GOALS

A. Mechanic Must Learn:

1. The procedures for applying thermal insulation to equipment and duct work.

B. Mechanic Must Develop These Skills:

1. Installing thermal insulation on equipment and duct work.

MECHANIC MUST ALREADY HAVE

A. Knowledge of:

1. Basic insulation materials.
2. Accessory insulation materials.

B. Skill in:

1. Selecting basic insulation.
2. Selecting insulation accessories.

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APPLICATION PROCEDURES

The procedures for the application of thermal insulation to equipment and duct work define the methods to be observed. Adherence to these procedures will assure quality applications.

Generally each procedure will be presented under the following headings:

1. Scope - tells what the procedure covers.

2. Materials - lists basic and accessory insulation materials included in the procedure.

3. Curved or Cylindrical Equipment - Insulation Application - specifies positioning of insulation and location of wires or bands.

4. Flat or Square Cornered Equipment - Insulation Application - specifies positioning of insulation and location of wires or bands.

5. Finish defines finish to be used and method of application.

6. Flashing - specifies flashing when required.

SAFETY PRECAUTIONS

In addition to observance of standard safety precautions special attention should be given the following:

1. Ladders and Scaffolds

   a. Inspect ladders and scaffolds daily.
   b. Tie ladders as required by plant requirement.
   c. Do not overreach, avoid falls.
   d. In handling insulation materials to work positions, use assistance or handline if necessary.

2. Tools

   a. Cuts from saws and knives.
   b Staplers - observe caution in use.

3. Housekeeping

   a. Store material properly to minimize tripping.
   b. Wipe up spills of accessory materials to reduce slipping hazards.

4. Equipment

   a. Operating equipment - lock out hazardous equipment.
   b. Piping - avoid burns from hot lines.

Bu 681

MISCELLANEOUS METHODS, PROCEDURES, AND DETAILS	THERMAL INSULATION STANDARD ENGINEERING SPECIFICATION	
INSULATING DISHED ENDS OF TANKS AND VESSELS	ISSUED NOV 1956	SN 208 P
	REVISED	Page 1 of 2

1. SCOPE

1.1 This Specification covers suggested application methods for insulating dished ends of tanks and vessels. Details for applying wires and bands are described in the appropriate application Specification.

2. CALCIUM SILICATE, 85 PERCENT MAGNESIA, AND GLASS FIBER BLOCKS

2.1 Calcium silicate, magnesia, or glass fiber should be applied to the dished ends of tanks and vessels in a pattern similar to that shown in Figure 1. Sections 1 and 2 are installed first. The areas are then built up in quarters in the order shown in Figure 1. Full length blocks are used where possible. When applying magnesia or calcium silicate, a wooden mallet should be used to make the material conform to the curvature of the vessel. Wires and bands must be drawn tightly as shaping progresses. If a second layer is required, it shall be applied by rotating joints 45 degrees so that all joints are staggered with the first layer. All chipped edges, cracks, or imperfections shall be filled in smoothly with Insulating Cement, Code 502 or 502.1.

2.2 Figure 1 pattern can be used for flat heads installed on vessels 30 inches and smaller by extending shell insulation and filling voids with insulation or insulation cement.

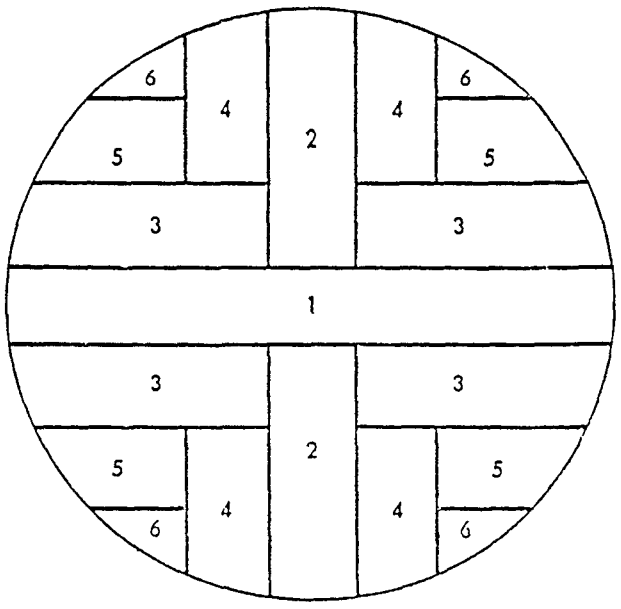

FIG 1

Calcium Silicate or 85% Magnesia

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DU 053432

3. CORK

3.1 Cork should be applied to the dished ends of tanks and vessels in a pattern similar to that shown in Figure 2. Sections 1 and 2 are installed first. The areas are then built up in quarters in the order shown in Figure 2. Full length blocks are used where possible. Blocks must be carefully mitered together to insure a close fit. Each block shall be coated with an adhesive on all contact surfaces with the insulation and equipment. All chipped edges, cracks, or imperfections shall be smoothed with Seam Filler, Code 808. Upon completion of the application, all wires or bands should be checked for tightness and drawn up where necessary. Subsequent layers are applied in the same manner except that all joints are staggered with the preceding layer.

3.2 Figure 1 pattern can be used for flat insulation heads installed on vessels 30 inches and smaller by extending shell insulation and filling joint voids with Seam Filler, Code 808.

4. CELLULAR GLASS

4.1 Cellular glass should be applied to the dished ends of tanks and vessels in a pattern similar to that shown in Figure 3. Blocks must be cut to conform to the curvature of the tanks and carefully mitered together with butt joints staggered. Blocks are built out radially from the circular piece shown as 1 in Figure 3. Each block shall be coated with an adhesive on all contact surfaces with the insulation and the equipment. All chipped edges or imperfections shall be smoothed with Seam Filler, Code 808. Upon completion of the application, all bands should be checked for tightness and drawn up where necessary. Subsequent layers are applied in the same manner except that all joints are staggered with the preceding layer.

4.2 Figure 1 pattern can be used for flat insulation heads installed on vessels 30 inches and smaller by extending shell insulation and filling joint voids with Seam Filler, Code 808.

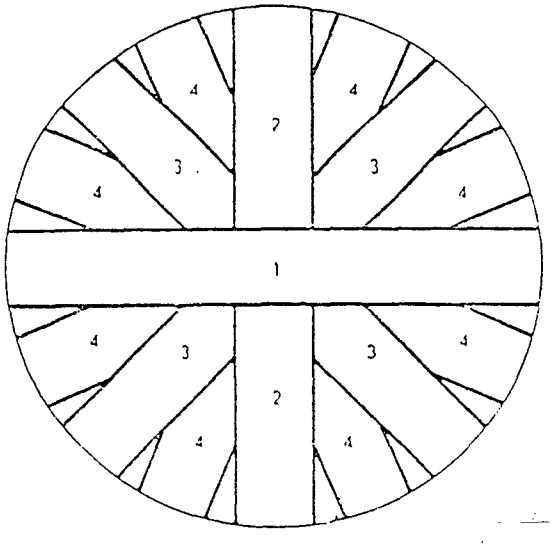

FIG 2

Cork

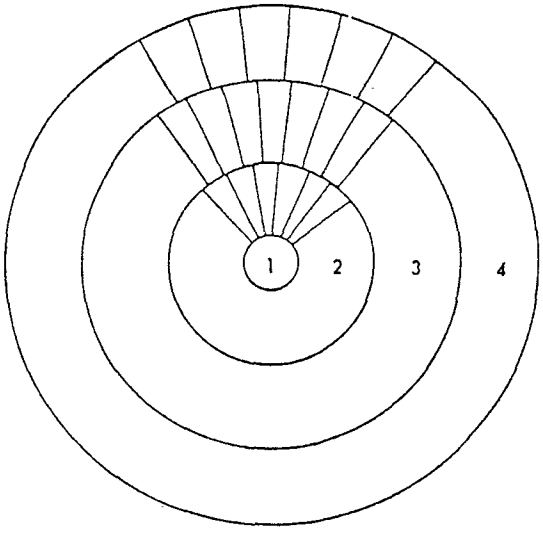

FIG 3

Foamglas

L05906

APPLICATION SERIES 100 – EQUIPMENT AND DUCT WORK FIELD-APPLIED HIGH-TEMPERATURE BREATHING MASTIC FINISH	THERMAL INSULATION STANDARD ENGINEERING SPECIFICATION	
	ISSUED NOV 1934	SN 100.64 A
	REVISED DEC 1959	Page 1 of 3

1. SCOPE

1.1 This Specification covers application of Molded Block Insulation with Field Applied High-temperature Breathing Mastic Finish on equipment and duct work.

2. MATERIALS

2.1 All materials shall be in accordance with the SN–M Section of the Standard Engineering Specifications governing.

2.2 Basic Insulation Materials – Molded*

Code 101 – 85% Magnesia
Code 102 – Calcium Silicate
Code 103 – Diatomaceous Earth
Code 104 – Inorganic Silicas and Asbestos Fiber
Code 106 – Asbestos and Diatomaceous Earth Molded
Code 107 – Asbestos Sponge
Code 109 – Corrugated Asbestos Preshrunk
Code 112.61 or Code 112.66 – Glass Fiber †
Code 114 – Mineral Wool (block only)

2.3 Basic Insulation Materials – Fluid and Plastic

Code 502* – Insulation Cement
Code 502.1 – Insulation and Finishing Cement (Limited to 800° F)

2.4 Accessory Materials

Code 706 – High-temperature Breathing Mastic
Code 706.1 – High-temperature Breathing Mastic (Cutback)
Code 707 – Insulation Primer Paint
Code 803 – Fibrous Adhesive
Code 807 – Flashing Compound
Code 920 Series – Stainless Steel Wires and Bands*
Code 930 Series – "Monel" Wires and Bands*
Code 934 – Spindle Anchors
Code 714 – Poultry Netting

3. CURVED OR CYLINDRICAL EQUIPMENT – INSULATION APPLICATION

3.1 Insulation on equipment shall be applied snugly with joints tightly butted together. Insulation 2½ inches or less in thickness shall be applied in a single layer except where the 2½-inch thickness will not readily conform to the surface being insulated. In such case, more than one layer may be necessary. Insulation over 2½ inches in thickness shall be double-layer construction.

3.2 Single-layer Construction. Single-layer block, curved, or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place. See Figure 1.

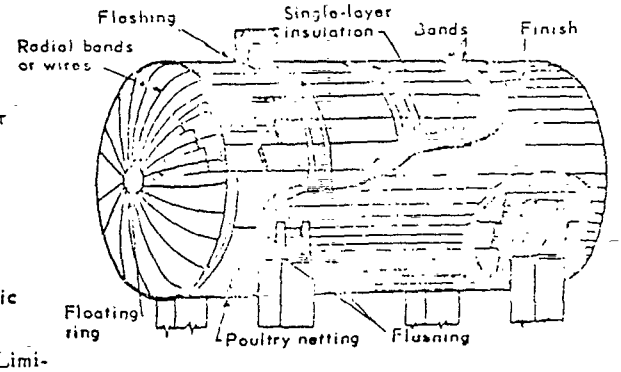

FIGURE 1

3.3 Double-layer Construction. The first or inner layer of curved block, or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer shall be applied so that all joints are staggered with the first layer and tightly butted together. Bands shall be placed over second layer of blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place. See Figure 2.

*Where Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed 800 degrees F.

*Selection specified on project or job specification index.

Sizes – See Table 1, Bands.

Vendors and merchandise designations are given to describe materials and may not include all acceptable products. Substitutions are to be made only on approval of the authority initiating the use of this Specification.

DUP 1012140

SUBCOMMITTEE NO 28

† Installation economies should be considered when selecting the optimal board or block type.

BLU 686

DU 053434

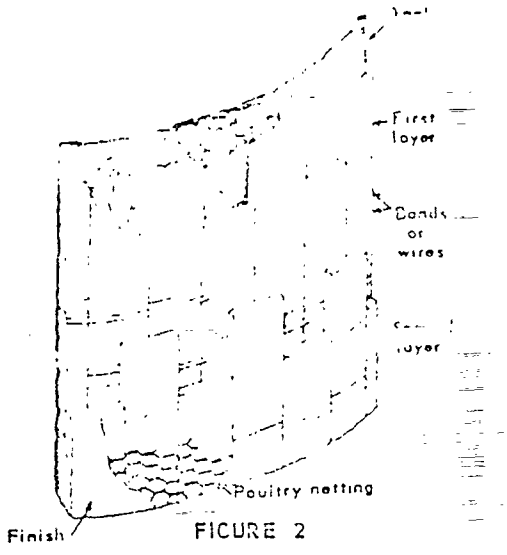

FIGURE 2

3.4 The insulation on heads or ends of cylindrical equipment shall be secured by tight bands or wires that are not over 4 inches apart and fastened to clips, angle iron bands or steel bands encircling the tank behind the rivet heads or circumferential head weld. See Figure 3. The insulation on the cylindrical tank shall be held in place at the center of the heads by radial wires or bands fastened to clips or a floating ring. Fibrous Adhesive, Code 803, can be used to support insulation on overhead surfaces until bands or wires can be applied. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place.

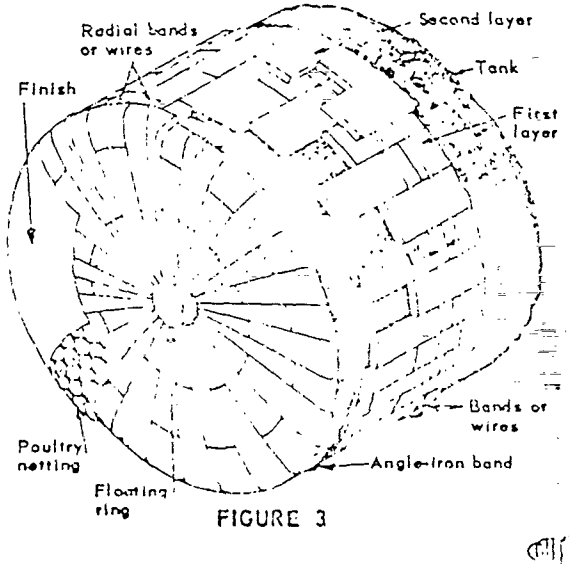

FIGURE 3

4. FLAT OR SQUARE-CORNERED EQUIPMENT – INSULATION APPLICATION

4.1 Insulation shall be applied snugly with joints tightly butted together. Thickness of insulation shall be in accordance with paragraph 3.1.

4.2 Block insulation shall be applied with joints tightly butted together and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each [illegible] length of insulation. Where welding is permissible, the blocks may be supported by bands fastened to clips that are tacked on the metal surfaces. For either vertical surfaces or horizontal surfaces facing up, the bands shall be spaced at 2-foot intervals. For horizontal surfaces facing down, the bands shall be spaced at 1-foot intervals. At square corners of insulation of flat surfaces, metal corner angles or shields shall be placed under the bands to prevent cutting of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. Over the insulation and bands apply Poultry Netting, Code 714, drawn tight and laced into place. See Figure 4.

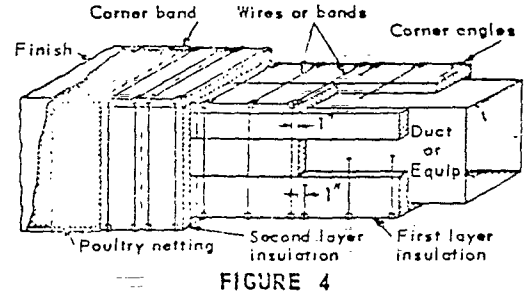

FIGURE 4

4.3 When specified on project or job specification, the blocks may be supported by Spindle Anchors, Code 964, applied to the metal surface by cementing, welding, or spot-welding. See Figure 5.

4.4 Spindle anchors, clips, rods, or bars may be welded or spot-welded to the metal surfaces of equipment or duct work ONLY with the written approval of Design, Construction and The Ind. Dept.

4.5 When the method of fastening is not specified on the project or job specification index, the applicator may choose the most economical or convenient method. However, written approval of welded fastenings must be obtained as outlined in paragraph 4.4.

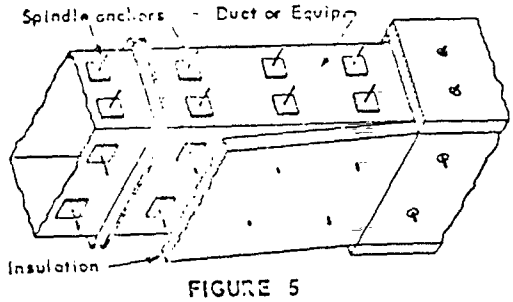

FIGURE 5

5. FINISH

5.1 Finish shall consist of a prime coat of Insulation Primer Paint, Code 707, applied by brushing or spraying over the insulation, bands, and Poultry Netting. (Primer can be eliminated over Code 112 material.) Trowel over the entire surface of the insulation, bands, and Poultry Netting two 1/4-inch coats of High-temperature Breathing Mastic, Code 706, to achieve a minimum 1/4-inch thickness when dry.

6. FLASHING

6.1 Flashing Compound, Code 807, shall be applied at all possible sources of moisture penetration such as the intersections of insulation at piers, nozzles, building walls, valve bonnets, supports, hangers, and other parts protruding through the surface of the finish. Prior to application, wipe down surfaces of talc-coated felts or other dusty surfaces with a damp cloth and allow to dry to gain maximum adhesion. The Flashing Compound, Code 807, shall be applied to provide a watershed in a 1/4-inch coating extending over all intersecting surfaces without feathering of edges. See Figure 1.

TABLE 1 - BANDS

Distance Around Outside Surface of Insulation		920 Series	930 Series		
Minimum (Ft.)	Maximum (Ft.)	Stainless Steel	Monel		
	4	922	932		
4	8	926	936		
8	20	927	937		
20		928	938		

DUP 1012142

DU 053436

APPLICATION SERIES 100 EQUIPMENT AND DUCT WORK DUAL-TEMPERATURE INSULATION REINFORCED VAPOR-BARRIER FINISH	THERMAL INSULATION STANDARD ENGINEERING SPECIFICATION	
	ISSUED MARCH 1959	SN 100.65 A
	REVISED	Page 1 of 2

1. SCOPE

1.1 This Specification covers the application of insulation for dual-temperature services of equipment and duct work with field-applied reinforced low-temperature vapor-barrier mastic finish.

2. MATERIALS

2.1 All materials shall be in accordance with the SN-M Section of the Standard Engineering Specifications governing.

2.2 Basic Insulation Materials – Molded

Code 111 – Cellular Glass

2.3 Accessory Materials

Code 206 – Glass Fiber Blanket (1-pound density and 1 inch thickness)
Code 709 – Vapor-Barrier Mastic
Code 710 – Glass Cloth
Code 714 – Poultry Netting
Code 717 – "Raymesh" Cloth
Code 724 – Asbestos Paper (1/8 inch thick, 64 pounds per 100 square feet)
Code 807 – Flashing Compound
Code 808 – Seam Filler
Code 811 – Water-Resistant Adhesive
Code 920 Series – Stainless Steel Bands

3. EQUIPMENT – APPLICATION

3.1 Insulation support angle iron bands shall be placed on all equipment at the knuckle weld. In addition, insulation support angle iron bands shall be placed on all vertical tanks on 18-foot centers. The leg of the angle iron bands shall be 1/2 inch less than the total thickness of the insulation.

3.2 For all dual-temperature services, the surface of the equipment shall be free of rust, dirt, and other foreign matter. The surface of the equipment shall be given a coat of Code 811, Water-Resistant Adhesive. For all surfaces, except the top half of the cylindrical surface on horizontal tanks, apply Code 206, Glass Fiber Blanket, into the mastic while it is still tacky. The glass fiber blanket shall not be lapped but shall be cut neat and the ends butted together. For the top half of the cylindrical surface on horizontal tanks, apply asbestos paper, Code 724, to the mastic while it is still tacky.

3.3 The glass fiber blanket shall completely cover all parts of the equipment except those surfaces covered with asbestos paper. The blanket shall be carried over brackets, supporting angles, nipples, and all other parts protruding into the insulation including parts protruding from surfaces covered with asbestos paper so that there is no contact between the foam glass and metal.

3.4 Poultry netting, Code 714, shall be applied over the glass fiber blanket or asbestos paper, pulled tight and laced. Over this, apply a thin coat of Code 811, Water-Resistant Adhesive (approximately two gallons per 100 square feet).

3.5 Apply Cellular Glass, Code 111, insulation over coated glass blanket or asbestos paper and poultry netting. The cellular glass blocks shall be applied with a joint stagger. Each segment of foam glass shall be coated with Code 811, Water-Resistant Adhesive, on all contact surfaces with the insulation and the coated glass fiber blanket, and shall be held firmly in place by bands. All chipped edges, cracks, and imperfections shall be filled in and smoothed with Seam Filler, Code 808.

4. BANDS

4.1 A band shall be placed over the foam glass blocks approximately 1 inch from each end of each block, thus providing 4 bands for each 18-inch length of insulation.

5. FINISH

5.1 Apply 1/16-inch spray or hand-applied layer of Vapor-Barrier Mastic, Code 709. Into this layer, embed Glass Cloth, Code 710, or "Raymesh" Cloth, Code 717. Apply a second coat of Vapor-Barrier Mastic, Code 709, over the reinforcing to a thickness of approximately 1/8 inch, totaling 3/16 inch wet or 1/8 inch dry vapor-barrier finish.

6. FLASHING

6.1 Flashing Compound, Code 807, shall be applied at all possible sources of moisture penetration such as the intersections of insulation at piers, nozzles, building walls, valve bonnets,

Vendors and merchandise designations are given to describe materials and may not include all acceptable products. Substitutions are to be made only on approval of the authority initiating the use of this Specification.

supports, hangers, and other parts protruding through the surface of the finish. The Flashing Compound, Code 807, shall be applied to provide a watershed in a 1/4-inch coating extending over all intersecting surfaces without feathering of edges.

TABLE 1 - BANDS

Distance Around Outside Surface of Insulation		920 Series Stainless Steel		
Minimum (Ft)	Maximum (Ft)			
	4	922		
4	8	926		
8	20	927		
20		928		

APPLICATION	THERMAL INSULATION STANDARD ENGINEERING SPECIFICATION	
SERIES 100 – EQUIPMENT AND DUCT WORK	ISSUED NOV 1954	SN 100.68 A
FIELD-APPLIED ALUMINUM JACKETS WITH MASTIC FLASHING	REVISED MAY 1959	Page 1 of 4

1. SCOPE

1.1 This Specification covers application of Molded Block Insulation with Field-Applied Aluminum Jacket on equipment and duct work.

2. MATERIALS

2.1 All materials shall be in accordance with the SN–M Section of the Standard Engineering Specifications governing.

2.2 Basic Insulation Materials – Molded*

Code 102 – Calcium Silicate
Code 104 – Inorganic Silicas and Asbestos Fiber
Code 106 – Asbestos and Diatomaceous Earth Molded
Code 112.61 – Glass Fiberboard, Plain †
Code 112.66 – Glass Fiber Block †
Code 114 – Mineral Wool (block only)

2.3 Basic Insulation Materials – Fluid and Plastic

Code 502* – Insulation Cement
Code 502.1 – Insulation and Finishing Cement (Limited to 800°F)

2.4 Accessory Materials

Code 709 – Low-temperature Vapor-barrier Mastic
Code 716 – Aluminum Jacket – 0.016-inch Thick
Code 801 – Lap Adhesive
Code 803 – Fibrous Adhesive
Code 807 – Flashing Compound
Code 920 Series – Stainless Steel Wires and Bands*
Code 930 Series – "Monel" Wires and Bands*
Code 964 – Spindle Anchors
Code 971.1 – Stainless Steel Sheet Metal Screws
Code 976 – 0.016-inch thick plain Aluminum Sheet
Code 977 – Corrugated Expansion Bands 3/4-inch x 0.015-inch Type 304 Stainless Steel
Code 978 – 9-inch x 0.032-inch Aluminum "S" Clips
Code 979 – Graham Pins
Code 980 – Breather Bands

3. CURVED OR CYLINDRICAL EQUIPMENT – INSULATION APPLICATION

3.1 Insulation on equipment shall be applied snugly with joints tightly butted together. Insulation 2 1/2 inches or less in thickness shall be applied in a single layer except where the 2 1/2-inch thickness will not readily conform to the surface being insulated. In such case, more than one layer may be necessary. Insulation over 2 1/2 inches in thickness shall be double-layer construction.

3.2 Single-layer Construction. Single-layer block, curved, or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands (see Table 1) shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. See Figure 1.

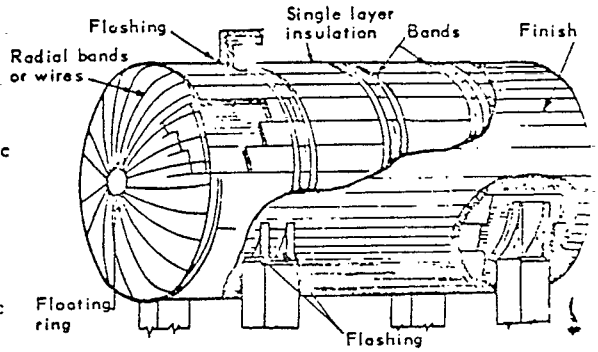

FIGURE 1

3.3 Double-layer Construction. The first or inner layer of curved block, or segmental block insulation shall be applied with joints tightly butted and lateral joints staggered. Bands (see Table 1) shall be placed over blocks approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. The second or outer layer shall be applied so that all joints are staggered with the first layer and tightly butted together. Bands shall be placed over second layer of block approximately 1 inch from each end of each block, thus providing four bands for each 36-inch length of insulation. All chipped edges, cracks or imperfections shall be filled and smoothed with Insulation Cement, Code 502. See Figure 2.

*Where Code 502 is specified herein, Code 502.1 can be substituted provided the temperature conditions do not exceed 800 degrees F.

*Selection specified on project or job specification index.

Sizes of Bands – See Table 1.

DUP 1012145

Vendors and merchandise designations are given to describe materials and may not include all acceptable products. Substitutions are to be made only on approval of the authority initiating the use of this Specification.

SUBCOMMITTEE NO 28

† Installation economies should be considered when selecting the optional board or block type.

BW 659

DU 053439

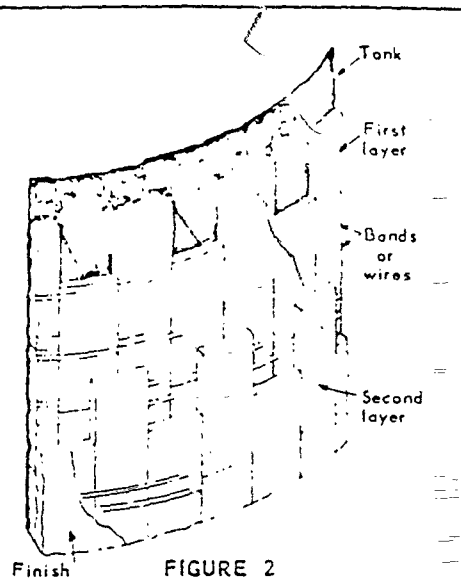

FIGURE 2

3.4 The insulation on heads or ends of cylindrical equipment shall be secured by tight bands or wires that are not over 4 inches apart and fastened to clips, angle iron bands, or steel bands encircling the tank behind the rivet heads or circumferential head weld. See Figure 3. The insulation on the cylindrical tank shall be held in place at the center of the head by radial wires or bands fastened to clips or a floating ring. Fibrous Adhesive, Code 803, can be used to support insulation on overhead surfaces until bands or wires can be applied. All chipped edges, cracks, or imperfections shall be filled and smoothed with Insulation Cement, Code 502.

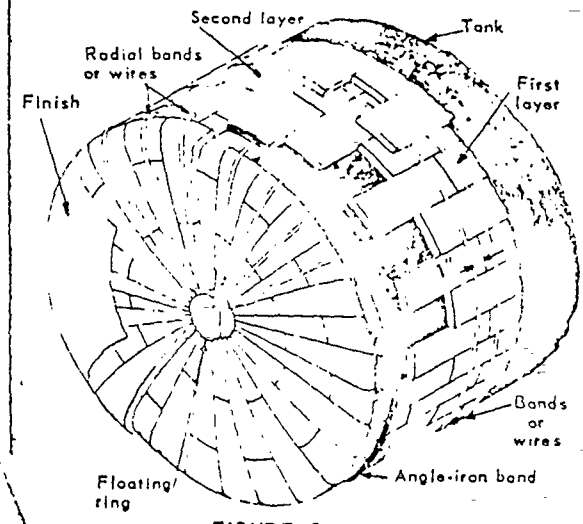

FIGURE 3

4. FLAT OR SQUARE-CORNERED EQUIPMENT – INSULATION APPLICATION

4.1 Insulation shall be applied snugly with joints tightly butted together. Single- versus double-layer construction shall be in accordance with paragraph 3.1.

4.2 Block insulation shall be applied with joints tightly butted together and lateral joints staggered. Bands shall be placed over blocks approximately 1 inch from each end of each block, thus providing 4 bands for each length of insulation.

4.2.1 Where welding is permissible, the blocks may be supported by bands fastened to clips that are tacked on the metal surfaces. For horizontal surfaces facing down, where spindle anchors are not specified, intermediate bands, held by clips, shall be installed.

4.2.2 At square corners of insulation of flat surfaces, metal corner angles or shields shall be placed under the bands to prevent cutting of insulation. All chipped edges, cracks, or imperfections shall be filled and smoothed with Insulation Cement, Code 502.

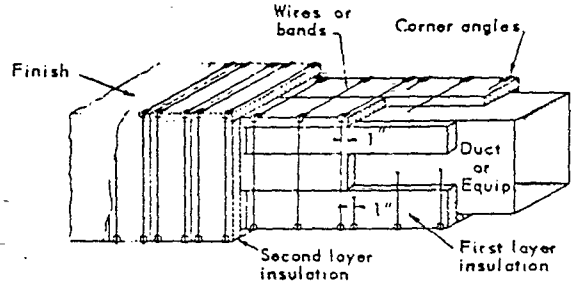

FIGURE 4

4.3 When specified on project or job specification, the blocks may be supported by Spindle Anchors, Code 964, applied to the metal surface by cementing, welding, or spot-welding.

4.4 Fastening devices may be welded or spot-welded to the metal surfaces of equipment or duct work ONLY with the written approval of Design, Construction and The Industrial Department.

4.5 When the method of fastening is not specified on the project or job specification index, the applicator may choose the most economical or convenient method. However, written approval of welded fastenings must be obtained as outlined in paragraph 4.4

5. FINISH

5.1 Vertical tanks and towers shall have an angle-support fastened by friction, see Fig 5, above the bottom knuckle weld, base or bottom head, directly under the insulation. The angle-iron support shall be in two sections for equipment less than 4-foot diameter and not less than 3 sections for equipment over 4-foot diameter. At any point where the steel angle-iron supports contact aluminum, apply Low-temperature Vapor-barrier Mastic, Code 709, to a dry thickness of 1/8 inch to prevent metal-to-metal contact between the aluminum and steel surfaces. The angle leg shall extend 1/2 inch beyond the surface of the insulation to provide a ledge to support the first course of corrugated aluminum.

5.2 Aluminum jacketing should be cut to wrap around the circumference of the equipment. Where long sheets are difficult to handle, they can be applied in two or more sections with a 3-inch horizontal and vertical lap. The lap shall be coated with Lap Adhesive, Code 801. The material shall be placed on the equipment with the laps located so as to shed water and present the least amount of resistance to the prevailing winds.

5.3 The sheets on vertical vessels shall be supported by using Aluminum "S" Clips, Code 978, placed on 36-inch centers. (See Figure 6.)

5.4 After the jacket has been installed and properly placed, two Stainless Steel Corrugated Expansion Bands, Code 977 or two Conventional Bands (see table 1) with "Techalloy" springs, Code 980, per circumferential sheets shall be placed over the jacket on 1/4 point centers. Where Code 977 is selected, the bands shall be applied in two pieces with the clips on the opposite sides of tower to insure an even pull and reduce crushing of the corrugation. On vertical vessels Stainless Steel Sheet Metal Screws, Code 971.1, shall be installed though the lapped sheets on the vertical joints on approximate 9-inch center line.

5.5 Stainless Steel Sheet Metal Screws, Code 971.1, shall be installed in the circumferential joints. To provide for vertical expansion of vertical vessels the screws shall be left out of circumferential lap joint in every third course, if the equipment is twelve feet high or greater. Screws shall be placed on 18-inch centers.

5.6 Tops of vertical or ends of horizontal equipment shall be finished with 0.016-inch thick plain Aluminum Sheet, Code 976. The sheet shall be cut into segments to conform to the radius of the curve of the head. Each segment shall overlap at least three inches. The lap shall be coated with Lap Adhesive, Code 801, and secured with Stainless Steel Sheet Metal Screws, Code 971.1, on 4-inch centers.

6. FLASHING

6.1 Flashing Compound, Code 807, shall be applied at all possible sources of moisture penetration, such as intersections of the insulation at piers, nozzles, etc., and other parts protruding through the surface of the finish. This shall be applied to provide a watershed in a 1/4-inch coating extending over all intersecting surfaces.

6.2 Where it is necessary to slit the aluminum jacket when forming around nozzles, etc., reinforce the slit joint with a backup piece of aluminum secured with Stainless Steel Sheet Metal Screws, Code 971.1.

TABLE 1 – BANDS

Distance Around Outside Surface Of Insulation		920 Series Stainless Steel	930 Series "Monel"	
Minimum (Ft)	Maximum (Ft)			
	8	926	936	
8	20	927	937	
20		928	938	

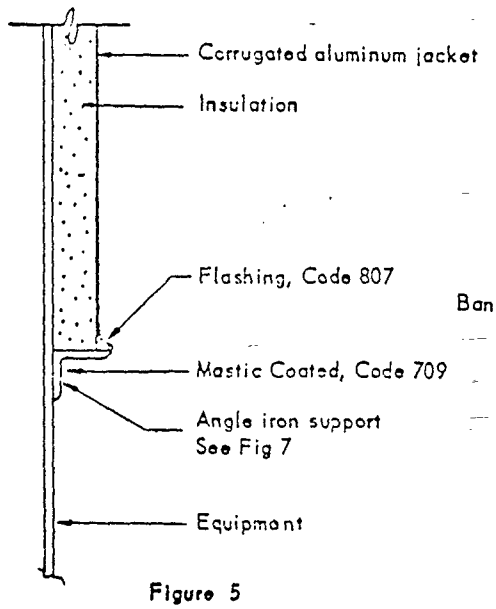

Figure 5

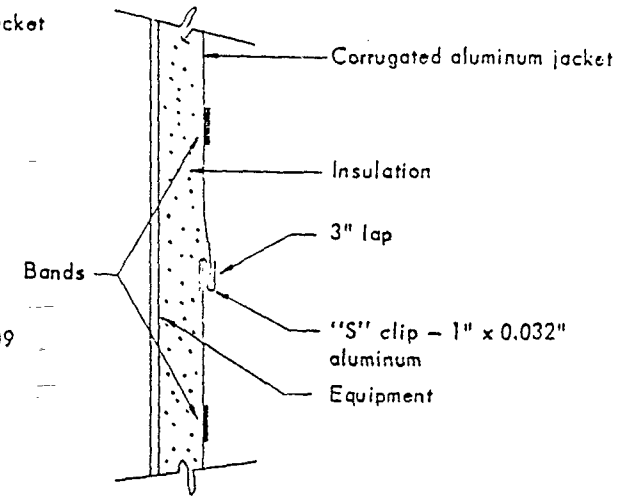

Figure 6

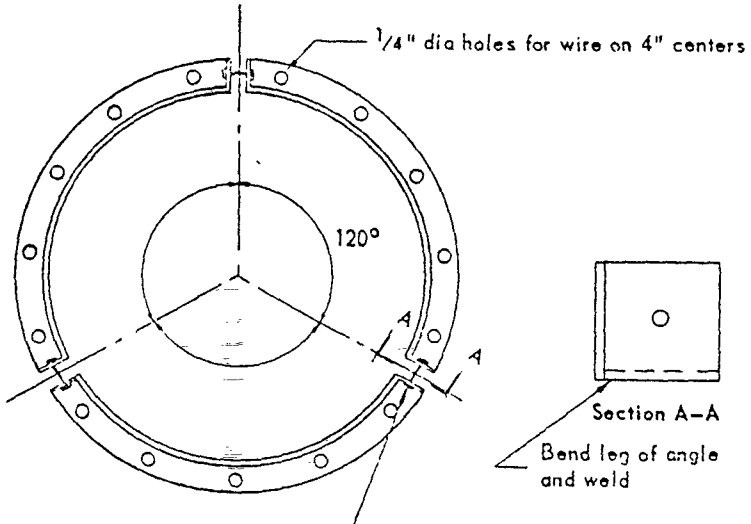

Figure 7 – Angle Detail

Drill 1/2" holes for 3/8" bolts – 1" and 1 1/2" angles
Drill 5/8" holes for 1/2" bolts – 2" and 3" angles
Drill 3/4" holes for 5/8" bolts in 4" angles

DUP 1012148

BW 697

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