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NATIONAL INSULATION MANUFACTURERS ASSOCIATION

441 LEXINGTON AVENUE - NEW YORK 17, N. Y.

PLAINTIFF'S EXHIBIT
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NIMA
STANDARD

PLAINTIFF'S EXHIBIT
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TO THE TECHNICAL & RESEARCH COMMITTEE

Rock & Slag Section Glass Section Molded Section

Re: NIMA Proposed Standard

Gentlemen:

Attached for your perusal is the initial draft of "NIMA Standard - Inorganic Thermal Insulation". This standard was asked to be developed by the Board of Directors.

Will you please send you comments and/or suggested changes to the NIMA office not later than January 1, 1963. This subject will be placed on the Agenda for the next T & R Committee meeting.

Sincerely yours

J. M. Barnhart

JMB:HCL
encl.

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PROPOSED
NEMA STANDARD
INORGANIC THERMAL INSULATION

PURPOSE

The purpose of this standard is to establish minimum specifications for insulating low temperature and heated surfaces with inorganic types of thermal insulation for guidance of manufacturers, distributors, contractors, engineers and users.

SCOPE

This standard covers minimum physical requirements for amosite asbestos, calcium silicate, diatomaceous earth, mineral fiber, cellular glass and magnesia thermal insulation in the form of pipe insulation, blocks or boards, cements, felts, blankets, loose and granulated, and industrial batts. It also includes standard sizes and standard facing materials.

DEFINITIONS

Compositions

1. Mineral Fibers - A generic term for all non-metallic inorganic fibers. These fibers may be natural, such as asbestos, or may be manufactured such as rock, slag or glass.

2. 85% Magnesia thermal insulation is composed principally of basic magnesium carbonate with reinforcing mineral fiber.

3. Diatomaceous Silica thermal insulation is composed principally of diatomaceous earth with or without heat-resistant inorganic binder(s) and reinforcing mineral fiber.

4. Calcium Silicate thermal insulation is composed principally of hydrous calcium silicate with reinforcing mineral fiber.

5. Cellular Glass thermal insulation is composed of glass processed by fusion, to form a homogeneous rigid mass of hermetically sealed cells.

6. Amosite Asbestos thermal insulation is composed principally of amosite asbestos fiber with or without heat resistant inorganic binder and filler.

7. Mineral Fiber thermal insulation is composed principally of fibers manufactured from mineral substances such as rock, slag or glass with or without binder.

Forms

1. Pipe insulation is thermal insulation suited for application to cylindrical surfaces of pipe and tubing.

   (a) Molded-type Pipe Insulation is thermal insulation preformed in cylindrical, semi-cylindrical or segmented sections to fit pipe and tubing.

   (b) Blanket-type Pipe Insulation is flexible thermal insulation furnished flat in sizes to fit around pipe and tubing.

2. Block or Board Insulation is rigid thermal insulation preformed in rectangular units to fit flat surfaces or curved surfaces of diameters above 33 inches.

3. Insulating Cement is composed of a dry mixture of fibrous, powdery or granular materials which when mixed with water, applied as a plastic mass and dried in place, forms a monolithic thermal insulation.

4. Finishing Cement is composed of a dry mixture of fibrous, powdery or granular materials which when mixed with water and applied as a plastic mass to thermal insulation, dries to a smooth, hard, protective surface.

5. Insulating-Finishing Cement is a dry mixture of fibrous, powdery or granular materials which when mixed with water, applied as a plastic mass, dries to form a monolithic thermal insulation with a smooth, firm surface.

6. Loose Fill Insulation is thermal insulation composed of a dry mixture of fibrous, powdery, or granular materials for installation between confining surfaces or as a top layer.

7. Blanket Insulation is flexible thermal insulation that can readily be conformed to curved surfaces, and which is suitably bound together to provide units of substantial area for handling and application and which may be faced or reinforced with confining media.

8. Felt Insulation is semi-rigid or flexible thermal insulation normally furnished in flat sheets composed of mineral fibers with or without binder.

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GENERAL REQUIREMENTS

1. When tested as specified in , the insulation shall be rated as incombustible or fire retardent.

2. Temperature of Use - When tested as specified in at the intended use temperature, as agreed upon between the manufacturer and the purchaser, the insulation shall show no physical changes that will adversely affect its service qualities.

3. Workmanship - The insulation shall not have visible defects that will adversely affect its service qualities.

4. Handleability - Individual units of insulation shall be construc ted in such a manner as to permit transportation and installation as a unit.

AMOSITE ASBESTOS

The amosite asbestos thermal insulation shall be supplied as hollow cylindrical shapes either whole or split in half lengthwise for application on standard sizes of pipe. Thicknesses available shall be in accordance with the manufacturer's standard sizes. When installed on pipe of specified size, sections shall fit snugly, and shall have tight longitudinal and circumferential joints.

Physical Requirements - When tested as specified, the insulation shall conform to Table I.

TABLE I - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF AMOSITE ASBESTOS PIPE INSULATION

Temperature limit, max., (see par)	1200F
Density, average, pcf (see par)	18
Thermal conductivity (average) Btu per hr sq ft F/in (see par)	
At mean temperature	
100 F	0.32
300 F	0.42
600 F	0.63
Linear shrinkage (length) after heat soaking, average, percent (see par)	0.5
Standard Sizes	
Length	3 ft
Width	
Thickness	1 to 4 in. in 1/2 in. increments

Dimensional Tolerances

The average measured length and thickness of any individual shape or segment of the insulation shall not differ from the manufacturers standard dimensions by more than the following:

Length	± 1/8 in.
Thickness	
Nominal pipe size up to 24 in.	± 1/8 in.
Nominal pipe size over 24 in.	± 5/32 in.

CALCIUM SILICATE

Calcium silicate pipe insulation shall be supplied either as hollow cylindrical shapes split in half lengthwise (in a plane including the cylindrical axis) or as curved segments. Thickness available shall be in accordance with the manufacturer's standard sizes. When installed on pipe of specified size, sections shall have tight longitudinal and circumferential joints.

Calcium silicate block-type thermal insulation shall be supplied in the form of flat or curved blocks as specified.

Salcium silicate shall be supplied as insulating cement.

Physical Requirements - When tested as specified the insulation shall conform to Table II.

TABLE II - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF CALCIUM SILICATE BLOCK, PIPE AND CEMENT INSULATION

	Pipe & Block	*Cement*
Temperature Limit, max., (see par)	1200 F	1200 F
Density, average, pcf (see par)	14	
Thermal conductivity (average) (see par) Btu per hr sq ft F/in At mean temperature		
300F	0.42	
500F	0.54	0.80
700F	0.63	
Compressive strength, average, at 5% deformation, psi., block only (see par)	60	

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Linear shrinkage (length) after heat soaking, max., percent (see par)	2.0	3.0
Volume change (shrinkage) upon drying, average, percent (see par)		25
Dry covering capacity, average, sq ft 1in in thickness per 100 lb of dry cement		35

Standard Sizes

Flat block - Flat block shall be furnished in a length of 36 in., a width of 6 in., and thickness from 1 to 4 in. in 1/2 in. increments. Flat block may also be furnished in a width of 12 in. in thickness from 1-1/2 to 4 in. in 1/2 in. increments.

Curved Block - Curved block may be furnished in a length of 36 in., a width of approximately 6 in., and curved to inside radii of over 16-1/2 in. Individual dimensions shall conform to those specified by the manufacturer.

Pipe	
Length	3 ft
Thickness	1 to 3 in. in 1/2 in. increments

Thickness greater than 2 in. may be furnished in 2 layers. Individual dimensions shall conform to those specified by the manufacturer.

Dimensional Tolerances

The average measured length, width and thickness shall not differ from the manufacturer's standard dimensions by more than the following:

	Block	Pipe
Length	± 1/8 in.	± 1/8 in.
Width	± 1/8 in.	-
Thickness	± 1/8 in.	± 1/8 in.

CELLULAR GLASS

Cellular glass pipe insulation shall be supplied as hollow cylindrical shapes in half section or segmental form. Thickness available shall be in accordance with the manufacturer's standard sizes. When installed on pipe of specified size, sections shall have tight longitudinal and circumferential joints.

Cellular glass block insulation shall be supplied in the form of flat blocks.

Physical Requirements - When tested as specified the insulation shall conform to Table III.

TABLE III - PHYSICAL REQUIREMENTS, STANDARD SIZES, AND DIMENSIONAL TOLERANCES OF CELLULAR GLASS BLOCK AND PIPE INSULATION

Temperature limit, max., (see par)	800F
Density, average, pcf (see par)	10
Thermal conductivity (average) Btu per hr sq ft F/in. (see par)	
At mean temperature	
100F	0.41
200F	0.55
300F	0.67
Compressive strength, average, psi (see par)	100
Linear Shrinkage (length after heat soaking, average, percent (see par)	0.5

Standard Sizes

Block

Size		Thickness, in.
Width, in.	Length, in.	
12	18	1-1/2, 1-3/4, 2, 2-1/2, 3, 4, 5,
18	25	2, 2-1/2, 3, 4, 5

Pipe

Length	18 or 24 in.
Thickness	To fit standard sizes of pipe

Dimensional Tolerances

The average measured length, width and thickness shall not differ from the manufacturer's standard dimensions by more than the following:

	Block	Pipe
Length	± 1/16 in.	± 1/16 in.
Width	± 1/16 in.	
Thickness	± 1/16 in.	± 1/16 in.

DIATOMACEOUS EARTH

Diatomaceous earth pipe insulation shall be supplied either as hollow cylindrical shapes split in half lengthwise (in a plane including the cylindrical axis) or as curved segments. Thickness available shall be in accordance with the manufacturer's standard sizes. When installed on pipe of specified size, sections shall have tight longitudinal and circumferential joints.

Diatomaceous earth block-type thermal insulation shall be supplied in the form of flat or curved blocks as specified.

Diatomaceous earth shall be supplied as insulating cement.

Physical Requirements - When tested as specified the insulation shall conform to Table IV.

TABLE IV - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF DIATOMACEOUS EARTH BLOCK, PIPE AND CEMENT INSULATION

	Block & Pipe		Cement
Temperature limit, max. (see par)	1600F & 1900F		1900F
Density, average, pcf (see par)			
Thermal conductivity, average, Btu per hr sq ft F/in. (see par)			
At mean temperature			
500F	0.66	0.70	0.85
700F	0.70	0.75	0.90
900F	0.74	0.80	1.00
Compressive strength, average, at 5% deformation, block only, psi (see par)	60	65	25
Linear shrinkage(length) after heat soaking, agerage, percent (see par)	2.0	3.5	5.0
Volume change (shrinkage) upon drying, average, percent (see par)			30
Dry covering capacity, average, sq ft 1 in. in thickness per 100 lb of dry cement			35

Standard Sizes

Flat block - Flat block shall be furnished in a length of 36 in., a width of 6 and 12 in., and in thicknesses of from 1 to 4 in. in 1/2 in. increments.

Curved block - Curved block may be furnished in a length of 36 in., a width of approximately 6 in., and curved to inside radii of over 16-1/2 in. Individual dimensions shall conform to those specified by the manufacturer.

Pipe

Length	3 ft
Thickness	1 to 3 in. in 1/2 in. increments.

Thicknesses greater than 2 in. may be furnished in two layers. Individual dimensions shall conform to those specified by the manufacturer.

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Dimensional Tolerances

The average measured length, width, and thickness shall not differ from the manufacturer's standard dimensions by more than the following:

	Block	Pipe
Length	± 1/8 in.	± 1/8 in.
Width	± 1/8 in.	
Thickness	± 1/8 in.	± 1/8 in.

85% MAGNESIA

Eighty-five percent magnesia pipe insulation shall be supplied either as hollow cylindrical shapes split in half lengthwise (in a plane including the cylindrical axis) or as curved segments. Thickness available shall be in accordance with the manufacturer's standard sizes. When installed on pipe of specified size, sections shall have tight longitudinal and circumferential joints.

Eight-five percent magnesia block-type thermal insulation shall be supplied either flat or curved as specified.

Eighty-five percent magnesia shall be supplied as insulating cement.

Physical Requirements - When tested as specified the insulation shall conform to Table V.

TABLE V - PHYSICAL REQUIREMENTS, STANDARD SIZES, AND DIMENSIONAL TOLERANCES OF 85% MAGNESIA BLOCK, PIPE AND CEMENT INSULATION

	Block & Pipe	Cement
Temperature limit, max., (see par)	600F	
Density, average, pcf	13	
Thermal conductivity, average, Btu per hr sq ft F/in. (see par)		
At mean temperature		
100F	0.35	0.50
200F	0.39	0.55
300F	0.44	0.60
Compressive strength, average, at 5% deformation, psi, block and cement only (see par)	50	50
Linear shrinkage (length) after heat soaking, average, percent (see par)	2.0	2.0
Volume change (shrinkage) upon drying, average, percent (see par)		30
Dry covering capacity, average, sq ft, 1 in. in thickness per 100 lb of dry cement		50

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Standard Sizes

Flat Block - Flat block shall be furnished in a length of 36 in., widths of 6 in., or 12 in., and a thickness of from 1 to 3 in. in 1/2 in. increments.

Curved Block - Curved block shall be furnished in a length of 36 in., a width of approximately 6 in., and curved to inside radii of over 16-1/2". Individual dimensions shall conform to those specified by the manufacturer.

Pipe

Length	3 ft
Thickness	1 to 3 in. in 1/2 in. increments

Thicknesses greater than 2 in. may be furnished in 2 layers. Individual dimensions shall conform to those specified by the manufacturer.

Dimensional Tolerances

The average measured length, width and thickness shall not differ from the standard dimensions by more than the following:

	Block	Pipe
Length	± 1/8 in.	± 1/8 in.
Width	± 1/8 in.	
Thickness	± 1/8 in.	± 1/8 in.

MINERAL FIBER

Types and Classes - The mineral fiber insulation shall be of the following types and classes in accordance with its form and construction, its rigidity or flexibility determined in accordance with and

Form I - Blocks and Boards - Rigid Material
- Type I - Organic-bonded - for use up to 400 F
- Type II - Organic-bonded - for use up to 700 F
- Type III - Inorganic-bonded - for use up to 1800 F

Form II - Blankets and Felts - Flexible and Semi-Rigid Materials
- Type I - Metal-mesh Covered Blankets
  - Class A - for use up to 1000 F
  - Class B - for use up to 1200 F
- Type II - Blankets, Resilient Flexible - for use up to 400 F
- Type III - Felts, Semi-Rigid - for use up to 400 F
- Type IV - Industrial Batts, Flexible - for use up to 1000 F

Form III - Pipe Insulations
- Type I - Molded - for use up to 370 F
- Type II - Blanket-Type
  - Class A (Resilient, Flexible) - for use up to 700 F
  - Class B (Metal-Mesh Covered) - for use up to 1000F
  - Class C (Metal-Mesh Covered) - for use up to 1200F

Form I - Blocks and Boards - Rigid Materials

Physical Requirements - When tested as specified, the blocks and boards shall conform to Table VI.

TABLE VI - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER BLOCKS AND BOARDS (FORM I)

Properties	Type I	Type II	Type III
Density, (average), lb per cu ft (see par)	12	12	25
Compressive strength, (average), load to produce a deformation in thickness of 10 percent, taking the original thickness under a preload of lb per sq ft	*	2.5	36
Load lb per sq ft (see par)	*	30	1440
Breaking strength, (average) lb per in. of thickness for a 6 in. wide specimen (see par)	*	*	15
Linear shrinkage after heat soaking (average), percent	*	*	4.0
Thermal conductivity (average), Btu in./hr sq ft deg Fahr (see par)			
At mean temperature			
100	0.28	0.27	
200	0.33	0.31	
300	0.42	0.38	0.45
700			0.70
900			0.85

*not applicable

Standard Sizes

Length, in.	Width, in.	Thickness, in.
18, 24, 30, 36, 48 60	6, 12, 15, 18, 24, 30	1 to 5 in. in 1/2 in. increments

Various sizes are available from manufacturers

Dimensional tolerances (all types)

Length	± 1/8 in.
Width	± 1/8 in.
Thickness	± 1/8 in.

Form II - Blankets and Felts - Flexible and Semi-Rigid Materials

Type I - Metal-Mesh Covered Blankets

Blankets (Metal-Mesh Covered) shall be a flexible or semi-rigid insulation (see par) covered by flexible metal-mesh facings on one or two sides and held together by ties extending through from one face to the other.

Physical Requirements - When tested as specified the metal-mesh covered blankets shall conform to the physical requirements shown in Table VII.

TABLE VII - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER METAL MESH COVERED BLANKETS (*Form II, Type I*)

	Class A		Class B
Density (average), without facings (see par.)	8 & 12		12
Thermal conductivity (average), Btu in./hr sq ft deg Fahr (see par)			
At mean temperature	8 pcf	12 pcf	
100	0.27	0.35	0.25
200	0.31		0.32
300	0.36	0.47	0.40
500		0.61	

Standard Sizes	All Classes
Length	48, 96 in.
Width	24
Thickness	1 to 6 in. in 1/2 in. increments

Dimensional Tolerances	All Classes
Length	- 1/8 in. **
Width	- 0 in. **
Thickness	- 0 in. **

** An excess in all dimensions will be permitted.

Facing Materials - Standard types of metal fabrics used as facings shall be:

1. Wire mesh, 1 in. galvanized No. 18 or 20 gage wire.
2. Expanded metal lath, (copper bearings, not galvanized) having diamond shaped openings, weighing 1.8 lb per sq yd, painted.
3. Expanded metal lath, (copper bearing, not galvanized) having diamone shaped openings weighing 2.5 lb per sq yd, painted.

Other types or compositions of facings required for rigidity, temperature and/or corrosion resistance (such as monel, stainless steel, etc.,) may be specified.

On units with facings on two sides the metal fabrics may be of the same type or any combination of two types, as specified.

Type II - Resilient, Flexible Blankets

Blankets shall be resilient flexible (see par.) insulation with binder added which may be plain or faced as specified and normally furnished in rolls and/or cut pieces. The blankets are provided in two types of fibers, fine and textile, and their characteristics are shown in Table VIII.

Density and Density Tolerance - Density shall be specified as one (or more) of the nominal densities listed in Table VIII. When tested in accordance with the density at nominal thickness shall be as specified within a tolerance of plus or minus 20 percent.

TABLE VIII - NOMINAL DENSITIES OF MINERAL FIBER INSULATION (FINE FIBER AND TEXTILE FIBER) Form II, Type II)

Designation	Nominal Density
B-1	0.65 pounds per cubic foot
B-2	0.76 " " " "
B-3	1.0 " " " "
B04	1.5 " " " "
B-5	2.0 " " " "
B-6	3.0 " " " "

Physical Requirements - When tested as specified the resilient flexible blankets shall conform to Table IX.

TABLE IX - PHYSICAL REQUIREMENTS - STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER RESILIENT FLEXIBLE BLANKETS (Fine Fiber and Textile Fiber) (Form II, Type II)

Thermal Conductivity (average), Btu in./hr sq ft deg Fahr (see Par) Fine Fiber At mean temperature	B-1	B-2	B-3	B-4	B-5 & B-6
75	0.31	0.30	0.28	0.26	0.25
100	0.34	0.32	0.30	0.28	0.26
200	0.47	0.43	0.39	0.35	0.32
Textile Fiber					
75	0.34	0.33	0.32	0.30	0.25
100	0.37	0.36	0.35	0.32	0.26
200	0.53	0.52	0.50	0.43	0.35

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Standard Sizes	All designations
Length	25, 50, 100, 200 ft rolls*
Width	24, 36, 48, 72 in.
Thickness	1/2 to 6 in. in 1/2 in. increments

Dimensional Tolerances	All Designations
Length	- 0 in. **
Width	- 1/8 in. **
Thickness	- 1/8 in. **

* Rolls may contain more than one piece, but no piece shall be less than 10 feet in length. Rool length will be dependent on blanket thickness. Maximum thicknesses not available in maximum densities.

** An excess in all dimensions will be permitted.

Type III - Felts - Semi-Rigid

Felt shall be semi-rigid (see par) thermal insulation with binder added, which may be plain or faced as specified, and furnished in flat sheets or cut pieces.

Density - Nominal densities as specified can be obtained from the manufacturers.

Density Tolerance - When tested as specified in the density tolerance shall be ± 1 pound per cubic foot or 20 percent whichever is smaller of the manufacturers nominal density.

Physical Requirements - hen tested as specified the felts shall conform to Table X.

TABLE X - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER FELT INSULATION (Form II, Type III)

Thermal conductivity (average), Btu in./hr sq ft deg Fahr. (see par)	Nominal Density	
	Under 6 pcf	6 pcf and over
At mean temperature		
75	0.30	0.29
100	0.32	0.30
200	0.44	0.36

Standard Sizes	
Length	30, 48, 60 in.
Width	12, 15, 24, 30 in.
Thickness	1 to 4 in. in 1/2 in. increments

Dimensional Tolerances

Length	- 0 in. *
Width	- 1/8 in. *
Thickness	- 1/8 in. *

* An excess in all dimensions will be permitted

Type IV - Industrial Batts - Flexible

Construction - Industrial batts shall be flexible (see par.) with or without binder added, and furnished in pieces or rolls.

Physical Requirements - When tested as specified the industrial batts shall conform to the physical requirements shown in Table XI.

TABLE XI - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER INDUSTRIAL BATT INSULATION (Form II, Type IV)

Density (average), lb per cu ft (see par.)	12
Thermal conductivity (average), Btu in./hr sq ft deg Fahr. (see par)	
At mean temperature	
100	0.31
200	0.38
300	0.46
Standard Sizes	
Length	48, 96 in.
Width	24 in.
Thickness	1 to 3 in. in 1/2 in. increments
Dimensional Tolerances	
Length	- 0 in. *
Width	- 0 in. *
Thickness	- 1/8 in. *

* An excess in all dimensions will be permitted.

Form III - Pipe Insulation

Type I - Molded

Construction - Molded-Type Pipe Insulation shall be made from mineral fibers and a suitable binder, molded into sections in the form of hollow cylinders split lengthwise on one or both sides of the cylindrical axis for application on standard sizes of piping or tubing. Thicknesses available for various pipe sizes shall be in accordance with the manufacturer's

standard sizes. When installed on pipe of specified size, sections shall fit snugly and shall have a tight longitudinal and circumferential joints.

Physical Requirements - When tested as specified the molded-type pipe insulation shall conform to Table XII.

TABLE XII - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER MOLDED-TYPE PIPE INSULATION (Form III, Type I)

Density (average) lb per cu ft ± 10 percent of the manufacturer's standard nominal densities, but the density shall not exceed 10.0 pounds per cubic foot.

Thermal conductivity (agerage)
Btu in. / hr sq ft deg Fahr. (see)

At mean temperature	"k"
75	0.26
100	0.27
200	0.30

Standard Sizes

Length	3 ft
Width	to fit standard pipe sizes
Thickness, nominal	1/2, 1, 1-1/2, 2 in. and up *

Dimensional Tolerances

Length	± 1/8 in.
Width	
Thickness	± 3/32 in.

* Thicknesses greater than 2 in. may be furnished in single or multiple layers.

Type II - Blanket-Type

Class A - Resilient - Flexible

Construction - Resilient flexible pipe insulation shall be insulation with binder added, which may be plain or faced. The insulation shall be furnished in rolls or flat pieces to fit snugly with tight longitudinal and circumferential joints when installed on pipe of the specified size.

Density Tplerance - When tested as specified in , the density shall be ± 20 percent of the nominal density as determined by dimensions and weight of a full size piece of material as received.

Physical Requirements - When tested as specified the resilient flexible pipe insulation shall conform to the physical requirements shown in Table XIII.

Class B & Class C Metal-Mesh Covered

Blanket-type pipe insulation (metal mesh covered) shall be a thermal insulation with a metal fabric facing on one or two faces and held together by heat resistant ties extending through from one side to the other. The insulation shall be furnished in flat units and when installed on pipes of specified size shall fit snugly with tight longitudinal and circumferential joints.

Physical Requirements - When tested as specified the blanket-type metal-mesh covered pipe insulation (Class B and Class C) shall conform to the physical requirements shown in Table XIV.

TABLE XIII - PHYSICAL REQUIREMENTS, STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER RESILIENT FLEXIBLE PIPE INSULATION CLASS A (Form III, Type II)

Density (average), lb per cu ft. (see par)	3	
Thermal conductivity (average), Btu in./hr sq ft deg Fahr. (see par.)		
At mean temperature	Fine Fiber	Textile Fiber
75	0.26	0.30
100	0.28	0.32
200	0.35	0.43
Standard Sizes		
Length	3 ft	3 ft
Width	To fit standard pipe sizes	
Thickness	1 to 4 in. in 1/2 in. increments	
Dimensional Tolerances		
Length	- 0 in.*	- 0 in.*
Thickness	- 1/8 in. *	- 1/8 in.*

* An excess in all dimensions will be permitted.

TABLE XIV - PHYSICAL REQUIREMENTS STANDARD SIZES AND DIMENSIONAL TOLERANCES OF MINERAL FIBER BLANKET-TYPE METAL MESH COVERED PIPE INSULATION _ CLASS B & CLASS C (Form III, TYPE II)

	Class B	Class C	
Density (Average), lb per cu ft (see par)	12	8 & 12	
Thermal conductivity (average) Btu in./hr sq ft deg Fahr (see par)		Nom. Dem	
At mean temperature		8 pcf	12 pcf
100	0.25	0.27	0.35

200	0.32	0.31	
300	0.40	0.38	0.47
500			0.61

Standard Sizes	Class B & Class C
Length	2 ft
Width	To fit standard pipe sizes from 3" up
Thickness	1 to 4 in. in 1/2 in. increments
Dimensional Tolerances	
Length	- 0 in.*
Thickness	- 0 in.*

* An excess in all dimensions will be permitted

Facing Materials - Standard types of metal fabrics used as facings shall be:

1. Woven wire mesh, 1 in. galvanized, No. 18 or 20 gage wire.
2. Expanded metal lath, (copper bearing, not galvanized) having diamond shaped openings, weighing 1.8 lb per sq yd, painted.
3. Expanded metal lath, (copper bearing, not galvanized) having diamond shaped openings, weighing 2.5 lb per sq yd, painted.

Other types or compositions of facings required for temperature and/or corrosion resistance (such as monel or stainless steel) may be specified.

When two facings are required, the facings of each unit of metal-mesh blanket insulation may be the same type, or any combination of two types.

SAMPLING, INSPECTION AND TEST PROCEDURES

1 Sampling - The insulation shall be sampled for the purpose of tests according to ASTM Designation C 390. When as agreed by the purchaser and the manufacturer or supplier, inspection of the material may be made at either the point of shipment or point of delivery.

2 Action in case of failure - A rejected lot may be resubmitted for inspection by the manufacturer after reworking the entire lot as to remove or correct all non conforming material.

3 Test Procedure - All facing material shall be removed before testing unless otherwise agreed to as a basis of purchase.

3.1 Rigidity - A piece of insulation 32 inches long, between 6 and 24 inches wide and 1 inch thick shall be placed on two horizontal, parallel, 1/2 inch pipe supports spaced 30 inches apart. The sag at the center of the span shall be measured from a straight line connecting two points on the surface directly above the supports.

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Material showing a sag not greater than 1/2 inch shall be classed as rigid.

Material showing a sag greater than 1/2 inch but which is not flexible (see) shall be classed as semi-rigid.

3.2 Flexibility - A 12" x 12" piece of the insulation shall be bent over a 1/2 inch iron pipe through an angle of 90 degrees, then released.

Material whose outer surface shows no visible rupture when bent shall be classed as flexible.

Material whose outer surface shows no visible rupture when bent, and upon release springs back to its original form and dimensions shall be classed as resilient, flexible.

3.3 Determination of density and dimensions shall be in accordance with ASTM Designation C 303 for Form I materials, ASTM Designation C 302 for Form III, Type I materials and ASTM Designation C 167 for Form II and Form III, Type II materials.

3.4 Combustibility (to be written as per Section VI of CS 131)

3.5 Thermal Conductivity - Determination of thermal conductivity shall be in accordance with ASTM Designation C 177 for flat material or ASTM Designation C 335 for pipe material.

3.6 Compressive Strength - Determination of compressive strength shall be in accordance with ASTM Designation C 165.

3.7 Breaking Strength - Determination of breaking strength shall be in accordance with ASTM Designation C 203, with the following exception:

Place the bearing bars 1/2 by 1 in. on top of the specified cylindrical bearing edges, with the 1 in. surface in contact with the specimens.

3.8 Temperature Resistance - Determination of temperature resistance shall be in accordance with ASTM Designation C 411.

3.9 Linear Shrinkage - Determination of linear shrinkage shall be in accordance with ASTM Designation C 356.

3.10 Volume change Upon Drying - Determination of volume change upon drying shall be in accordance with ASTM Designation C 166.

3.11 Dry Covering Strength - Determination of dry covering capacity shall be in accordance with ASTM Designation C 166.

PREPARATION FOR DELIVERY

Packaging and Marking - Unless otherwise agreed or specified between the purchaser and the manufacturer or supplier, the insulating material shall be packed in the manufacturer's standard commercial containers. Unless otherwise specified container shall be marked with supplier's name and designation, form type, class, size, thickness and quantity of material contained.

Ordering Data - The form, type, quantity, class, sizes, thickness, facing (s) and attachments if any, of the insulating material suited to the conditions of intended service shall be specified by the purchaser in the invitation for bids or order.

(a) Other than minimum standard weights of canvas jacketing for pipe insulation must be specified when required.

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PROPOSED SPECIFICATION
for
CALCIUM SILICATE BLOCK AND PIPE
THERMAL INSULATION
(ASTM C-000)

SCOPE

1. These specifications cover the composition, sizes, dimensions and physical properties of calcium silicate block and pipe thermal insulation intended for use on surfaces operating at temperatures up to 1200 F. For specific applications, the actual temperature limit shall be agreed upon between the manufacturer and the purchaser.

DEFINITIONS

2. The Definitions of Terms Relating to Thermal Insulating Materials (ASTM Designation C 168) shall be considered as applying to the terms used in these specifications.

DESCRIPTION

3. (a) Composition - Calcium silicate thermal insulation shall be composed principally of hydrous calcium silicate with reinforcing mineral fiber.

(b) Jackets - Jackets, where required for pipe insulation, shall be specified.

(c) Accessories - Bands, seat strips, etc., for pipe insulation shall be supplied when and as specified by the purchaser.

PHYSICAL REQUIREMENTS

4. The insulation shall conform to the following physical requirements:

Density (average) max., lb per cu ft			14.0
Thermal conductivity (average) max., Btu in. per hr sq ft deg Fahr:			
At mean temperature of 300 F	500	.60	0.50 .45
At mean temperature of 500 F	600	.65	0.60 .55
At mean temperature of 700 F	700	.70	0.71 .65
Compressive strength (average) min., at 5 percent deformation, psi (block only)			
Dry			60.0
Wet (After 16 hr immersion in water)			25.0

Flexural strength (average) min. psi	(a)
Linear shrinkage (length)(average) max., percent after heat soaking	2.0

(a) The average flexural strength in pounds per square inch shall be numerically equal to three times the density in pounds per cubic foot, but not less than 35 psi.

STANDARD SHAPES, SIZES AND DIMENSIONS

5.(a) Calcium silicate block-type thermal insulation shall be supplied in the form of flat or curved blocks as specified.

1. Standard sizes of the block type insulation shall be as follows:

Flat block - Flat block shall be furnished in a length of 36 in., a width of 6 in., and thickness from 1 to 4 in. in 1/2 in. increments. Flat block may also be furnished in a width of 12 in. in thickness from 1-1/2 to 4 in. in 1/2 in. increments.

Curved block - Curved block may be furnished in a length of 36 in., a width of approximately 6 in., and curved to inside radii of over 16-1/2 in. Individual dimensions shall conform to those specified by the manufacturer.

(b) Calcium silicate pipe insulation shall be supplied either as hollow cylindrical shapes split in half lengthwise (in a plane including the cylindrical axis) or as curved segments.

The pipe insulation shall be furnished in sections or segments in a length of 36 in. to fit standard sizes of pipe and tubing, and in nominal thicknesses of from 1 to 3 in. in 1/2 in. increments. Thicknesses greater than 2 in. may be furnished in 2 layers. Individual dimensions shall conform to those specified by the manufacturer.

DIMENSIONAL TOLERANCES

6. The average measured length, width and thickness shall not differ from the manufacturer's standard dimensions by more than the following:

	Block	Pipe
Length	± 1/8 in.	± 1/8 in.
Width	± 1/3 in.	---
Thickness	± 1/8 in.	± 1/8 in.

WORKMANSHIP

7. Since some requirements for this material are not easily specified by a numerical value, the insulation shall not have visible defects that will adversely affect its service qualities.

SAMPLING

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8. The insulation shall be sampled for the purpose of tests in accordance with *ASTM Designation:C* 390.

METHODS OF TEST

9. The properties enumerated in these specifications shall be determined in accordance with the following methods:

(a) Density - Block insulation - ASTM C 303
Pipe insulation - ASTM C 302

(b) Thermal Conductivity - Block insulation - ASTM C 177
Pipe insulation - ASTM C 335

(c) Linear Shrinkage After Hot Soaking - ASTM C 356, the linear shrinkage shall be determined at the manufacturer's recommended temperature limit.

(d) Flexural Strength - *Block insulation* - ASTM C 203
Pipe insulation - ASTM C 446

(e) Compressive Strength - Block insulation only, ASTM C 165

PACKAGING AND MARKING

10. (a) Packaging - Unless otherwise agreed or specified between the purchaser and the manufacturer or supplier, mineral fiber molded-type pipe insulation shall be packed in the manufacturer's standard commercial containers.

(b) Marking - Unless otherwise specified each container shall be plainly marked with the manufacturer's name, the name, class quanity, nominal thickness, hacket and accessories if any, of the material in the container.

INSPECTION AND REJECTION

11. (a) *Inspection* - When agreed by the purchaser and the manufacturer or supplier, inspection of the material shall be made at either the point of shipment or the point of delivery.

(b) *Rejection* - If the averages of the test data obtained on the pieces tested fail to conform to the requirements of this specification, rejection may be made in accordance with the following procedure:

(1) A second sample from the same lot shall be taken, prepared and tested. The results of the retest shall be averaged with the results of the original test to determine compliance with this specification.

(b) Rejection - If the averages of the test data obtained on the pieces tested fail to conform to the physical requirements, standard shapes, sizes, dimensions and dimensional tolerances of this specification, rejection may be made in accordance with the following procedure:

(1) A second sample from the same lot shall be taken, prepared and tested. The results of the retest shall be averaged with the results of the original test to determine compliance with *this specification.*

(2) Upon retest as described in (1), failure to conform to this specification shall constitute grounds for rejections.

(3) In case of rejection, the manufacturer or supplier shall have the right to reinspect the rejected shipment and resubmit the lot after removal of that portion of the shipment not conforming to the specified requirements.

January 29, 1963

TO: Members of NIMA Technical & Research Committee - Molded Section

SUBJECT: Detailed Agenda For February 21, 1963 Meeting

This will augment Jack Barnhart's January 7, 1963 notice of the NIMA Technical and Research Committee meeting being held at the Shoreham Hotel in Washington, D.C., February 21, 1963.

1. Recommended Practice for Determining OD's of Thermal Insulation for Tubes. (This is a carryover from last September 18th meeting.) Please note attached memo from V. L. Miller, dated January 28th, and come prepared to take appropriate action.

2. "K" Values, ASHRAE Guide. NIMA sent communication to members October 29, 1962. Letter Ballot called for by November 30th.

3. Mil-I-2781 D and Mil-I-2819 D. Please refer to following NIMA Communications:
   December 12, 1962 to Chilcote
   December 14, 1962 to NIMA T & R Committee members.
   December 14, 1962 to NIMA T & R Committee members with letter ballot.
   December 17, 1962 to Chilcote
   Also, please find attached a copy of letter from V. L. Miller to Barnhart dated January 15, 1963, for your information. Desired committee action should be decided at February 21st meeting.

4. Standard Facings for Pipe Insulation (including Performance Standards). See Barnhart's letter to Committee dated October 17, 1962. I really don't know background for this. By this communication I am asking Jack Barnhart, and any of you committee members, to furnish more information for our February 21st meeting so we can take appropriate action.

5. NIMA Standards (See Barnhart's communication dated December 3, 1962 which requested committee reply by January 1, 1963). I am asking Jack to have the results of committee answers tabulated for us by February 21st meeting, or if possible, circulated before then so we can study results and discuss them at the meeting.

New items to be added to our agenda include:

6. Calcium Silicate in Nuclear Reactors (See Barnhart's January 17th communication).

7. Chart "Heat Transmission Vs. Surface Resistance for Flat Cylindrical Surfaces". See NIMA's October 29, 1962 letter which called for answers by December 1, 1962. I am asking Barnhart to report results of this action for our February 21st meeting.