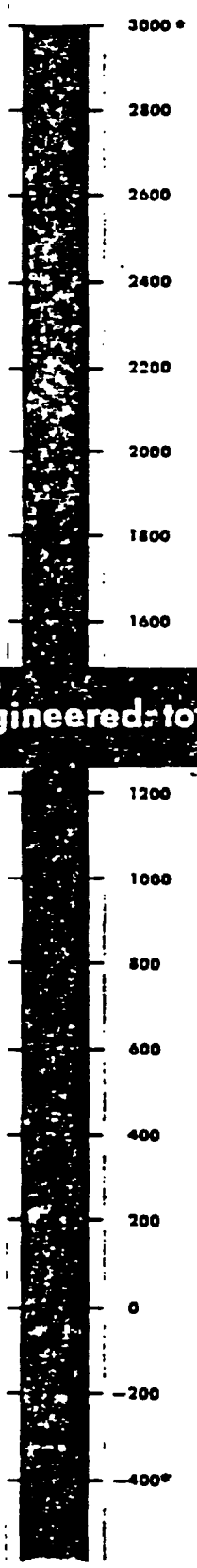
PLAINTIFF'S
EXHIBIT
K-1489

OF TEMPERATURES FROM 400 F BELOW ZERO TO 3000 F ABOVE



Johns-Manville
INSULATIONS

Engineered to conserve fuel and power, reduce maintenance cos

JOHNS-MANVILLE
JM
PRODUCTS

J-M History
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DEFENDANT'S
EXHIBIT
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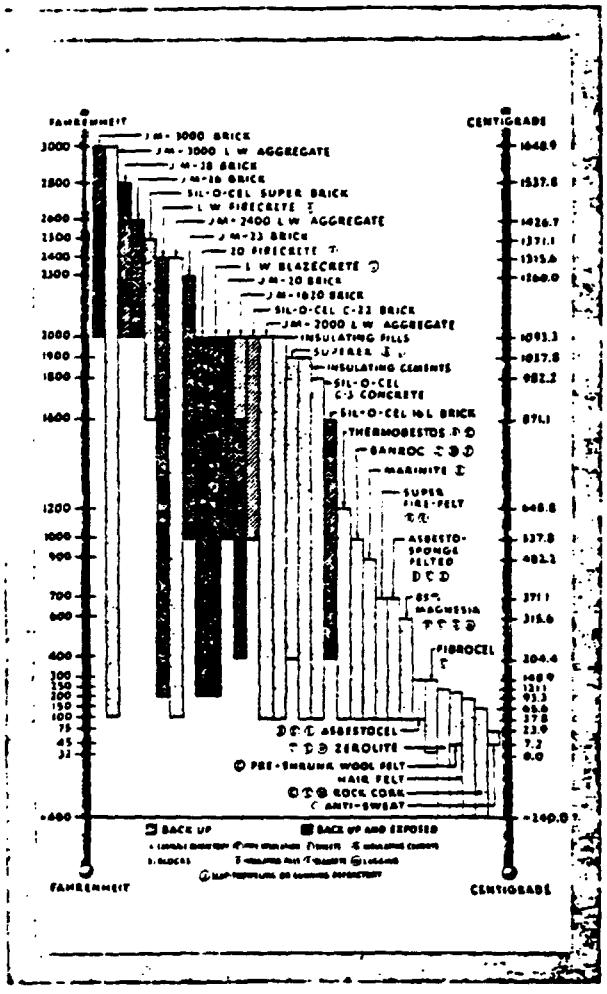
INSULATIONS

The World's Most Complete Insulation Service



An attractive chart of Johns-Manville Thermal Insulations, similar to the one above, is available in size 11½" x 18". The chart is printed in four colors and is mounted on heavy card stock suitable for hanging on the wall. For your free copy of this ready reference chart, write your nearest Johns-Manville office for Form IN-6D.

With a background of nearly a century of experience and study of all types of insulation problems, Johns-Manville offers you undivided responsibility for all your insulation problems. This service includes:

- ***A FULL LINE OF INSULATIONS***—Johns-Manville insulations, made from asbestos, diatomaceous silica and other materials, are each made to serve a specific purpose. They are used on every kind of process equipment or piping for service temperatures from minus 400F to 3000F above.

- ***ENGINEERING***—Johns-Manville provides the services of highly skilled insulation engineers. In solving modern industry's complex insulation problems, these engineers must consider many important factors—most economical thickness, strength and durability of the insulation, and protection against weather, moisture, chemicals and mechanical abuse. Johns-Manville engineers are thoroughly familiar with the correct usage of Johns-Manville materials, and they are available to see that the insulation for your job is scientifically correct.

- ***SKILLED APPLICATORS***—Johns-Manville has established J-M Insulation Technical Service Units and J-M Insulation Contract Units throughout the country to serve you. These units are staffed with men who understand insulation engineering and with skilled applicators who are thoroughly trained in proved Johns-Manville methods. Working with J-M materials and with J-M Insulation Engineers, these men know how to apply J-M insulations to provide long trouble-free performance.

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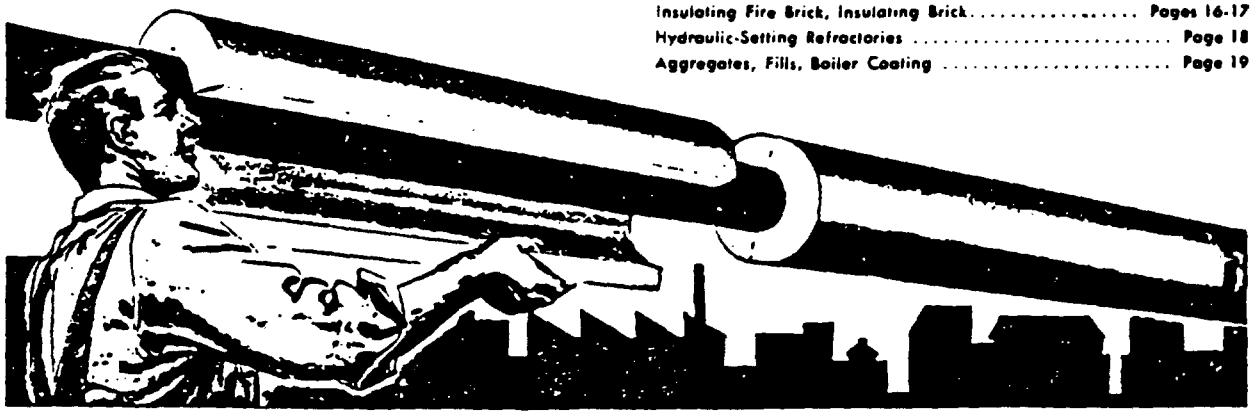
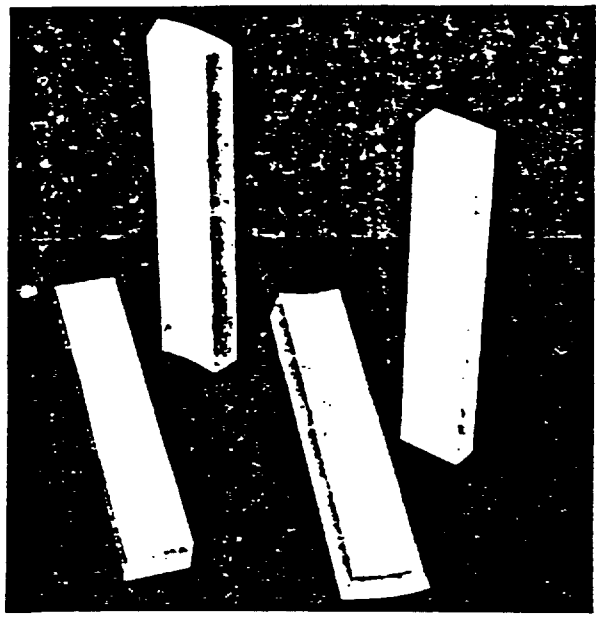
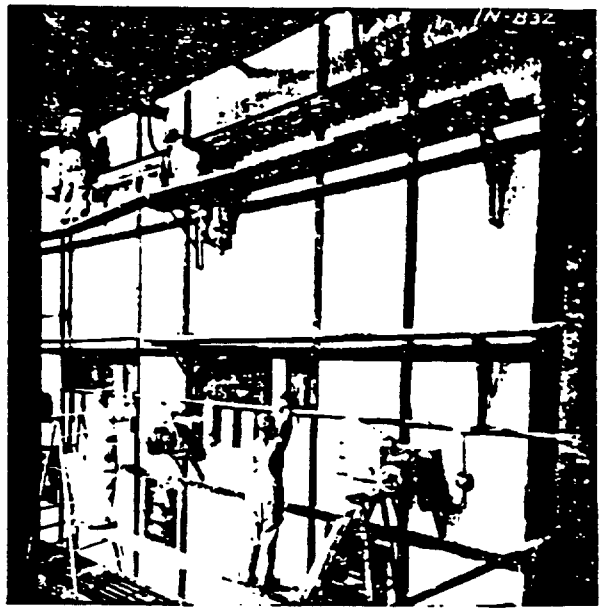


Blocks for High Temperature Service



J-M 85% Magnesia has proven its value over many decades of satisfactory, economical service.



J-M 85% Magnesia is particularly adapted to conditions where high insulating value and light weight are needed.

J-M 85% MAGNESIA BLOCKS

The Standard Insulation for Service to 600F

HIGH INSULATING VALUE • LIGHT WEIGHT • EASILY CUT • PROVED LONG LIFE

Johns-Manville 85% Magnesia is composed of hydrated basic carbonate of magnesia bonded with asbestos fiber, and molded into block form. Its high insulating value and permanence have been proved over many decades of satisfactory, trouble-free service. Time and again, it has earned its right to be called "Industry's greatest fuel saver for temperatures to 600F."

The process by which the materials are fabricated into J-M 85% Magnesia block insulation results in a durable product embodying good resistance to heat transmission, the lightest weight consistent with good mechanical strength, and excellent workability. It is economical to apply on flat, curved or irregular surfaces, and is particularly adapted to conditions where high insulating value and light weight are needed or where surfaces are so irregular that an easily-cut insulation is required.

Where temperatures exceed 600F, J-M 85% Magnesia is used as the outer layer over Superex. This construction, known as Superex Combination, is described on page 4. J-M 85% Magnesia in pipe insulation form is described on page 10.

J-M Water-Resistant Magnesia for service to 450F offers the same unique combination of properties as J-M 85% Magnesia. In addition, because of its very high degree of water-resistance, it can be expected to function under moisture conditions that eliminate other insulations. Also available in pipe insulation form.

PHYSICAL AND THERMAL PROPERTIES*

Density (dry)	12.5 to 13.5 lb. per cu. ft.				
Transverse Strength (modulus of rupture)	45 to 55 psi				
Compressive Strength	65 to 75 psi to produce 5% compression				
Linear Shrinkage	1 to 2% after 24-hr. soaking period at 600F				
Maximum Service Temperature	600F				
Conductivity	Mean temperature	100F	200F	300F	400F
	Btu in. per sq. ft. per F per hr.	.42	.45	.48	.52

*The figures given in this table are average values obtained in accordance with accepted test methods.

Standard Sizes

Length, inches	Thickness, inches	Width, inches
18 and 36	1 through 4	3 and 6, flat or curved
	1½ through 4	9 and 12, flat only

Note: On curved blocks the 4-in. thickness is furnished subject to the specific radius required.

Blocks for High Temperature Service

SUPEREX® BLOCKS AND SUPEREX COMBINATION

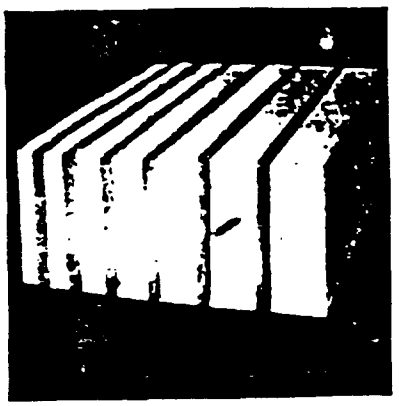
For service to 1900F

Johns-Manville Superex Blocks are made of calcined diatomaceous silica blended with other insulating materials and bonded with asbestos fiber. These light weight, large size blocks will safely withstand temperatures up to 1900F with negligible shrinkage. They are widely used for equipment operating at high temperatures, such as boiler furnaces, hot blast stoves, mains and bustle pipes, petroleum cracking furnaces, producer gas mains and metallurgical furnaces of various types. Superex is often used next to the hot surface because of its high heat resistance, with J-M 85% Magnesia as the outer layer because of its greater insulating value (Superex Combination).

Superex M is a diatomaceous earth block having all of the desirable properties of Superex, but with a temperature limit of 1500F. The lower temperature limit makes possible a reduction in density and conductivity.

STANDARD SIZES

Width, In.	Length, In.	Thickness, In.
3 and 6 flat or curved	18 and 36	1 through 4
9 and 12 flat only		1½ through 4



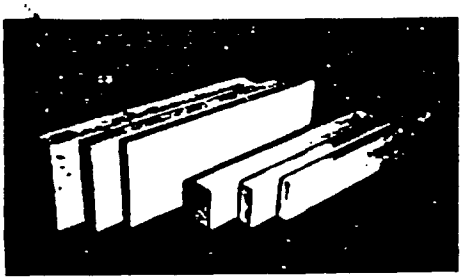
Large size Superex Blocks mean fewer joints and faster application.

THERMOBESTOS® BLOCKS

For service to 1200F

Johns-Manville Thermobestos Block Insulation is made of hydrous calcium silicate combined with asbestos fiber by a special J-M process. Used for insulating boilers, tanks, heat exchangers and other equipment having flat or curved surfaces where temperature does not exceed 1200F.

At temperatures above 600F, where the expansion of equipment is a significant factor, blocks should be applied in double-layer construction with staggered joints to prevent excessive heat losses and surface temperatures at the joints, opened by expansion, thereby eliminating damage to the exterior finish. Double-layer, staggered joint construction also minimizes thermal stresses in the insulation by reducing the temperature differential across each layer.



Thermobestos blocks may be used where temperature on the insulation does not exceed 1200F.

STANDARD SIZES

Width,* In.	Length	Thickness, In.
6 and 12	3-ft.	1, 1½, 2, 2½, 3, 3½, 4

*Other widths to 12 in. and curved blocks on special order.

PHYSICAL AND THERMAL PROPERTIES* OF SUPEREX AND THERMOBESTOS

Property	Superex	Thermobestos
Density (dry)	23 to 25 lb per cu ft	10 to 12 lb per cu ft
Transverse Strength (Modulus of Rupture)	60 to 80 psi	50 to 70 psi
Compressive Strength	80 to 90 psi to produce ⅛ in. compression	120 to 140 psi to produce ⅛ in. compression
Linear Shrinkage	2.7% after 24-hr soaking period at 1900F	1.5% after 24-hr soaking period at 1200F
Maximum Service Temperature	1900F	1200F
Conductivity (Btu in. per sq ft per F per hr at mean temperature)	400F: 0.69; 600F: 0.73; 800F: 0.77; 1000F: 0.82; 1200F: 0.88; 1400F: 0.96	100F: 0.33; 200F: 0.37; 300F: 0.41; 400F: 0.46; 500F: 0.50; 600F: 0.55; 700F: 0.60

*The figures given in this table are average values obtained in accordance with the accepted test methods.

RECOMMENDED THICKNESS OF 85% MAGNESIA, SUPEREX COMBINATION AND THERMOBESTOS

Temperature of Surface, F	Inner Layer: Superex, In.	Outer Layer: 85% Magnesia, In.	Total Thickness,* In.
100 to 199	...	1½	1½
200 to 299	...	2	2
300 to 399	...	2½	2½
400 to 499	...	3	3
500 to 599	...	3½	3½
600 to 699	1	2½	3½
700 to 799	1½	2½	4
800 to 899	2½	2	4½
900 to 999	3	1½	4½
1000 to 1099	3½	1½	5
1100 to 1200	4	1½	5½

*Also recommended thicknesses of Thermobestos blocks.

JM INSULATIONS

Sheets, Blocks, Tapes, Blankets

Johns-Manville manufactures a form or type of insulation for practically any industrial requirement. Some of the more widely used insulations are described briefly on this page, covering such forms as sheets, blocks, tapes and blankets for various service conditions and temperatures ranging from 500F (Asbestocel Sheets and Blocks) to the extremely high temperatures encountered in jet powered aircraft where Thermoflex Blankets are used. Regardless of your particular insulation problem, Johns-Manville is the logical place to turn for a satisfactory solution. Additional information about any of the insulations tabulated below may be obtained from your J-M Insulation Technical Service Unit, your Johns-Manville Distributor or your nearest Johns-Manville office.

J-M Insulation	Description	Use	Temp limit, F	Standard Sizes
ASBESTOCEL-SHEETS AND BLOCKS	Alternate plain and corrugated asbestos felts built up to various thicknesses.	To insulate medium and low pressure boilers, warm air ducts, etc.	500	36 to 96 in. long; 6 to 36 in. wide; ⅓ to 4 in. thick. (Coarse and fine corrugated.)
SUPER FIRE-FELT SHEETS AND BLOCKS	Made of felted asbestos fibers and binder. Light in weight and resilient.	Where large, resilient sheets are desired.	700 unsupported 900 supported	Sheets 24 in. x 36 in.; blocks 6 in. x 36 in.; from ½ in. to 4 in. thick.
ASBESTOS ROLL FIRE-FELT	A soft, flexible asbestos felt in roll form.	To insulate heated surfaces where space does not permit thicker or more rigid forms.	1000	Standard rolls contain 100 sq ft; 36 in. wide; 1/32 in. to ¼ in. thick.
ASBESTOS BLANKETS	Asbestos-fiber-filled asbestos cloth envelope, wire tufted.	To insulate irregular surfaces where insulation must be readily removable.	850	1½, 2 and 2½ in. thick; can be used in double-layer combinations through 4½ in. thick.
BANROC® BLANKETS	Made of a felted, spun mineral wool fiber secured between various types of metal fabric, asbestos paper or other finishes depending upon service requirements.	To insulate ovens, dryers, ducts, breechings and similar equipment.	Under normal conditions, up to 1000	Metal fabric: 24 in. x 96 in., 24 in. x 48 in.; 1 in. to 6 in. thick. Asbestos Paper: 24 x 48 in. in thicknesses through 3½ in.; 24 x 24 in. in 4 in. thickness.
ASBESTOS PAPER AND ROLL BOARD	Thin, fireproof flexible felts made from various grades of asbestos fiber.	To insulate where a material of minimum thickness is required. Resists shock of sudden heat or flame.	Up to 400	Asbestos Paper: 25, 50 and 100 lb rolls; 18, 24, 36, 37½, 72 in. wide; 0.015 in. to 1/16 in. thick. Asbestos Roll Board: 25, 50 and 100 lb. rolls; 18, 36, 72 in. wide; 1/32 in. and ⅛ in. thick.
ASBESTOS SHEET MILLBOARD	A rigid sheet made from various grades of asbestos fiber.	For general use in protecting against fire, heat, acid fumes, etc. Comes in various grades. Commercial grade is No. 106.	Up to 1800	42 x 48 in.; 1/32 to ½ in. thick; cut pieces also furnished.
ASBESTO-SPONGE® FELTED SHEETS AND BLOCKS	Laminations of tough asbestos felts cemented together —averaging about 40 layers per in. of thickness.	Especially efficient under severe service conditions because of high insulating value and durability.	Up to 700	36 in. long; 6, 9, 12, 18, 24 and 36 in. wide; 1 through 4 in. thick.
THERMO-WRAP® AND THERMO-TAPE®	Composed of asbestos fibers enclosed in an asbestos cloth jacket. Outer surface is impregnated with fire- and abrasion-resisting coating.	To insulate steam and hot water pipes on railroad and similar equipment. Thermo-Wrap is wrapped and laced on; Thermo-Tape is spirally wound on.	450	Thermo-Wrap: 36 in. sections; 1, 1½ and 2 in. thick for pipe from ¾ to 3 in.; for tubing from ⅞ to 3 in. O.D. Also tees, 45° and 90° ells, and crosses. Thermo-Tape: 2⅜ x ⅜, 2 x ⅛, 1⅝ x 3/16 and 1 x 3/16 in; 50-ft rolls.
THERMOFLEX® FELT	Uniform ceramic fibers felted with a small amount of binder to form a refractory-fiber insulation with unusual degree of lightness, resistance to heat, low conductivity and sound-control properties. Also available in loose fiber form.	For high temperature service. When enclosed in heat-resisting metal foil, an insulation for jet engines, exhaust assembly components, ice-elimination systems. — A sound-control material for high temperatures. — A filter medium for chemical filtration. — A refractory packing and fill.	To 2000	Semi-rigid or flexible felts in a variety of densities and thicknesses. Regularly furnished in 3, 4, 5, 6, 8 and 26* ft. lengths; 42 in. wide untrimmed. *Not in all densities
THERMOFLEX® TAPE	Asbestos fiber enclosed in knitted Inconel mesh.	To insulate diesel engine exhaust manifolds and as expansion joint filler in refractory settings.		Approx. 1¾ in. wide; 1 in. thick; 25 ft or more long.

For Heated Piping



J-M 85% Magnesia has proven its high insulating value and mechanical strength in decades of economical and satisfactory service.

J-M 85% MAGNESIA PIPE INSULATION

The Universal Insulation for Heated Piping to 600F

LIGHT WEIGHT • HIGH INSULATING VALUE • ECONOMICAL • PROVEN LONG LIFE

Johns-Manville 85% Magnesia is molded into sectional and segmental pipe insulation from hydrated basic carbonate of magnesia bonded with asbestos fiber. The Johns-Manville process provides J-M 85% Magnesia Insulation with a maximum number of voids, or minute dead-air cells, which increases the natural resistance to heat transmission and reduces the weight of this durable insulation. Maximum mechanical strength consistent with high insulating value is an added advantage and the insulation is quickly and easily installed.

For temperatures above 600F, J-M 85% Magnesia is often used as an outer layer over Superex Pipe Insulation. This construction (Superex Combination) combines the high heat resistance of Superex with the greater insulating value of 85% Magnesia. Thickness recommendations for 85% Magnesia and Superex Combination are tabulated on page 9; physical and thermal properties on page 3.

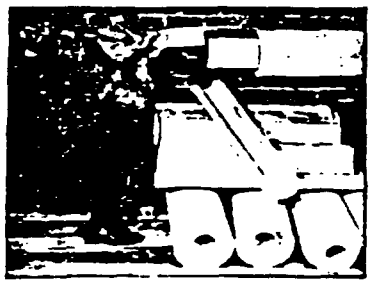
J-M Water-Resistant Magnesia, as described on page 3, is also furnished in pipe insulation form.

STANDARD SIZES

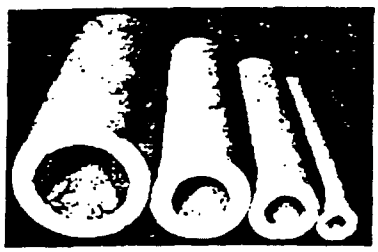
Length	*Nominal Thickness, In.*	*Form*	*Standard finish*
3 ft	1 (through 6-in. pipe size only), 1½, 2, 2½—single layer. 2 (through 4-in. pipe size), 2½ (through 6-in. pipe size), also furnished double-layer. 3 and greater normally furnished double-layer but can be furnished single-layer in limited quantities.	Furnished in sectional or segmental form according to pipe size and thickness.	Sectional form furnished with canvas jackets. Segmental form for larger pipe sizes furnished without canvas.

NOTE Also available to fit straight runs of copper tubing with nominal diameters of ⅜ in. and up. When ordering, OD of tubing to be fitted must be stated.

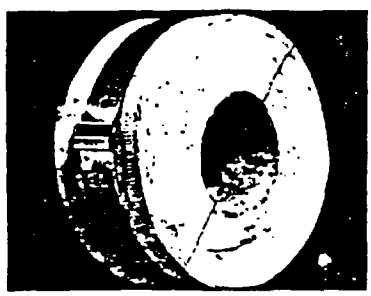
For Heated Piping



Superex Combination Pipe Insulation—an inner layer of Superex and outer layer of J-M 85% Magnesia.



Thermobestos is used for insulating steam and heated process lines with temperatures to 1200F.



Asbesto-Sponge Felted Pipe Insulation stands up under rough usage and mechanical abuse.

SUPEREX® PIPE INSULATION

For Service to 1900F

Made from calcined diatomaceous silica blended with other insulating materials and bonded with asbestos fiber, producing a material of high heat resistance and insulating value. Often used as inner layer in combination with J-M 85% Magnesia (Superex Combination) to combine the greater insulating value of 85% Magnesia with the high heat resistance of Superex. Thickness recommendations for Superex Combination are given on page 9. Physical and thermal properties of Superex are given on page 4.

THERMOBESTOS® PIPE INSULATION

For Service to 1200F

Composed of hydrous calcium silicate combined with asbestos fiber by a special J-M process and used for insulating steam and heated process lines. Above 600F, where pipe expansion is a significant factor, pipe insulation should be applied in double-layer construction with staggered joints. This construction prevents excessive heat losses and surface temperatures at the joints opened by pipe expansion, thus eliminating scorched or burned jackets...eliminates potential fire hazard of exposing jackets to higher temperatures at the joints...minimizes thermal stresses in the insulation by reducing temperature differential across each layer. Thickness recommendations given on page 9. Physical and thermal properties on page 4.

ASBESTO-SPONGE® FELTED PIPE INSULATION

For Service to 700F

Made of asbestos felts so combined to give a spongy laminated material. Felts are wound one over the other to the desired thickness, the cylinder then being slit lengthwise to permit application. Has excellent thermal characteristics and retains these characteristics in service. Can be furnished with an integral weatherproof asbestos jacket or permeable jacket of wire-inserted asbestos cloth for use where subjected to water submersion.

BANROC® PIPE INSULATION—a felted, spun mineral wool fiber insulation which may be used to 1000F under normal conditions. Style No. 25 consists of Banroc secured to expanded metal lath; Style No. 65, to a sheet metal jacket.

STANDARD SIZES

J-M Insulation	*Length*	*Thickness, In. (to fit standard pipe sizes)*	*Standard Finish*
SUPEREX	3-ft sections and segments.	Nominal 1 (through 6" pipe size only), 1½, 2, 2½ and 3.	Canvas jacket for pipe sizes 1½" and smaller.
THERMOBESTOS	3-ft sections.	Nominal 1 (through 6" pipe size only), 1½, 2, 2½, 3, 3½ and 4—single layer. Nominal 2 (through 4" pipe size), 2½ (through 6" pipe size) and greater also furnished double-layer.	Canvas jacket.
*ASBESTO-SPONGE FELTED	3-ft sections.	1 to 2½, single-layer; 2½ and over, double-layer.	Canvas jacket (lacquered metal bands furnished).
BANROC STYLE NO. 25	2-ft sections.	1, 1½, 2, 2½, 3 and 4 for all standard pipe sizes 2" in diameter and larger.	Finishing cement and canvas jacket for interior work (not furnished); weatherproof jacket for outdoor work (not furnished).
BANROC STYLE NO. 65	2-ft sections with 2" extra casing length for end laps.	1, 1½, 2, 2½ and 3 for all standard pipe sizes 2" in diameter and larger—4 in 4", 6", 8", 10" and 12" pipe sizes only.	24-gage galvanized sheet metal outer casing with flange seam containing ¼" galvanized stove bolts.

*Also available for straight runs of copper tubing with nominal diameters of ⅜ in. and up.

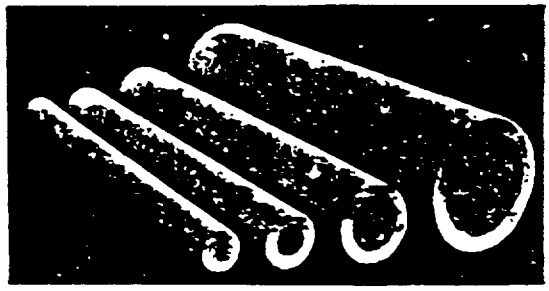
For Low Temperature Piping

FIBROCEL® PIPE INSULATION

For Hot and Cold Water, Low Pressure Steam and Combination Wet Heating and Cooling System Pipes

Service Temperatures 35F to 300F

Fibrocel is a new low pressure insulation which, because of its mineral composition, is equally suited for use on chilled water or low pressure steam pipes. Non-shrinking ...decay resistant...fireproof...thermally efficient... dimensionally uniform...hard texture...economical to apply.



Available in three jacket styles:

Fibrocel C for steam or hot water. Furnished with standard or special weight canvas jacket and metal bands. For service temperatures from 60F to 300F.

Fibrocel G for steam or hot or cold water. Furnished with glazed white plastic-coated paper jacket and metal bands. For service temperatures from 60F to 300F.

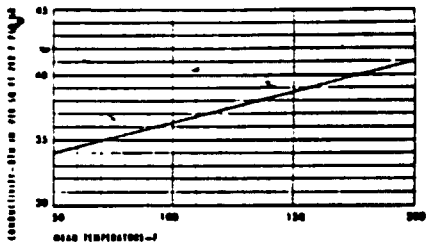
Fibrocel VB for chilled water or dual service. Furnished with vapor barrier jacket consisting of aluminum foil faced both sides with creped natural kraft, adhered with special non-asphaltic waterproof laminant. Finish may be painted if desired. For use on cold pipes subject to sweating. Particularly adapted for combination wet heating and cooling system pipes. For service temperatures from 35F to 200F.

PHYSICAL AND THERMAL PROPERTIES*

Density	9 lb per cu ft
Transverse Strength (Modulus of Rupture)	50 psi
Shrinkage (Moist to dry)	0.05" per 36" length

*The figures given in this table are average values obtained in accordance with accepted test methods.

FIBROCEL CONDUCTIVITY

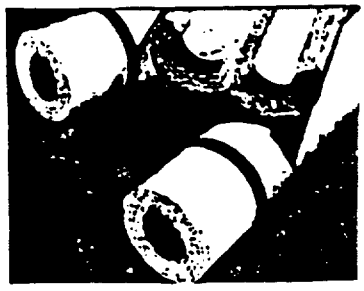


PRE-SHRUNK ASBESTOCEL® PIPE INSULATION

For Service to 300F

J-M Pre-Shrunk Asbestocel is a cellular type of insulation, made up of alternate layers of plain and corrugated asbestos felts, for use on pipes conveying low pressure steam and hot water. Specially-treated, moisture-resistant asbestos paper is used which prevents "breathing," removing the cause of objectionable shrinkage cracks. Furnished in 3-ft. sections to fit standard pipe sizes and in standard thicknesses of 2 to 8 plies, each ply approximately ¼" thick.

Three finishes available: Glazed White, Asbestos Paper, and Canvas. Also available for straight runs of copper tubing with nominal diameters of ¾" and up.



Glazed white finish of Pre-Shrunk Asbestocel will not carry flames.

OTHER J-M PIPE INSULATIONS FOR SPECIAL REQUIREMENTS

J-M Insulation	*Description*	*Use*	*Standard Sizes*
*Pre-Shrunk Wool Felt	Moisture-resistant indented wool felt with dual-service liner.	Hot and cold water service lines for temperatures between 60 and 225F and with integral jacket, between 45 and 60F.	3-ft lengths; ½ to 2 in. thick single layer; 1, 1½, 2 in. thick, double layer for pipe sizes ½" and up.
*Anti-Sweat	Pre-shrunk insulating and waterproofing felts.	For temperatures above 45F. Keeps water cold—prevents condensation and dripping.	3-ft sections; ½ and ¾ in. thick single-layer 1, 1½ and 2 in. thick double layer for standard pipe sizes
*Zero	Layers of hair felt surrounded by several layers of wool felt.	Prevents cold water pipes from freezing under ordinary conditions.	3-ft lengths for all pipe sizes ½ and up. About 1¼ in. thick.

*Also available for straight runs of copper tubing with nominal diameters of ½ in. and up.

Cements and Fills

J-M INSULATING CEMENTS AND FILLS

EXCELLENT COVERAGE • DURABLE FINISH



Johns-Manville manufactures a quality insulating cement or insulating fill for practically any industrial requirement.

Insulating cements are used for insulating irregular surfaces such as valves, flanges, etc. Asbestos finishing cements are generally used as a surface finish over block or sheet insulation to seal the joints and provide a smooth finish.

Insulating fills are generally used to pack irregular or otherwise inaccessible spaces to provide insulation on both high and low-temperature equipment. Detailed information on Johns-Manville Insulating Cements and Fills is tabulated below.

J-M INSULATING CEMENTS

Name	General use	Character or base	Maximum Service Temperature, F	Covering capacity, applied and dried, 1 in. thick		Approx lb water needed to mix 100 lb cement	Packaging, lb per bag
				sq ft per 100 lb	sq ft per bag		
NO. 302	Finishing	Asbestos	....	25	25	175	100
NO. 352		Asbestos		19	9½ or 19	100	50 or 100
NO. 301	Insulating-Finishing	One-coat Application	....	34	17	120	50
NO. 678	Protective Finishing	Semi-refractory	1900	20	10	75	50
NO. 319		Semi-refractory	1600	15	7½	60	50
SUPEREX®	Insulating	Diatomaceous silica	1900	45	34	250	75
NO. 500		Expanded vermiculite	1800	78	39	300	50
NO. 450		Mineral wool	1500	50	25	250	50
J-M 85% MAGNESIA		Magnesium carbonate	600	70	35	450	50

J-M INSULATING FILLS

Name	Composition	Maximum Service Temperature, F	Density to which usually packed, lb per cu ft	Packaging, lb per bag
FIBROFIL®	Mixture of diatomaceous silica and asbestos fiber.	1800†	18	80
FIL-INSUL	A mixture of mineral fibers.	1000	15	65
BANROC® LOOSE: GRANULATED	Mineral wool.	1000	12 9–12	40
GRANULATED ROCK CORK®	Mineral wool and bituminous binder.	150†	12–14	40
ZEROFIL®	Asphalt-impregnated loose mineral wool.	150†	10	40

† Normally used at temperatures below 100F.

Johns-Manville

INSULATIONS

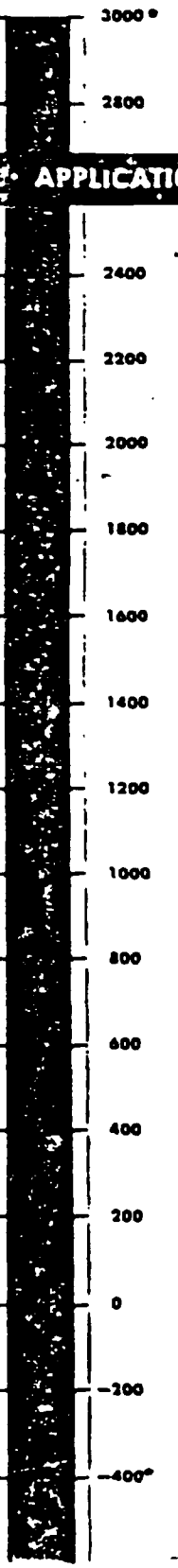
MATERIALS · ENGINEERING · APPLICATIONS

When you pay for top-quality insulation, back up your investment with the best installation service money can buy. Today, with high fuel and maintenance costs, it is especially important to place your insulation job in skilled hands. The scientific application of J-M quality insulations by J-M Insulation Contractors will assure you of the maximum return on your insulation investment for years to come. Moreover, you get undivided responsibility for *all* your insulation requirements.

Johns-Manville has established J-M Insulation Technical Service Units and J-M Insulation Contract Units throughout the country to serve you—units staffed with men who understand insulation engineering and with skilled applicators who are thoroughly trained in proven Johns-Manville methods.

Working with J-M materials and with J-M Insulation Engineers, these contractors *know* how to apply J-M insulation correctly to insure long, trouble-free performance. You can have the utmost confidence in their ability to handle your insulation application from start to finish.

And remember this important point: When your architect or engineer specifies Johns-Manville insulations, any J-M Insulation Contractor in the country will be able to give you a quick, accurate bid, regardless of the size or location of the job.



Johns-Manville

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