

PLAINTIFF'S
EXHIBIT
JM-2285

384676

Refractionary
Pipe Products

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Johns-Manville Refractory-Fiber Products Quick Reference Table

PRODUCT	TYPE (S)	SPREADSHEET COST/UNIT			COST /UNIT	OVERALL COMPETITIVE BID IN PERCENT PER FOOT									
		Nov	Dec	Jan		Feb	Mar	Apr	May	Jun	Jul	Aug	Sep		
SHEETS AND ROLLS Coated	2400	0.20	0.25	0.27	3	.69	.53	1.22	1.18	2.02	2.54	3.16	3.68		
					4	.62	.42	1.05	1.34	1.68	2.00	2.95	3.09		
					6	.55	.71	.89	1.31	1.61	1.94	2.31			
					8	.32	.45	.40	.97	1.16	1.38	1.52	1.52		
					10	.50	.52	.75	.50	1.04	1.25	1.45	1.69		
BULK FIBER Coated	2100	0.70	0.25	0.27	316.6	-	.99	1.30	-	-	-	-	-		
					13	.49	.60	.71	.84	.98	1.13	1.28	1.49		
					17	.56	.68	.81	.96	1.11	-	-	-		
					20	.52	.65	.80	.97	1.16	1.38	1.59	1.69		
					14	.48	.59	.70	.82	.95	1.09	1.23	1.52		
BOARD AND BUNDLED SAMPLES Coated Form Board Coated Form 1/4 Sheet Coated 1/2 Of Expansion Joint Bid	2100	0.70	0.25	0.27	3	.52	.65	.80	.97	1.16	1.38	1.63	1.92		
					17	.49	.58	.65	.78	.88	-	-	-		
					17	.49	.58	.65	.78	.88	-	-	-		
					17	.49	.58	.65	.78	.88	-	-	-		
					17	.49	.58	.65	.78	.88	-	-	-		
FIBERGLASS PRODUCTS Fiber	2100	0.70	0.25	0.27	3	.49	.93	1.22	1.58	2.02	2.54	3.16	3.68		
					4	.60	.82	1.05	1.34	1.68	2.00	2.95	3.09		
ROUNDER, COILING and IMPERMEATING CEMENTS Coated (Sb) Coated (Sb)	2100	0.70	0.25	0.27	3	.49	.93	1.22	1.58	2.02	2.54	3.16	3.68		
	2300	0.70	0.25	0.27	3	.49	.93	1.22	1.58	2.02	2.54	3.16	3.68		
					4	.60	.82	1.05	1.34	1.68	2.00	2.95	3.09		
					6	.55	.71	.89	1.09	1.33	1.44	1.94	2.31		
					8	.52	.65	.80	.90	1.16	1.38	1.52	1.52		
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FIBERGLASS PRODUCTS Fiber	2100	0.70	0.25	0.27	3	.49									

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Johns-Manville
REFRACTORY FIBER products
provide light, efficient insulation
for a variety of services to 2300F
(with FIBERCHROME effective up to 2700F)

John-Manville offers a complete line of refractory fiber products to meet the high temperature insulation requirements of industry. These lightweight thermal insulation products are designed for a wide range of applications to 2200°F. with fiber-reinforced suitable for continuous operating temperatures up to 2700°F.

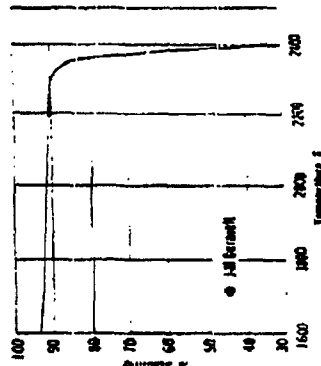
Originally developed by Johns-Manville Research and Development, the shield jet airfalls from searing engine heat, then deposits a thin, flexible inorganic material that effectively protects engine and component surfaces from the heat. Camlet and Apollo space vehicles. It is now providing vital insulation service in many industrial applications.

For-sheathed clonifiers are using refractory fiber in various forms as an efficient, economical replacement for many conventional insulation materials because it offers almost unlimited possibilities for a diversity of high temperature uses. A few of its outstanding features are:

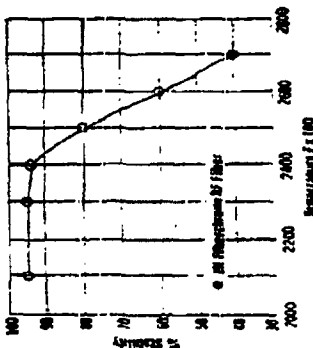
- High heat resistance
- Flexibility
- Thermal stability
- Low k factor
- Chemical stability
- Light weight
- Good fill/cure qualities
- Good abrasion loss

THERMAL STABILITY

Thermal stability is a measure of a refractory fiber's resistance to elevated temperature. Refractory fibers tend to devitify or lose their glassy structure and become crystalline and brittle as the temperature is increased.



NOTES: The values given herein are average typical values obtained in accordance with accepted test methods and are subject to change. Data must not be obtained solely for being information.



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The format and uses described in this brochure are typical examples of the versatility of J-M refractory floor products. It is not possible to show the full range of uses because new applications are constantly being discovered, with modern design techniques and manufacturing methods frequently changing to meet the new approach to the creation or reduction of today's products.



Stability percentage is the amount of fibers that did not diverge at the specified temperature after exposure for 24 hours. A stability of 40-50% is used as a guide to recommend service temperature limits.

SHEETS AND ROLLS



J-M CERAFELT sheets and rolls

Cerafelt is a lightweight refractory fiber felt insulation available for its excellent thermal and chemical stability. Made predominantly of alumina and silica, it combines highest heat resistance, low conductivity, and high sound absorption qualities.

Cerafelt is recommended for a great variety of high temperature industrial applications such as insulation, protection in refractory open hearth roofs, on cover-type assemblies in fill openings for electrical access, expansion joints in kilns, furnaces and hot air ducts.

Among the many advantages of Cerafelt refractory fiber felt are:

HIGH HEAT RESISTANCE
Will withstand continuous exposure to a full 2300°F.

LOW THERMAL CONDUCTIVITY
Excellent low thermal conductivity at high temperatures due to opacity of basic fibers to infrared radiation.

HIGH WEIGHT
Weighs as little as 1 lb./sq. ft. volume of hot fire brick.

CHEMICALLY STABLE
Non-alkaline and chemically stable. Contains no corrosive promoting agents.

Cerafelt is furnished in sheets and rolls in the following dimensions:

Density: 4, 6, 8, 10, 12, 14, 16 and 24 pcf.
Thickness: 1/2", 1", 1 1/2", 2", 3", 4", 6", 8", 10", 12", 14", 16", 18", 20", 22", 24", 26", 28", 30", 32", 34", 36", 38", 40", 42", 44", 46", 48", 50", 52", 54", 56", 58", 60", 62", 64", 66", 68", 70", 72", 74", 76", 78", 80", 82", 84", 86", 88", 90", 92", 94", 96", 98", 100".

Length: (sheets) 48" and up.
(rolls) 4 ft. through 4 ft. density, also available in 27' rolls in the 4 ft. X 8 ft. sizes.

Width: 12", 16", 20", 24", 30", 36", 42", 48", 54", 60", 66", 72", 78", 84", 90", 96", 100".

Also available in loose form (J-M CERAFELT). See page 4.

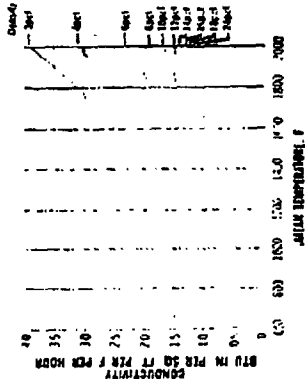
PHYSICAL PROPERTIES

Service Temperature (°F)	2300
Density (pcf)	3 to 24
Specific Heat (Btu/lb./°F)	
2000	0.20
1800	0.25
1600	0.27
Typical Chemical Analysis (%)	
SiO ₂	54.0
Al ₂ O ₃	45.5
Fe ₂ O ₃	8.2
MgO	0.2
Ignition Loss (%)	2 to 5
Fiber Diameter (microns)	3.5

Airflow Resistance (cfm/in. w.e./sq. ft./in.)

F	3	4	6	8	10	12	14	16	24
75	65.6	80.0	114	100	63	43	32	19	11
100	33.4	20.0	8.5	5.0	3.2	2.2	1.6	0.9	0.6
200	24.0	14.4	6.4	3.6	2.2	1.6	1.2	0.7	0.4

THermal CONDUCTIVITY



Thermal Conductivity (K) in BTU IN PER SQ. FT. PER HOUR vs. TEMPERATURE (°F)

Thickness (inches)	125	150	180	200	250	300	350	400	450
1	0.21	0.18	0.15	0.14	0.13	0.12	0.11	0.10	0.09
2	0.22	0.19	0.16	0.15	0.14	0.13	0.12	0.11	0.10
3	0.23	0.20	0.17	0.16	0.15	0.14	0.13	0.12	0.11
4	0.24	0.21	0.18	0.17	0.16	0.15	0.14	0.13	0.12
5	0.25	0.22	0.19	0.18	0.17	0.16	0.15	0.14	0.13
6	0.26	0.23	0.20	0.19	0.18	0.17	0.16	0.15	0.14

Values are based on the average of the sound absorption coefficient at high and low frequencies (100 and 2000 cycles/sec).

BULK FIBER

J-M CERAFIBER bulk fiber

Cerafiber is a white, lightweight bulk refractory fiber suitable for continuous exposure up to 2300°F. It is an exceptionally high purity alumina-silica fiber with high refractory resistance, good dimensional stability and good resistance to vitrification. It is especially well suited for chemical use in hydrofluoric and phosphoric acids, and strong alkalis. It is highly resistant to thermal and physical properties will be fully retained after drying.

Cerafiber can be used anywhere a lightweight fibrous and resilient insulation or fill is needed. It is excellent as a fill for hot duct equipment or for packing vessels and expansion joints. It can be used as a loose insulating fill for chimneys and walls of kilns, sulphur burning, non-oxidizing heat treating and hold fire furnaces. Good for insulating bin car tops, as a packing in furnace joints, fan boxes, burner openings, furnace door joints and brickwork voids.

Among the many advantages of Cerafiber bulk refractory fiber are:

HIGH HEAT RESISTANCE
Will withstand continuous exposure to a full 2300°F.

LOW THERMAL CONDUCTIVITY
Unusually low thermal conductivity at high temperatures due to opacity of basic fibers to infrared radiation.

CHEMICALLY STABLE

Non-alkaline and chemically stable. Contains no corrosive promoting agents.

RESILIENT

Resilient refractory fibers assure that void will remain completely filled.

Cerafiber is available in loose bulk form, packed in 25-lb. boxes (18" x 18" x 24").

Also available in felt form (J-M CERAFELT). See page 4.

PHYSICAL PROPERTIES

Service Temperature (°F)	2300
Density (pcf)	3 to 4
Specific Heat (Btu/lb./°F)	
2000	0.20
1800	0.25
1600	0.27
Thermal Conductivity (K) in BTU IN PER SQ. FT. PER HOUR	
2000	0.09
1800	0.13
Typical Chemical Analysis (%)	
SiO ₂	54.2
Al ₂ O ₃	45.5
Fe ₂ O ₃	8.2
MgO	0.15



TAPE

J-M CERAFELT refractory fiber tape



Ceralfelt tape is a lightweight, refractory fiber insulation suitable for its excellent thermal and chemical stability. Made predominantly of alumina and silica, it combines lightness, heat resistance, low conductivity and high sound-absorption qualities.

Ceralfelt tape is recommended for a great variety of high temperature industrial applications such as expansion joints in kilns, furnaces and boiler walls; insulation protection in repairing open brickwork; concrete encasement in fill openings for electrical access.

Among the many advantages of Ceralfelt tape are: HIGH HEAT RESISTANCE Withstands continuous exposure to a full flame.

LOW THERMAL CONDUCTIVITY Possesses low conductivity at high temperatures due to presence of basic fibers to infra-red radiation.

CHEMICAL STABILITY Non-alkaline and chemically stable. Contains no corrosion-promoting acids.

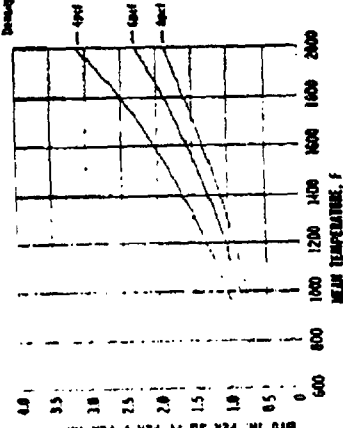
Ceralfelt tape is furnished in rolls of 27" (7' thick) and 30" (2' thick) in widths of 1' and 2'.

PHYSICAL PROPERTIES

Service Temperature (°F)	2200
Density (lb/ft³)	0.20
Specific Heat (Btu/lb/°F)	0.25
1000°F	0.27
1800°F	0.35
Fiber Diameter (microns)	532
Typical Chemical Analysis (typical basis %)	
SiO₂	48.3
Al₂O₃	0.2
Fe₂O₃	0.15
Ignition Loss (%)	2.5

*Data derived from laboratory tests.

THERMAL CONDUCTIVITY



PAPER J-M CERAPAPER refractory fiber paper



Cerapaper is a lightweight refractory fiber paper which is flexible and very resistant to high temperatures and thermal shock to 2200°F. In addition, it retains a high degree of resilience at high temperatures while maintaining a very low thermal conductivity.

Cerapaper is recommended for packages and perforated paper or sheets needed for high temperature applications. It can be used for high temperature gas seals, combustion chamber linings, tap hole plug covers, and expansion joint material for molten metal troughs. Also an excellent thermal insulation for a wide variety of applications in areas with small clearances.

Among the many advantages of Cerapaper refractory fiber paper are:

LOW THERMAL CONDUCTIVITY Does not store large amounts of heat so can be heated or cooled almost instantaneously.

CHEMICAL STABILITY Chemically very resistant to high temperatures (up to 2200°F) in air.

It can be easily repaired from atmospheric temperature to full operating temperature without degradation.

GOOD MECHANICAL PROPERTIES

is very flexible, with good tensile strength and high resilience.

Cerapaper is available in the following dimensions:

Thickness, mils	Length, ft (approx)				Weight, lb/roll
	6 in	12 in	24 in	36 in	
.005	156	312	78	156	260
.010	90	180	45	90	151
.020	47	95	23	47	79

Width, inches: 12, 24, 36 ± 1/16

Size, ft.: 5, 10, 25 ± 1/8

*All sizes will be available in all thicknesses, but only in 25-ft rolls.

PHYSICAL PROPERTIES

Melting Point	Over 3200°F
Ultimate Tensile Strength	2200 PSI
Elongation at Break	2.61
Specific Heat	0.27 Btu/lb/°F
Impact Fiber Diameter	3 to 4 microns
Water Content	5%
Chemical Analysis	
% by weight: Silica (SiO₂)	46
Alumina (Al₂O₃)	54
Other SO₂	

Type Number	1-175		1-176		1-177	
	100 ± 10%	100 ± 10%	100 ± 10%	100 ± 10%	100 ± 10%	100 ± 10%
Basic Thickness, mils	1.75	1.76	1.75	1.76	1.75	1.76
Approximate Thickness, mils (uncompressed)	1.52	1.76	1.52	1.76	1.52	1.76
Density, g/cc	1.7	1.7	1.7	1.7	1.7	1.7
Weight, lb/ft² (1000 sq ft)	32 ± 3%	32 ± 3%	32 ± 3%	32 ± 3%	32 ± 3%	32 ± 3%
Weight, lb/ft² (1000 sq ft)	32 ± 3%	32 ± 3%	32 ± 3%	32 ± 3%	32 ± 3%	32 ± 3%
Tensile Strength, psi (machine direction)	302	302	302	302	302	302
Compressive Strength, psi (machine direction)	1.7	1.7	1.7	1.7	1.7	1.7
Modulus of Elasticity, psi (machine direction)	1.3	1.3	1.3	1.3	1.3	1.3
Modulus of Elasticity, psi (machine direction)	1.3	1.3	1.3	1.3	1.3	1.3
Modulus of Elasticity, psi (machine direction)	1.3	1.3	1.3	1.3	1.3	1.3
Modulus of Elasticity, psi (machine direction)	1.3	1.3	1.3	1.3	1.3	1.3

*Thickness measured at 0 psi compression, per Tensile Machine Test.

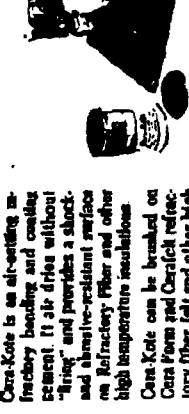
THERMAL CONDUCTIVITY

Average values

Mean Temp., °F	Thermal Conductivity, k (per ft² in² ft)
200	.26
400	.41
600	.55
800	.65
1000	.72
1200	.78
1400	.83
1600	.88
1800	.93
2000	.98

BONDING, COATING and IMPREGNATING CEMENTS

J-M CERA-KOTE[®] bonding and coating cement



Cera-Kote is an air-setting refractory bonding and coating cement. It air dries without "firing" and provides a shock- and abrasion-resistant surface on Refractory Fiber and other high temperature insulations.

Cera-Kote can be brushed on Cera Form and Ceralfelt refractory fiber felt and other high temperature insulations when a hard surface coating is required. It will also bond these insulations together in multilayer applications, or to a variety of other surfaces.

It is available in quart and gallon containers. Complete application instructions on the label.

J-M CERA-PRG[®] inorganic impregnant

Cera-PRG is an inorganic impregnant that can be brushed or sprayed on Refractory Fiber or other high temperature insulation surfaces. It is normally applied to the surface after installation and allowed to air dry. It provides a harder and more abrasion-resistant, but less resilient, surface on the material being treated. It is recommended for use in bonding the surface of Ceralfelt or Cera Form where additional abrasion resistance is desired.

Cera-PRG is available in quart and gallon containers. Complete application instructions on the label.

PHYSICAL PROPERTIES

Compressive strength	100 to 150 psi
Weight per cubic foot	14 lb
Water content	10
Specific heat	0.27 Btu/lb/°F
Impact fiber diameter	3 to 4 microns
Water content	5%
Chemical analysis	
% by weight: Silica (SiO₂)	46
Alumina (Al₂O₃)	54
Other SO₂	

CHEMICAL COMPOSITION

As described	Cera-Kote		Cera-PRG	
	Dry	As described	Dry	As described
SiO₂	48.3	48.3	48.3	48.3
Al₂O₃	0.2	0.2	0.2	0.2
Fe₂O₃	0.1	0.1	0.1	0.1
Ignition loss	2.5	2.5	2.5	2.5



Johns-Manville

22 East 40th Street • New York, N. Y. 10018
Sales Offices in Principal Cities

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Johns-Manville

PRODUCT INFORMATION

type: Sheet

temp limit: 1200F

J-M ASBESTOS MILLBOARD Insulating sheet material

DESCRIPTION: Johns-Manville Asbestos Millboard is a dense, rigid sheet of board material formed of asbestos fibers and a small amount of binder. A natural light gray in color, Millboard sheets are furnished in standard sizes of 42" x 48", in thicknesses ranging from 1/32" to 1/2". Cut pieces can also be supplied.

AVAILABLE FORMS

No. 106 Millboard—A general purpose, high utility millboard suitable for most uses. It will withstand temperatures to 1000F.

No. 102 Millboard—A higher quality millboard than No. 106. Will withstand temperatures to 1000F.

No. 219 Millboard—This is a premium grade millboard, specially treated for greater strength. Suitable for temperatures to 1100F. It can be used up to 1800F where some loss of strength is not detrimental.

C Grade Millboard—This millboard contains an especially long grade of asbestos fiber. It is suitable for temperatures to 1200F; embrittlement occurs above this limit. Where brittleness is not objectionable, may be used at temperatures up to 1800F.

XXX Millboard—This millboard is inorganically bonded. It is suitable for applications where organic matter cannot be tolerated.

Silicated Millboard—All grades of millboard can be specially treated to increase surface hardness. Where such sheets are required, the word "silicated" should appear on the order before the millboard type. Weight of Silicated Millboard is approximately 5% higher than for unsilicated.

Special—Millboards for special purposes can be tailored to service requirements.

USES: J-M Asbestos Millboard is recommended for applications which require a sheet or board insulation for protection against fire, heat, acid fumes, etc. Frequently used as a fire-resistant lining for floors, partitions, ceilings, stores and garages. It has been found particularly valuable in the steel industry where literally scores of uses have been discovered for this versatile material.

ADVANTAGES

Versatile

Adapted to literally scores of industrial applications.

Fireproof

Made of asbestos, the world's most famous fireproof material.

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