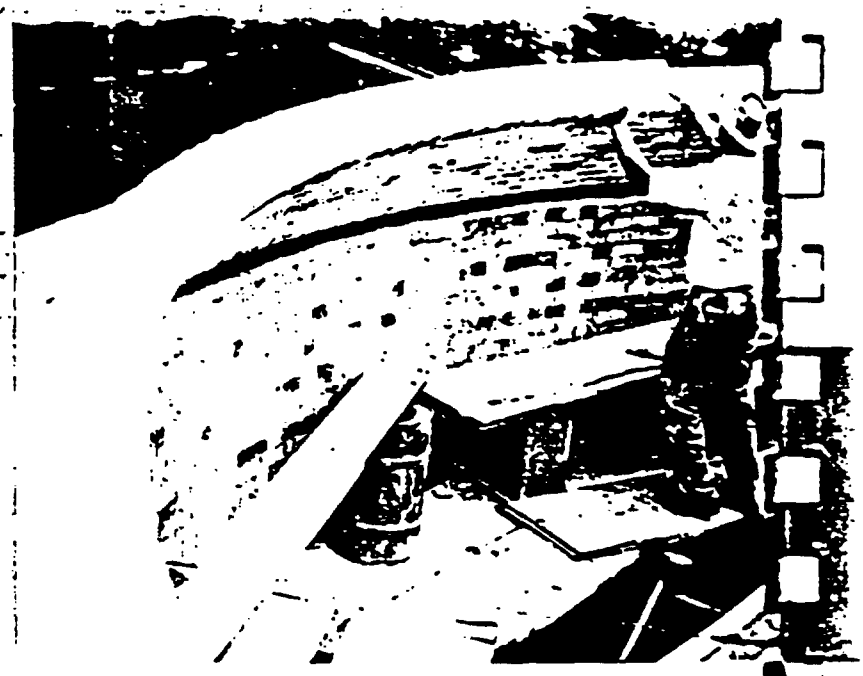
Johns-Manville

PRODUCT INFORMATION



type: Brick
temp limit: 3000F

PLAINTIFF'S EXHIBIT K-1705

J-M INSULATING FIRE BRICK

DESCRIPTION: Johns-Manville produces six types of Insulating Fire Brick to provide operators and builders of high temperature equipment six opportunities to get the one insulating fire brick that's right for a given service.

Each type of J-M Insulating Fire Brick has the correct balance of thermal and physical properties for its recommended service. All six types offer light weight, low conductivity and high structural strength.

Made from high quality refractory clays (plus alumina in the case of JM-3000), these insulating fire brick contain a carefully graded organic filler which is burned out during manufacture to give a uniform, controlled pore structure.

AVAILABLE TYPES:

JM-3000*—for temperatures to 3000F exposed.

JM-28—for temperatures to 2800F exposed.

JM-26—for temperatures to 2600F exposed.

JM-23—for temperatures to 2300F exposed.

JM-20—for temperatures to 2000F exposed.

JM-1620—for temperatures to 1600F exposed; to 2000F back-up.

*JM-3000 Insulating Fire Brick is the newest of the six types. It provides long-life insulation at a full 3000F, in back-up or direct exposure service, and is molded from specially selected kaolin clays plus alumina

USES: Recommended for use as refractory lining or as back-up insulation behind other refractory protection in kilns, furnaces, flues, refining vessels, regenerators, gas producers and mains, soaking pits, stress-relieving furnaces, reactor chambers and similar high temperature industrial equipment.

ADVANTAGES

High Insulating Value

The light weight and high insulating value of J-M Insulating Fire Brick make possible thinner furnace walls, improved efficiency and lower operating costs.

Quick Heat Up

Furnaces can be brought up to operating temperatures with unusual speed, resulting in increased production.

DEFENDANT'S EXHIBIT OE-277

PRODUCED JM - 83

INSULATING FIRE BRICK
Specification Data

PHYSICAL PROPERTIES*

	JM-3000	JM-28	JM-26	JM-23	JM-20	JM-1620
Temperature Limit	3000F**	2800F**	2600F**	2300F**	2000F**	2000F*** 1600F**
Approximate Density	65 pcf	58 pcf	51 pcf	31 pcf	29 pcf	27 pcf
Transverse Strength	200 psi	175 psi	140 psi	140 psi	100 psi	80 psi
Cold Crushing Strength	400 psi	300 psi	210 psi	210 psi	150 psi	95 psi
Linear Shrinkage	†0.8% at 3000F	1.4% at 2800F	1.0% at 2600F	0.1% at 2300F	0.0% at 2000F	0.0% at 2000F
Reversible Thermal Expansion	0.65-0.75% at 2000F	0.65-0.75% at 2000F	0.65-0.75% at 2000F	0.5-0.6% at 2000F	0.5-0.6% at 2000F	0.5-0.6% at 2000F

*The figures given in this table are average values obtained in accordance with accepted test methods.
**Back-up or exposed. ***Back-up only.
†24-hr Simulative Service Panel Test; all others 24-hr soaking period.

PACKAGING

Type	No. of Brick per Carton
JM-3000	20
JM-28	20
JM-26	25
JM-23	25
JM-20	25
JM-1620	25

COMPLIANCE WITH GOVERNMENT SPECS

JM-20 complies with MIL-B-16305 A, class A
JM-28 complies with MIL-B-16305 A, class B

STANDARD SIZES

Type	Size
JM-3000 JM-28 JM-26 JM-23 JM-20 JM-1620	Accurately sized in all standard 9 in. shapes of the 2½ and 3 in. series, as well as special shapes.

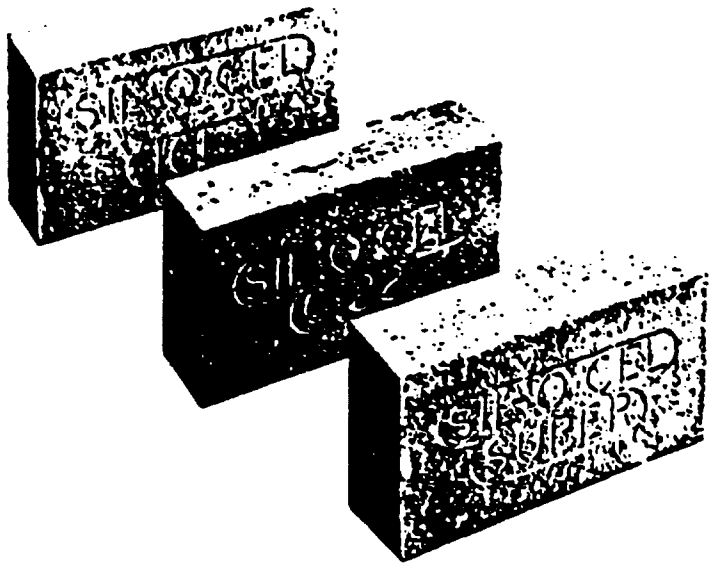
THERMAL CONDUCTIVITY.

	MEAN TEMPERATURE, F			
	500	1000	1500	2000
JM-3000	3.22	3.30	3.37	3.46
JM-28	2.55	2.80	3.06	3.32
JM-26	2.22	2.44	2.68	2.93
JM-23	1.01	1.18	1.34	1.50
JM-20	0.95	1.18	1.27	1.27
JM-1620	0.90	1.07	1.27	—

CONDUCTIVITY: BTU IN. PER SQ FT PER F PER HR

Johns-Manville

PRODUCT INFORMATION



type: Brick
temp limit: 2500F

J-M SIL-O-CEL® INSULATING BRICK

DESCRIPTION: Made from diatomaceous silica, a material composed of millions of microscopic cells that offer maximum resistance to heat flow. Sil-O-Cel Insulating Brick are particularly useful where high load-bearing characteristics are required. Sil-O-Cel Insulating Brick are furnished in three types for use as back-up insulation behind refractory fire brick linings or behind insulating fire brick linings. The new Sil-O-Cel 16L brick may also be used for exposed as well as back-up service.

AVAILABLE TYPES:

Sil-O-Cel Insulating Brick are furnished in three different types as follows:

Sil-O-Cel Super—for temperatures to 2500F back-up only.

Sil-O-Cel C-22—for temperatures to 2000F back-up only.

Sil-O-Cel 16L—for temperatures to 1600F back-up or exposed.

USES: Sil-O-Cel Insulating Brick are recommended for use as back-up insulation in furnaces, kilns, hot blast stoves, soaking pits, boiler walls, oil heaters, regenerators, and similar high temperature equipment in the steel, chemical, ceramic, power, petroleum and glass industries.

ADVANTAGES

Good Insulating Value

Used as back-up insulation, Sil-O-Cel Insulating Brick make it possible to reduce the necessary thickness of the exposed refractory as much as one-third. This results in substantial savings in furnace wall construction for all the types of high temperature equipment for which these brick are recommended.

High Load Bearing Strength

Sil-O-Cel Insulating Brick are made from diatomaceous silica, a natural fossilized material which imparts to the finished brick great strength. The Sil-O-Cel C-22 brick, for example, has a cold crushing strength of 700 lbs per square inch.

SIL-O-CEL INSULATING BRICK
Specification Data

PHYSICAL PROPERTIES*

	Super	C-22	16L
Temperature Limit	2500F**	2000F**	1600F***
Approximate Density	40 pcf	38 pcf	34 pcf
Transverse Strength	90 psi	115 psi	60 psi
Cold Crushing Strength	300 psi	700 psi	350 psi
Linear Shrinkage	2.0% at 2500F	0.8% at 2000F	0.7% at 1600F
Reversible Thermal Expansion	1.3% at 2000F	0.7% at 2000F	less than 0.1% at 1600F

*The figures given in this table are average values obtained in accordance with accepted test methods.
**Back-up only. ***Back-up or exposed.

THERMAL CONDUCTIVITY

	MEAN TEMPERATURE, F			
	500	1000	1500	2000
Super	1.70	1.95	2.19	2.45
C-22	1.67	1.88	2.08	—
16L	0.92	1.07	1.22	—

CONDUCTIVITY: BTU IN. PER SQ FT PER F PER HR

COMPLIANCE WITH GOVERNMENT SPECS

Sil-O-Cel Super complies with MIL-B-16182B

STANDARD SIZES

Type	Size
Sil-O-Cel Super	Furnished in all standard 9 in. shapes of the 2½ and 3 in. series, as well as special shapes.
Sil-O-Cel C-22	
Sil-O-Cel 16L	

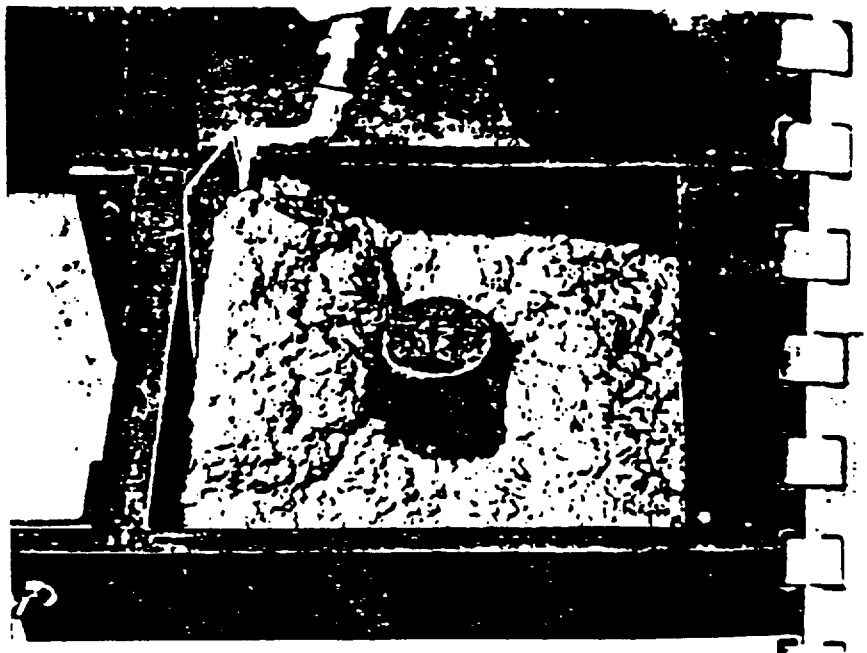
PACKAGING INFORMATION

All Sil-O-Cel Insulating Brick are packaged 25 to a carton.

PRODUCED
JM - 83

Johns-Manville

PRODUCT INFORMATION



type: Castable

temp limit: 3000F

J-M FIRECRETE® hydraulic setting refractory cement

DESCRIPTION: Johns-Manville produces seven types of hydraulic setting castable refractory cements to meet practically every castable requirement for temperatures through 3000F. Each of these refractories is economical and efficient in the service range for which it is recommended. All harden rapidly and are highly resistant to spalling.

AVAILABLE TYPES:

3X Firecrete – For service to 3000F. Composed principally of high aluminous materials calcined at high temperatures. Recommended for casting thicknesses of 2 inches or more.

H.T. Firecrete–For service to 2800F. Recommended for casting thicknesses 2" inches or more.

Standard Firecrete–For service to 2500F. Develops exceptional strength on air curing. Can be used to cast thicknesses as thin as 1 inch.

L.W. Firecrete–A light weight, insulating refractory concrete for service to 2400F. 75 lbs of dry material required for one cubic foot.

CA Insulating Firecrete–A light weight, low iron content refractory for use in controlled atmospheres. For service to 2600F.

CA 2200 Insulating Firecrete–A light weight, low iron content refractory for use in controlled atmospheres. For service to 2200F.

No. 20 Firecrete–Similar to L.W. Firecrete but lighter. 58 lbs of dry material required for one cubic foot. Service to 2000F.

C-31 M Refractory Cement–A chrome base castable refractory for service to 3000F.

Lo-D Firecrete–Designed primarily for use as a back-up insulating refractory in naval boilers. Service to 2500F.

USES: Firecrete is used extensively for monolithic furnaces and linings and is recommended for such special shapes as those required for burner rings, baffle tile, header protection tile, pipe linings, furnace bottoms and similar installations.

ADVANTAGES

Hardens Rapidly

Firecrete permits casting and use of any desired shape within 24 hours.

Resists Spalling

All seven types are highly resistant to spalling.

Negligible Shrinkage

Firecrete has no drying shrinkage and only negligible fire shrinkage at recommended temperatures.

Easy and Economical to Use

The adaptability of Firecrete makes possible the easy construction of monolithic furnaces, linings and the like which would otherwise require the use of special shapes or involve costly cutting and fitting of brick.

FIRECRETE

Specification Data

PHYSICAL PROPERTIES*

Highest Recommended Service Temperature	3X 3000F	H.T. 2800F	STD. 2500F	L.W. 2400F	CA Insulating 2600F	CA 2200 Insulating Firecrete 2200F	No. 20 2000F	C-31 M Refractory 3000F	Lo-D 2500F
Pyrometric Cone Equivalent	33 (3173F)	30 (3002F)	16 (2669F)	15 (2615F)	32½ (3135F)	16-17 (2740F)	14 (2552F)	36 (3290F)	–
Weight									
As Placed	148 pcf	131 pcf	130 pcf	109 pcf	109 pcf	97 pcf	96 pcf	193 pcf	100 pcf
Oven Dried at 220F	134 pcf	113 pcf	116 pcf	80 pcf	80 pcf	66 pcf	62 pcf	183 pcf	48 pcf
After 5-Hr Firing at 1750F	130 pcf	110 pcf	110 pcf	75 pcf	75 pcf	57 pcf	58 pcf	177 pcf	44 pcf
Crushing Strengths After 5-Hr Firing at:									
220F	3500 psi	700 psi	1310 psi	630 psi	580 psi	310 psi	220 psi	2920 psi	–
1200F	2680 psi	560 psi	1190 psi	595 psi	475 psi	320 psi	210 psi	1780 psi	–
1750F	2350 psi	300 psi	780 psi	490 psi	595 psi	375 psi	220 psi	1300 psi	–
2000F	–	–	–	–	–	–	320 psi	–	–
2200F	2490 psi	580 psi	1190 psi	690 psi	650 psi	–	–	1690 psi	–
2400F	2950 psi	1500 psi	2130 psi	1690 psi	840 psi	–	–	3850 psi	–
Linear Change After 5-Hr Firing at:									
1200F	–0.2%	0.0%	0.0%	–0.2%	–0.1%	–0.1%	–0.2%	–0.2%	–
1750F	–0.1%	0.0%	–0.2%	–0.3%	–0.2%	–0.1%	–0.4%	–0.2%	–
2000F	–0.1%	–	–	–	–	–0.1%	–0.6%	–	–
2200F	–0.2%	0.0%	–0.6%	–0.5%	–0.3%	–	–	–0.3%	–
2400F	–0.7%	+0.6%	+1.6%	–2.4%	–0.8%	–	–	–0.5%	–
2800F	–0.9%	+0.9%	–	–	–	–	–	–1.9%	–
3000F	–	–	–	–	–	–	–	–3.1%	–

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

THERMAL CONDUCTIVITY

	MEAN TEMPERATURE, F						
	800	1000	1200	1400	1600	1800	2000
3X	–	7 0	7 2	7.5	7.8	8.4	9.4
H T	–	4 45	4 76	5 08	5 41	5 74	–
Std	4 16	4 34	4 59	4 88	5 19	5 52	–
L W	1 99	2 09	2 21	2 36	2 56	2 82	–
CA Ins	–	2 57	2 70	2 90	3 12	3.33	3.65
No 20	1 43	1 54	1 65	1 76	1 87	1.98	–
C 31 M		6 0	6 1	6 3	6 5	6 7	6 9

CONDUCTIVITY: BTU IN. PER SQ FT PER F PER HR

PACKAGING INFORMATION

	Pounds Required for 1 cubic foot	Packaging
3X Firecrete	130	100-lb bags
H.T. Firecrete	110	100-lb bags
Standard Firecrete	110	50 or 100-lb bags
L.W. Firecrete	75	80-lb bags
CA Insulating Firecrete	75	80-lb bags
CA 2200 Insulating Firecrete	57	80-lb bags
No. 20 Firecrete	58	80-lb bags
C-31 M Refractory Cement	180	100-lb bags
Lo-D Firecrete	44	50-lb bags

COMPLIANCE WITH GOVERNMENT SPECS

Lo-D Firecrete complies with MIL C 19794A

Johns-Manville

PRODUCT INFORMATION

type: Gunning-Troweling
temp limit: 3000F

J-M BLAZECRETE® hydraulic setting refractory cement

DESCRIPTION: Four types of dry monolithic, hydraulic setting refractory cements have been developed and produced by Johns-Manville for gunning and slap-troweling applications.

These four refractories are especially adaptable for gun application in building new refractory linings and repairing old ones. They adhere readily with a minimum of loss when "shot" in place. Mixed with water at the gun nozzle, they are pneumatically projected with great force, resulting in a dense, homogeneous lining.

Blazecrete is equally effective for heavy patching by troweling, especially where brickwork has eroded deeply. It eliminates the laborious ramming or tamping required with "plastics," and patches need not be prefired.

AVAILABLE TYPES:

3X Blazecrete—For service to 3000F. High alumina content. Particularly adaptable for gun applicators and for heavy patching by slap-troweling.

Standard Blazecrete—For service to 2400F. Alumina silicate base.

L.W. Blazecrete—For service to 2000F. Light weight, alumina silicate base refractory. Used extensively for stack linings, heaters and other applications where gunning mix with low rebound loss is required.

C-2 Refractory Cement—For service to 2300F. Used to advantage in making a protective abrasion-resistant refractory surface over L.W. Blazecrete.

USES: Recommended for lining or patching forge furnaces, ashpits, cyclones, heaters, boilers, oil refining equipment, furnace bottoms, ladles and similar applications. L.W. Blazecrete is extensively used on tanks, structural steel and skirts for fire protection purposes.

ADVANTAGES

Hardens Rapidly

Applications ready for use within 24 hours of gunning or slap-troweling.

Resists Spalling

All four types are highly resistant to spalling.

Easy to Use

Can be applied by gunning or slap-troweling.

PRODUCED
JM - 83

BLAZECRETE
Specification Data

PHYSICAL PROPERTIES*

	3X	STD.	L.W.	C-2 Cement
Highest Recommended Service Temperature	3000F	2400F	2000F	2300F
Pyrometric Cone Equivalent	33 (3173F)	16 (2669F)	14 (2552F)	15 (2608F)
Weight Slap Troweled:				
As Placed	148 pcf	132 pcf	104 pcf	140 pcf
Oven Dried at 220F	133 pcf	116 pcf	69 pcf	126 pcf
After 5-Hr Firing at 1750F	130 pcf	110 pcf	65 pcf	120 pcf
Weight Gunned:				
As Placed	153 pcf	134 pcf	117 pcf	142 pcf
Oven Dried at 220F	142 pcf	124 pcf	76 pcf	134 pcf
After 5-Hr Firing at 1750F	140 pcf	118 pcf	73 pcf	128 pcf
Crushing Strengths After 5 Hours Firing at:				
220F	570 psi	1350 psi	275 psi	6200 psi
1200F	700 psi	1070 psi	338 psi	4700 psi
1750F	790 psi	1130 psi	400 psi	2600 psi
2000F	—	—	461 psi	—
2200F	1040 psi	1480 psi	—	—
2400F	2390 psi	2870 psi	—	—
Linear Change After 5 Hours Firing at:				
1200F	0.0%	−0.1%	−0.3%	−0.2%
1750F	0.0%	−0.4%	−0.6%	−0.2%
2000F	—	—	−0.8%	−0.5%
2200F	−0.2%	−0.6%	—	—
2400F	−0.2%	−0.4%	—	—

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

THERMAL CONDUCTIVITY

	MEAN TEMPERATURE, F							
	600	800	1000	1200	1400	1600	1800	2000
3X	-	-	4.10	4.30	4.68	5.40	6.35	7.68
STD	-	3.89	3.95	4.05	4.24	4.57	5.09	—
L.W.	1.42	1.52	1.64	1.76	1.89	2.01	—	—
C-2	-	-	3.40	3.50	3.80	4.30	5.10	5.90

CONDUCTIVITY: BTU IN. PER SQ FT PER F PER HR

PACKAGING INFORMATION

	Pounds required for 1 cu ft	Packaging
3X Blazecrete	130 (slap-troweling) 140 (gunning)	100 lb bags
Standard Blazecrete	110 (slap-troweling) 118 (gunning)	100 lb bags
L.W. Blazecrete	65 (slap-troweling) 73 (gunning)	80 lb bags
C-2 Refractory Cement	120 (slap-troweling) 140 (gunning)	100 lb bags

Johns-Manville

PRODUCT INFORMATION

type: Fill
temp limit: 2400F

J-M AGGREGATES AND FILLS

DESCRIPTION: Johns-Manville lightweight aggregates and fills are available in a wide selection for temperatures through 2400F.

Zelie L.W. and JM-2400 L.W. Aggregates may be mixed with calcium aluminate cement to form an insulating refractory concrete for various operating conditions. Sil-O-Cel C-3 may be mixed with calcium aluminate or portland cement for lower temperature conditions. By selection of the aggregate, an insulating refractory concrete can be made with the characteristics desired for constructing core, japanning and enameling ovens, foundations and bases of heated equipment, furnace doors, and many special shapes. In addition, all materials listed below may be used as fills for insulating irregular spaces in high temperature equipment, making it possible to conserve heat where other forms of insulation cannot be economically installed.

AVAILABLE TYPES

Name	Composition	Temperature limit, F	Approx density to which fills are normally packed, lbs per cu ft	Packaging
JM-2400 L.W. Aggregate	al. silicate	2400	50	80-lb bags
Zelie L.W. Aggregate	al. silicate	2400	31	65-lb bags
Sil-O-Cel C-3	calcined, coarse-graded diatomaceous silica	2000	31	50-lb bags
Sil-O-Cel Insulating Powder	finely ground diatomaceous silica	1600	17	50-lb bags
Sil-O-Cel Coarse Grade	similar to Sil-O-Cel Insulating Powder, but more coarsely ground	1600	22	50-lb bags

Johns-Manville

INSULATION

PRODUCT INFORMATION

type: Refractory Mortar
temp limit: 3200F

J-M BONDING MORTARS

■ DESCRIPTION: J-M Refractory Bonding Mortars are recommended for bonding together many relatively small units into a stable, strong, and gas-tight structure. The use of refractory mortars reduces slag or gas penetration and cuts down heat loss caused by open joints. There are two general classifications of bonding mortars: heat setting and air setting. Heat setting mortars will develop a bond only with the application of heat. Air setting mortars develop a strong bond without the application of heat.

J-M Bonding Mortars have been scientifically formulated to insure good workability, low shrinkage, and long shelf life.

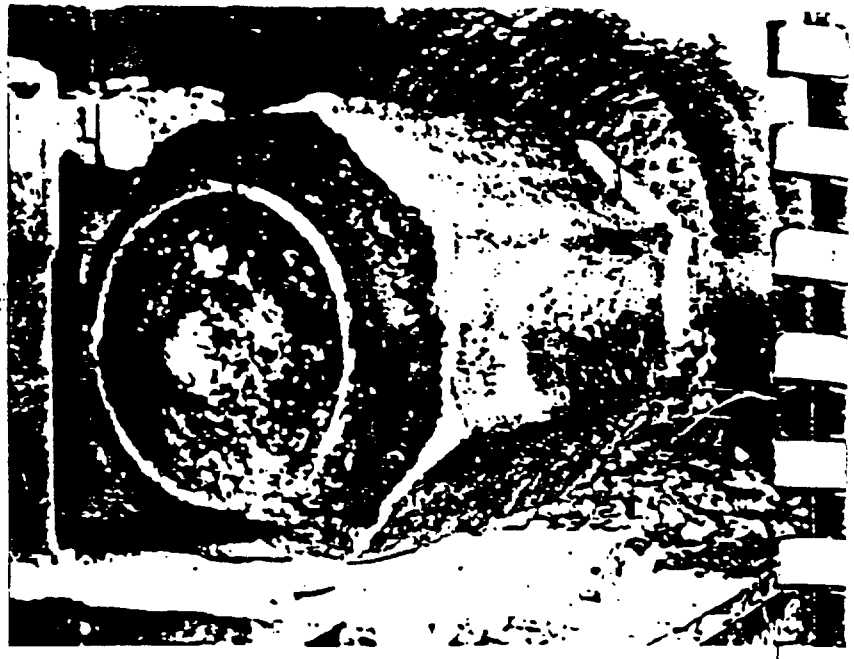
AVAILABLE TYPES

Mortar	Type	Temperature Limit, F	Uses	Packaging
[illegible]*	air setting	3200	laying insulating fire brick or refractory brick; shallow patching hot or cold surfaces	200, 100, 50, 25, 15, 10 and 5-lb containers
Super Blakite*	air setting	3000	for coating over vertical industrial boiler tubes, shallow patching, laying brick	200, 100 and 50-lb containers
Heliite*	air setting	3000	laying fire brick; shallow patching	200, 100 and 50-lb containers
No. 20	air setting	2700	laying fire brick	200, 100, 50, 25, 15, 10 and 5-lb containers
No. 26	air setting	2600	laying fire brick; patching	100-lb bags
No. 31	(coarse) heat setting	3100	laying fire brick	100-lb bags
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Johns-Manville

PRODUCT INFORMATION

type: Refractory Felt
temp limit: 2300F



J-M CERAFELT® refractory fiber felt

DESCRIPTION: J-M Cerafelt is a lightweight, refractory-fiber insulation notable 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.

AVAILABLE FORMS: Furnished in densities ranging from 3 to 24 lbs per cu ft. Also available in loose form (J-M CERAFIBER) in 25-lb bags.

USES: Recommended for a great variety of high temperature industrial applications such as insulation protection in repairing open hearth roofs; on cover-type annealers to fill openings for electrical access; expansion joints in kilns, furnaces and boiler walls.

ADVANTAGES

High Heat Resistance

Will withstand continuous exposure to a full 2300F.

Low Thermal Conductivity

Unusually low conductivity at high temperatures due to opacity of basic fibers to infra-red radiation.

Light Weight

Weighs as little as 1/40th equal volume of hard fire brick.

Chemically Stable

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

THERMAL CONDUCTIVITY

Density, lbs per cu ft	MEAN TEMPERATURE, F							
	300	400	500	600	700	800	900	1000
3	.40	.48	.57	.68	.80	.93	1.08	1.25
4	.38	.44	.52	.61	.71	.82	.94	1.07
6	.36	.41	.47	.54	.62	.70	.79	.89
8	.34	.39	.45	.51	.57	.64	.72	.81
10	.33	.38	.43	.49	.55	.61	.68	.76
12	.33	.37	.42	.47	.53	.59	.65	.72
14	.33	.37	.41	.46	.51	.57	.63	.69
18	.32	.36	.40	.45	.50	.55	.60	.65
24	.31	.35	.39	.44	.48	.53	.58	.62

CONDUCTIVITY: BTU IN. PER SQ FT PER F PER HR

STANDARD DENSITIES AND THICKNESSES

Type	Density*, lbs per cu ft	Available Thicknesses,* Inches								
		1/8	3/16	1/4	3/8	1/2	3/4	1	1 1/2	2
CRF-300	3				0	0	0	0	X	X
CRF-400	4			0	0	0	0	0	X	
CRF-600	6			0	0	0	0	X	X	
CRF-800	8	0	0	0	0	0	0	X		
CRF-1000	10	X	X	X	X	X	X	X		
CRF-1200	12	X	X	X	X	X	X	X		
CRF-1400	14	X	X	X	X	X	X			
CRF-1800	18	X	X	X	X	X				
CRF-2400	24	X	X	X	X	X				

*Other thicknesses and densities available on request
0 denotes availability of 4' and 8' sheets and 26' rolls
X denotes availability of 4' and 8' sheets only
Standard width is 42 inches

PRODUCED
JM - 83

COPY FORM	INITIALS	DATE

BOX NUMBER	SEGMENT NO.	REQUESTING PARTY
P-517		GSU hs

NOTES