

PLAINTIFF'S  
EXHIBIT  
JM-2255

Refraction  
Products

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## Johns-Manville Refractory-Fiber Products Quick Reference Table

| Product                 | Temp. Limit (°F) | Specific Gravity (lb./cu. ft.) | Thermal Conductivity (Btu./hr. sq. ft. in. °F.) | Strength (psi) | Modulus of Elasticity (10 <sup>6</sup> psi) | Thermal Expansion (10 <sup>-6</sup> in./in. °F.) |
|-------------------------|------------------|--------------------------------|-------------------------------------------------|----------------|---------------------------------------------|--------------------------------------------------|
| <b>SHEETS AND ROLLS</b> |                  |                                |                                                 |                |                                             |                                                  |
| Cerastat                | 2300             | 0.20                           | 0.25                                            | 0.27           | 3                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 4                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 5                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 6                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 7                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 8                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 9                                           | 0.00                                             |
|                         |                  |                                |                                                 |                | 10                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 11                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 12                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 13                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 14                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 15                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 16                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 17                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 18                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 19                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 20                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 21                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 22                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 23                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 24                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 25                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 26                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 27                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 28                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 29                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 30                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 31                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 32                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 33                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 34                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 35                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 36                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 37                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 38                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 39                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 40                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 41                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 42                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 43                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 44                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 45                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 46                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 47                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 48                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 49                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 50                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 51                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 52                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 53                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 54                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 55                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 56                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 57                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 58                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 59                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 60                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 61                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 62                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 63                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 64                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 65                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 66                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 67                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 68                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 69                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 70                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 71                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 72                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 73                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 74                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 75                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 76                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 77                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 78                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 79                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 80                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 81                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 82                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 83                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 84                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 85                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 86                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 87                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 88                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 89                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 90                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 91                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 92                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 93                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 94                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 95                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 96                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 97                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 98                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 99                                          | 0.00                                             |
|                         |                  |                                |                                                 |                | 100                                         | 0.00                                             |

\* Other densities available upon request.

**WARRANTY:** JOHN-MANVILLE warrants that all products sold hereunder are manufactured in accordance with the applicable specifications and are free from defects in material and workmanship under normal conditions of use. The full or partial liability for failure of any of our products to meet the foregoing warranty is limited to the extent of the purchase price of the product. No other warranty, express or implied, shall be in supply, an equivalent amount of products for use as

When it is required for use and found to be defective, the user may return the product to the manufacturer for a full refund of the purchase price. The user must retain the original invoice and the product must be returned within 90 days of the date of purchase. The user must also provide a written statement of the defect and the conditions of use. The manufacturer's liability is limited to the purchase price of the product and does not include any consequential or incidental damages. No other warranty, express or implied, shall be in supply, an equivalent amount of products for use as

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

Johns-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 2300°F with FIBERCHROME available for continuous operating temperatures up to 2700°F.

Originally developed by Johns-Manville Research to shield jet aircraft from scorching outside heat, this flexible inorganic material has effectively protected astronauts and equipment aboard the Mercury, Gemini and Apollo space vehicles. It is now providing vital insulation service in many industrial applications.

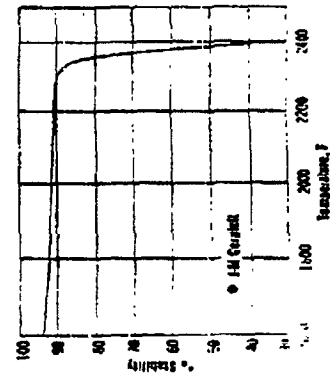
Far-sighted designers are using refractory fiber in various forms as an efficient, economical replacement for many conventional insulation materials because it offers almost unlimited possibilities for a diversity of high temperature uses. A few of its outstanding features are:

- High heat resistance
- Flexibility
- Thermal stability
- Sound absorption
- Low factor
- Chemical stability
- Light weight
- Good vibration qualities

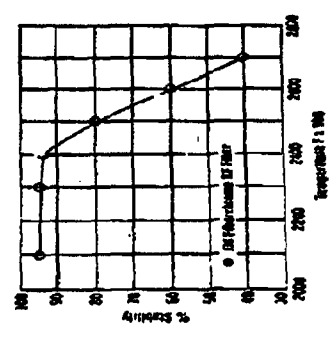
## THERMAL STABILITY

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

J-M Cerastat

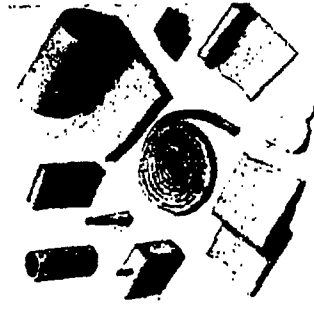


J-M Fiberglass RF Fiber



NOTE: The values given herein are average typical values obtained in accordance with accepted test methods and are subject to change. Check nearest J-M district office for latest information.

The forms and uses described in this brochure are typical examples of the versatility of J-M refractory fiber 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 redesign of today's products.



Stability percentage is the amount of fiber that did not devitrify at the specified temperature after exposure for 24 hours. A stability of 40% is used as a guide in recommending service temperatures.

## SHEETS and ROLLS



### J-M CERAPELT sheets and rolls

Cerapelt is a lightweight refractory fiber felt available 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.

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

Among the many advantages of Cerapelt refractory fiber felt are:

**HIGH HEAT RESISTANCE**  
Will withstand continuous exposure to a full 2200°F.

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

**LIGHT WEIGHT**  
Weighs as little as 1 anti-rapped volume of hard fire brick.

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

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

**Thickness:** 3, 4, 6, 8, 10, 12, 14, 16 and 24 in. 1  
**The above:** 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  
**Width:** 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) 40' and 96'

**Rolls:** 3 ft. through 8 ft. density also available in 25' rolls in these thicknesses:

3 ft. 1" through 2"  
4 ft. 1" through 2"  
6 ft. 1" through 1 1/2"  
8 ft. 1" through 1 1/2"

Also available in loose form (J-M CERAPELT) See page 5.

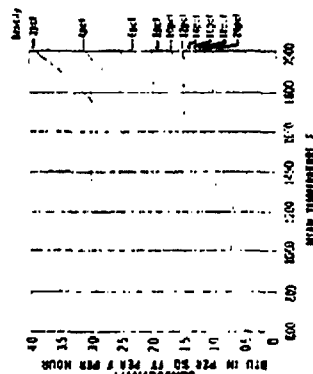
## PHYSICAL PROPERTIES

|                                |         |
|--------------------------------|---------|
| Service Temperature (°F)       | 2200    |
| Ready-to-Use                   | 3 to 25 |
| Specific Heat (Btu/lb.°F)      |         |
| 2000                           | 0.20    |
| 1800                           | 0.21    |
| 1600                           | 0.22    |
| Typical Chemical Analysis (%): |         |
| SiO <sub>2</sub>               | 64.0    |
| Al <sub>2</sub> O <sub>3</sub> | 43.5    |
| Fe <sub>2</sub> O <sub>3</sub> | 0.2     |
| Imp. Loss (%)                  | 2 to 5  |
| Flame Resistant (under test)   | 15      |

### Airflow Resistance (cfm/in. w.c. 1 sq. ft./in.)

| Thickness (in.) | 3    | 4    | 6    | 8    | 10   | 12   | 14   | 16  | 24  |
|-----------------|------|------|------|------|------|------|------|-----|-----|
| 75              | 65.8 | 49.0 | 32.8 | 24.3 | 18.3 | 13.1 | 10.1 | 7.1 | 4.1 |
| 100             | 33.4 | 20.0 | 13.3 | 10.0 | 7.3  | 5.1  | 3.1  | 2.1 | 1.1 |
| 200             | 16.0 | 10.0 | 6.4  | 4.4  | 3.3  | 2.1  | 1.6  | 1.2 | 0.6 |

## THERMAL CONDUCTIVITY



### CYCLE TEST RESULTS (Approx.)

| Thickness (in.) | 105  | 250  | 500  | 1000 | 2000 | 4000 | 10000 |
|-----------------|------|------|------|------|------|------|-------|
| 1               | 0.31 | 0.10 | 0.07 | 0.03 | 0.02 | 0.01 | 0.01  |
| 2               | 0.61 | 0.19 | 0.11 | 0.06 | 0.03 | 0.02 | 0.01  |
| 3               | 0.91 | 0.29 | 0.16 | 0.09 | 0.04 | 0.02 | 0.01  |
| 4               | 1.21 | 0.39 | 0.21 | 0.12 | 0.05 | 0.03 | 0.01  |
| 5               | 1.51 | 0.49 | 0.26 | 0.14 | 0.06 | 0.03 | 0.01  |
| 6               | 1.81 | 0.59 | 0.31 | 0.16 | 0.07 | 0.04 | 0.01  |

\*Note: Based on a Cerapelt 1000. The average of 10 test observations at 250, 500, 1000 and 2000 cycles per second.

## BULK FIBER

### J-M CERAFIBER bulk fiber

Cerapelt is a white, lightweight bulk refractory fiber suitable for continuous exposure up to 2200°F. It is an exceptionally high purity alumina-silica fiber with high temperature resistance, good thermal stability and good resistance to vibration. It is essentially unaffected by chemicals except for hydrofluoric and phosphoric acids, and strong alkalis. If wet by oil or water, its thermal and physical properties will be fully restored after drying.

Cerapelt can be used anywhere a lightweight fibrous and resilient insulation or fill is needed. It is excellent as a fill on heated equipment or for packing voids and expansion joints. It can be used as a loose insulating fill for covers and walls of kilns, sulphur burning, incineration, heat treating and boiler furnaces. Great for insulating like car tops, as a packing in furnace joints, fire boxes, boiler openings, furnace door seals and brickwork voids.

Among the many advantages of Cerapelt bulk refractory fiber are:

**HIGH HEAT RESISTANCE**  
Will withstand continuous exposure to a full 2200°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 corrosion-promoting agents.

## RESILIENT

Resilient refractory fibers means that yield will remain completely fixed.

Cerapelt is available in loose bulk form, packed in 55-lb. boxes (16" x 16" x 24").

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

## PHYSICAL PROPERTIES

|                                |         |
|--------------------------------|---------|
| Service Temperature (°F)       | 2200    |
| Ready-to-Use                   | 3 to 25 |
| Specific Heat (Btu/lb.°F)      |         |
| 2000                           | 0.20    |
| 1800                           | 0.21    |
| 1600                           | 0.22    |
| Typical Chemical Analysis (%): |         |
| SiO <sub>2</sub>               | 64.0    |
| Al <sub>2</sub> O <sub>3</sub> | 43.5    |
| Fe <sub>2</sub> O <sub>3</sub> | 0.2     |
| Imp. Loss (%)                  | 2 to 5  |
| Flame Resistant (under test)   | 15      |



# BOARD and MOLDED SHAPES

## J-M CERA FORM



Cera Form is a lightweight refractory fiber insulation notable for its excellent thermal and chemical stability. It is integrally vacuum molded from a wet slurry of J-M refractory fiber bonded together with multicomponent inorganic binders.

Cera Form is recommended for a wide range of high temperature applications to 2100°F. A few of its uses are as refractory fiber tap hole plug covers, combustion chamber linings, back insulation, high temperature pipe insulation, furnace riser sleeves and for industrial furnace construction.

Among the many advantages of Cera Form refractory fiber board are:

**HIGH HEAT RESISTANCE**  
Will withstand continuous exposure to a full 2100°F.

**LOW THERMAL CONDUCTIVITY**  
Usually low conductivity at elevated temperatures (21 at 1000°F mean).

**STRUCTURALLY STRONG**  
Cera Form is self-supporting, thus eliminating the need for heavy dense refractories or additional reinforcement.

**LIGHT WEIGHT**  
Cera Form is as light as many insulating materials possessing a fraction of its strength and durability. A board foot weighs approximately one pound.

Cera Form is available in the following dimensions:  
Density: 10 to 14 pcf  
Thickness: 1/2" to 3 1/2"

Size: (sheets) 24" x 26", 12" x 30", 12" x 18" and 18" x 24" in thicknesses of 1/2", 1", 1 1/2", 2", 3" and 3 1/2".  
(cylinders) up to 20" ID x 18" long x 1 1/2" thick

Molded shapes can also be made in a wide variety of sizes and shapes to meet specific customer needs.

### PHYSICAL PROPERTIES

|                                                                               |      |
|-------------------------------------------------------------------------------|------|
| Density (pcf)                                                                 | 10   |
| Transverse Strength (psi Linear Shrinkage %)                                  | 50   |
| After 2100°F soak                                                             |      |
| 1000F                                                                         | 0.25 |
| 1500F                                                                         | 0.30 |
| 2000F                                                                         | 2.40 |
| 2300F                                                                         | 3.70 |
| Compression Resistance (psi Pressure Temperature 5° Pressure Temperature 10°) | 1.75 |
|                                                                               | 1.25 |

### THERMAL CONDUCTIVITY

| Mean Temperature, F | Thermal Conductivity |
|---------------------|----------------------|
| 200                 | 0.27                 |
| 400                 | 0.34                 |
| 600                 | 0.40                 |
| 800                 | 0.46                 |
| 1000                | 0.50                 |
| 1200                | 0.54                 |
| 1400                | 0.58                 |
| 1600                | 1.13                 |
| 1800                | 1.26                 |
| 2000                | 1.40                 |

## J-M CERA FORM RIS-A-SLEEVE<sup>®</sup> refractory fiber insulating riser



Developed from space age refractory fibers by Johns-Manville research scientists, the J-M Ris-A-Sleeve reduces the heat transfer from the riser. With heat more effectively contained within the molten metal, there is a gain of precious minutes to facilitate uniform feeding back to the mold, thus reducing rejects and improving yield.

Ris-A-Sleeve is used primarily for non-ferrous casting, but it may be used in some ferrous casting applications.

Among the many advantages of Ris-A-Sleeve are:

**STRENGTH**  
Ris-A-Sleeve is strong, yet easy to cut, shape and handle.

**REFRAPS METAL AGAIN LONGER**  
Riser metal stays molten previous minutes longer, thus facilitating uniform feed-back to the mold. This results in a sound casting with fewer rejects.

**REDUCES RISER SIZE**  
Because J-M Ris-A-Sleeve insulates better, it permits substantial reduction in riser size with a consequent increase in yield.

**LIGHTWEIGHT**  
Ris-A-Sleeve is light and thin. Its fibrous structure facilitates handling.

### PHYSICAL PROPERTIES

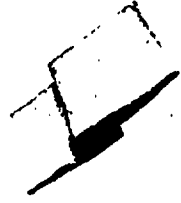
|                                   |                                                         |
|-----------------------------------|---------------------------------------------------------|
| Composition                       | J-M Refractory Fiber with organic and inorganic binders |
| Density, nominal                  | approx. 12 lbs per cu ft.                               |
| Linear shrinkage after 2300F soak | 2.2%                                                    |

### PACKAGING

| Weight (lb.) | Number of Sheets per Cart | Number of Sheets per Cart |
|--------------|---------------------------|---------------------------|
| 1            | 200                       | 0                         |
| 1 1/2        | 150                       | 0%                        |
| 2            | 120                       | 7                         |
| 2 1/2        | 90                        | 12                        |
| 3            | 72                        | 7%                        |
| 3 1/2        | 60                        | 8                         |
| 4            | 48                        | 8%                        |
| 4 1/2        | 36                        | 8                         |
| 5            | 30                        | 10                        |
| 5 1/2        | 24                        | 12                        |
| 6            | 20                        | 12                        |

\*Ris-A-Sleeves are packed in cartons 24" x 24" x 24 1/2"

## J-M CERA-PAK<sup>®</sup> flexible wet-packaged sheets



Cera-Pak is a refractory fiber, vacuum-molded and bonded sheet packaged in moist form in polyethylene bags. This provides a flexible sheet that can be hand molded to the desired shape, then dried in service. The resulting material is very similar to Cera Form.

Cera-Pak can be used for a wide variety of installations in industrial furnace construction where unusual configurations or limited access prevents the use of solid segments. The flexible sheets can be inserted in hard-to-reach areas and custom molded in the required size, shape and thickness.

The flexible sheets are available in polyethylene bags in the following sizes: 24" x 36", 18" x 36", 12" x 18" and 18" x 24" in thicknesses of 1/2", 1", 1 1/2", 2", 3" and 3 1/2".

## RF EXPANSION JOINT BOARD



RF Expansion Joint Board is made of refractory fibers for service up to 2300°F. Its resiliency and uniform density make it excellent for use as an expansion joint in industries ranging from petrochemical to metals - wherever heat is used with brick. In one simple operation, RF Expansion Joint Board provides the necessary spacing in the refractory construction plus the fiber to fill the joint. In this light, makes construction easy, and is right enough to build against.

Provides a permanent, resilient expansion joint in the refractory wall, floor or car top that lasts as long as the furnace liner.

Among the many advantages of RF Expansion Joint Board are:

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

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

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

**RESILIENT**  
Resilient refractory fibers ensure that expansion joint space will be completely filled.

**STRONG AND RIGID**  
Firm enough to provide excellent handling properties during construction, yet easily cut for accurate, light fit.

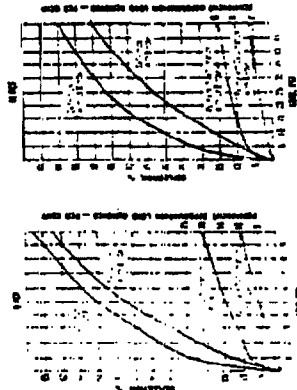
RF Expansion Joint Board is available in the following dimensions:

Density: 8 and 14 pcf  
Thickness: 1/2" to 3"  
Size: Up to 4' x 8' sheets

### PHYSICAL PROPERTIES

|                          |          |
|--------------------------|----------|
| Service Temperature (°F) | 2300     |
| Density                  | 8 and 14 |
| Linear Shrinkage (%)     | 4.1%     |
| 14 pcf                   | 4.6%     |
| Thermal Stability (°F)   |          |
| 2000                     | 0%       |
| 2100                     | 0.1%     |
| 2200                     | 0.2%     |
| 2300                     | 0.3%     |
| 2400                     | 0.5%     |
| Linear Shrinkage (%)     |          |
| (4 x 8 sheets)           |          |
| 8 pcf                    | 1.5      |
| 14 pcf                   | 1.5      |
| Best Strength (psi)      |          |
| 8 pcf                    | 14 pcf   |
| 1/2"                     | 50       |
| 1"                       | 50       |
| 1 1/2"                   | 50       |
| 2"                       | 50       |
| 3"                       | 50       |
| 3 1/2"                   | 50       |
| Splices (psi)            |          |
| 200F                     | 0.25     |
| 1000F                    | 0.25     |
| 1600F                    | 0.27     |

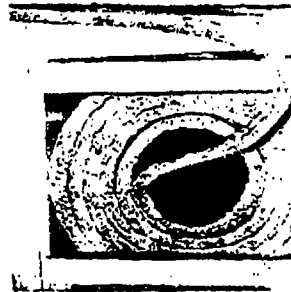
### DEFLECTION UNDER LOAD AND PERMANENT DEFORMATION



# TAPE

## J-M CERAFELT

### refractory fiber tape



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

Cerafelt 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 hearth cracks; on cover-type manholes to fill openings for electrical access.

Among the many advantages of Cerafelt tape are: **HIGH HEAT RESISTANCE** Will withstand continuous exposure to a full flame.

**LOW THERMAL CONDUCTIVITY** Unusually low conductivity at high temperatures due to purity of basic fibers in silica-felt radiation.

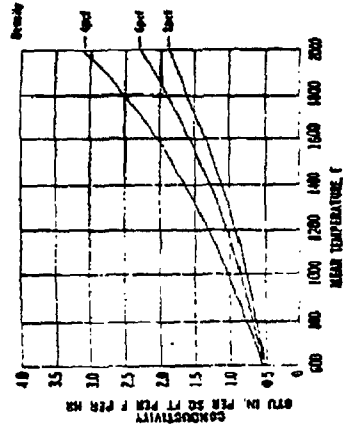
**CHEMICAL STABILITY** Non-soluble and chemically stable. Contains no corrosive/irritating agents.

Cerafelt tape is furnished in rolls of 25" (1" thick) and 50" (1" thick) in widths of 1" and 2".

## PHYSICAL PROPERTIES

|                                      |      |
|--------------------------------------|------|
| Service temperature (°F)             | 2200 |
| Weight (lb/ft <sup>2</sup> )         | 8    |
| Specific heat (Btu/lb °F)            | 0.20 |
| 1800°                                | 0.25 |
| 1600°                                | 0.27 |
| 1400°                                | 0.3  |
| Foot Diameter (inches)               |      |
| Type of Chemical Agent Applied (ppm) |      |
| SO <sub>2</sub>                      | 512  |
| NO <sub>2</sub>                      | 481  |
| Fe <sub>2</sub> O <sub>3</sub>       | 0.2  |
| Na <sub>2</sub> O                    | 0.15 |
| Ignition Limit (°C)                  | 7.5  |

## 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 packings and gaskets, or sheets needed for high temperature seals. It can be used for high temperature pass-locks, conduction chamber linings, tap hole plug covers, and expansion joint material for molten metal trunks. Also an excellent thermal insulation for a wide variety of applications in areas with small repairs.

Among the many advantages of Cerapaper refractory fiber paper are:

**LOW THERMAL CONDUCTIVITY** Does not store large amounts of heat so can be located or buried almost instantaneously.

**LOW THERMAL EXPANSION** This usually low coefficient of thermal expansion (0.00001 in/in/°F) is maintained at high temperatures.

**LOW THERMAL STABILITY** Can be recycled rapidly from cryogenic temperatures without degradation.

## GOOD MECHANICAL PROPERTIES

Is very flexible, with good tensile strength and high resistance.

Cerapaper is available in the following dimensions:

| Thickness, inches | Length, ft (approx) |     |     |     | Weight, lb/ft <sup>2</sup> |
|-------------------|---------------------|-----|-----|-----|----------------------------|
|                   | 18"                 | 24" | 36" | 48" |                            |
| .020              | 156                 | 312 | 468 | 624 | 2.0                        |
| .040              | 78                  | 156 | 234 | 312 | 4.0                        |
| .060              | 52                  | 104 | 156 | 208 | 6.0                        |
| .080              | 39                  | 78  | 117 | 156 | 8.0                        |
| .100              | 31                  | 62  | 92  | 123 | 10.0                       |

\*J-M rolls are available in all thicknesses, but only in 12 1/2 ft rolls.

## PHYSICAL PROPERTIES

|                                           |                |
|-------------------------------------------|----------------|
| Rolling Point                             | Over 2200°     |
| Rolling Temperature Limit                 | 2200°          |
| Specific Gravity                          | 2.61           |
| Specific Heat                             | 0.27 Btu/lb °F |
| Average Fiber Diameter                    | 1 to 6 microns |
| Moisture Content                          | 5%             |
| Chemical Analysis                         |                |
| % by weight: Silicon Dioxide              | 46             |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) | 54             |

| Type Number | Tensile Strength, psi |           | Tensile Elongation, % |
|-------------|-----------------------|-----------|-----------------------|
|             | 1-175                 | 1-176     |                       |
| 1-175       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-176       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-177       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-178       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-179       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-180       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-181       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-182       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-183       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-184       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-185       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-186       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-187       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-188       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-189       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-190       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-191       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-192       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-193       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-194       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-195       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-196       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-197       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-198       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-199       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |
| 1-200       | 100 ± 10%             | 100 ± 10% | 10 ± 10%              |

\*Thickness measured at 1 psi compression, per tape in roll 1410000.

## THERMAL CONDUCTIVITY

| Temperature (°F) | Thermal Conductivity (K) |
|------------------|--------------------------|
| 200              | 0.020                    |
| 500              | 0.025                    |
| 1000             | 0.030                    |
| 1500             | 0.035                    |
| 2000             | 0.040                    |

## 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 "blistering" and provides a strong, adhesive-resistant surface on Refractory Fiber and other high temperature insulations.

Cera-Kote can be brushed on Cera-Felt and Ceradelt refractory fiber felt and other high temperature insulations where 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 adhesive-resistant, but less resilient, surface on the material being treated. It is recommended for use in hardening the surface of Ceradelt or Cera-Felt 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                      | 2200 psi |
| Tensile strength                          | 100 psi  |
| Flexural strength                         | 100 psi  |
| Impact strength                           | 100 psi  |
| Modulus of elasticity                     | 100 psi  |
| Specific heat (Btu/lb °F)                 | 0.27     |
| Specific gravity                          | 2.61     |
| Moisture content                          | 5%       |
| Chemical analysis                         |          |
| % by weight: Silicon Dioxide              | 46       |
| Alumina (Al <sub>2</sub> O <sub>3</sub> ) | 54       |

## CHEMICAL COMPOSITION

| Chemical                       | Weight % |
|--------------------------------|----------|
| SiO <sub>2</sub>               | 46.0     |
| Al <sub>2</sub> O <sub>3</sub> | 54.0     |
| Fe <sub>2</sub> O <sub>3</sub> | 0.1      |
| CaO                            | 0.1      |
| MgO                            | 0.1      |
| Na <sub>2</sub> O              | 0.1      |
| K <sub>2</sub> O               | 0.1      |
| Loss on ignition               | 0.1      |
| Total                          | 100.0    |

# FIBERCHROME PRODUCTS

## J-M FIBERCHROME<sup>®</sup> refractory fiber felt



Fiberchrome refractory fiber felt is a strong, long-fiber, flexible felt material for temperatures to 2700F. It is formed from an alumina-silica chromia composition and has the ability to retain a soft fibrous structure at 2700F. These fibers have high temperature resistance, good thermal stability and good resistance to vibration and physical abuse. Fiberchrome is unaffected by chemicals except for hydrofluoric and phosphoric acids, and strong alkalis. If wet by water or oil, its thermal and physical properties will be fully restored to normal after drying.

Fiberchrome was developed to meet the demand for a high temperature, lightweight insulation for a wide range of industrial applications. Its balance of features: low thermal conductivity and durability, plus its ability to take a full 2700F temperature, make it an economically sound investment for use anywhere a higher-temperature fibrous and resilient insulation is needed.

Among the many advantages of Fiberchrome refractory fiber felt are:

### HIGH TEMPERATURE LIMIT

Suitable for 2700F temperature limit for continuous operation; higher for transient service.

### RETAINS FLEXIBLE

Retains its soft structure at 2700F.

### LOW THERMAL CONDUCTIVITY

Unusually low conductivity at higher temperatures due to opacity of basic fibers to infrared radiation.

### CHEMICALLY STABLE

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

### EASY APPLICATION

Sheets are easy to handle, cut and fit.

Fiberchrome refractory fiber felt is available in the following dimensions:

Density: 3, 4, 6, 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", 24", 30", 36", 42", and 48"

Length: (widths) 4' and 8'

(widths) 4-ft through 8-ft, density also available in 25' rolls in following thicknesses:

3 lb 1/2" through 2"

4 lb 1/2" through 2"

6 lb 1/2" through 1 1/2"

8 lb 1/2" through 1 1/2"

Also available in loose bulk form in 12' rolls, 18" x 24" for most common

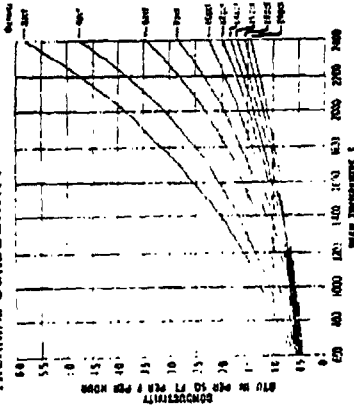
### PHYSICAL PROPERTIES

|                          |         |
|--------------------------|---------|
| Service Temperature (F)  | 2700    |
| Beauty (pcf)             | 3 to 26 |
| Specific Heat (Btu/lb/F) |         |
| 200F                     | 0.20    |
| 1000F                    | 0.23    |
| 1800F                    | 0.27    |

### TYPICAL CHEMICAL ANALYSIS (%)

|                                |      |
|--------------------------------|------|
| SiO <sub>2</sub>               | 53.0 |
| Al <sub>2</sub> O <sub>3</sub> | 48.5 |
| Cr <sub>2</sub> O <sub>3</sub> | 4.0  |
| Fe <sub>2</sub> O <sub>3</sub> | 2.21 |
| Mn <sub>2</sub> O              | 0.18 |

### THERMAL CONDUCTIVITY



Airflow Resistance (inches w.c./ft. @ 10 ft/min)

| Density | 3    | 4    | 6    | 10   | 12  | 14  | 16  | 18  | 20  | 24 |
|---------|------|------|------|------|-----|-----|-----|-----|-----|----|
| 75      | 65.8 | 40.8 | 17.8 | 10.0 | 6.3 | 4.3 | 3.2 | 1.9 | 1.1 |    |
| 100     | 33.4 | 20.0 | 9.5  | 5.0  | 3.2 | 2.2 | 1.5 | 0.9 | 0.6 |    |
| 200     | 24.6 | 14.4 | 6.4  | 3.6  | 2.2 | 1.6 | 1.2 | 0.7 | 0.4 |    |

## J-M FIBERCHROME<sup>®</sup> bulk refractory fiber



Fiberchrome in bulk form is a strong, long fiber refractory insulation suitable for continuous operation temperatures up to 2700F. It is formed from an alumina-silica chromia composition and has the ability to retain a soft fibrous structure at 2700F. These fibers have high temperature resistance, good thermal stability and good resistance to vibration and physical abuse. Fiberchrome is unaffected by chemicals except for hydrofluoric and phosphoric acids, and strong alkalis. If wet by water or oil, its thermal and physical properties will be fully restored to normal after drying.

Fiberchrome was developed to meet high temperature insulation and fill requirements of industry. Its unique properties make it ideal for use in critical locations where irregular areas and hard-to-reach spaces rule out the use of a regular sheet insulation. Its balance of light weight, low thermal conductivity and durability, plus its ability to take a full 2700F temperature, make it an economically sound investment for use anywhere a high temperature fibrous and resilient insulation or fill is needed.

Among the many advantages of Fiberchrome bulk refractory fiber are:

### HIGH TEMPERATURE LIMIT

Suitable for 2700F temperature limit for continuous operation; higher for transient service.

### RETAINS FLEXIBLE

Retains its soft fibrous structure at 2700F.

### LOW THERMAL CONDUCTIVITY

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

### CHEMICALLY STABLE

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

### RESILIENT

Resilient refractory fibers assure complete filling of walls.

Fiberchrome is furnished in loose bulk form, packed in 25-lb boxes (18" x 18" x 24"). Also available in felt form.

### PHYSICAL PROPERTIES

|                          |        |
|--------------------------|--------|
| Service Temperature (F)  | 2700   |
| Beauty (pcf)             | 3 to 6 |
| Specific Heat (Btu/lb/F) |        |
| 200F                     | 0.20   |
| 1000F                    | 0.23   |
| 1800F                    | 0.27   |

### TYPICAL CHEMICAL ANALYSIS (%)

|                                |      |
|--------------------------------|------|
| SiO <sub>2</sub>               | 53.0 |
| Al <sub>2</sub> O <sub>3</sub> | 48.5 |
| Cr <sub>2</sub> O <sub>3</sub> | 4.0  |
| Fe <sub>2</sub> O <sub>3</sub> | 2.21 |
| Mn <sub>2</sub> O              | 0.18 |

## J-M FIBERCHROME<sup>®</sup> and support insulation (insulating sleeve)

Fiberchrome and support insulation is made of refractory fiber and is designed to resist high furnace temperatures and mechanical abuse involved in slab, billet and bloom reheating furnaces. It is exceptionally easy to handle, install and maintain, with a balance of light weight, low thermal conductivity and durability that makes it an economically sound investment for this type of service.

Furnished in cylindrical shape from 12" long by 1" thick, in diameters to 12". Also available with

stainless steel reinforcement to facilitate attachment to skid rail or other critical areas.

Among the many advantages of Fiberchrome and support insulation are:

### LOW CONDUCTIVITY

Thermal conductivity of .71 at 1000F.

### EASY INSTALLATION

Lightweight, easy to cut and fit.

### ECONOMICAL

Much less expensive than most available refractories. Savings of fuel cost of \$0.50 per million Btu approximately \$3.50 sq ft of pipe surface.

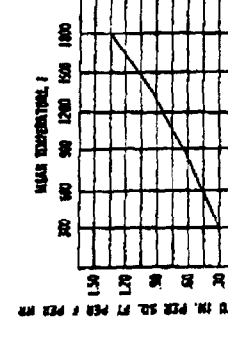
### MADE OF REFRACTORY FIBER

Won't crack or break due to changes in thermal extremes.

### PHYSICAL PROPERTIES

|                                 |       |
|---------------------------------|-------|
| Uses Available, % at 2000F      | 13    |
| Beauty, pcf                     | 14    |
| Installation at 2000F           |       |
| Shrinkage, % per surface per ft | 11.00 |
| Insulated with Fiberchrome      | 4.00  |

### THERMAL CONDUCTIVITY



### CHEMICAL ANALYSIS (%)

|                                |      |
|--------------------------------|------|
| SiO <sub>2</sub>               | 53.0 |
| Al <sub>2</sub> O <sub>3</sub> | 48.5 |
| Cr <sub>2</sub> O <sub>3</sub> | 4.0  |
| Fe <sub>2</sub> O <sub>3</sub> | 2.21 |
| Mn <sub>2</sub> O              | 0.18 |
| Na <sub>2</sub> O              | 0.14 |
| K <sub>2</sub> O               | 0.06 |
| CaO                            | 0.04 |

### ACCESSORY MATERIAL REQUIREMENTS

| Insulating Sleeve | Refractory Fiber | Support Insulation | Refractory Fiber | Support Insulation |
|-------------------|------------------|--------------------|------------------|--------------------|
| Temperature (F)   | Temperature (F)  | Temperature (F)    | Temperature (F)  | Temperature (F)    |
| 25                | 45               | 45                 | 45               | 45                 |
| 30                | 45               | 45                 | 45               | 45                 |
| 35                | 45               | 45                 | 45               | 45                 |
| 40                | 45               | 45                 | 45               | 45                 |
| 45                | 45               | 45                 | 45               | 45                 |
| 50                | 45               | 45                 | 45               | 45                 |
| 55                | 45               | 45                 | 45               | 45                 |
| 60                | 45               | 45                 | 45               | 45                 |
| 65                | 45               | 45                 | 45               | 45                 |
| 70                | 45               | 45                 | 45               | 45                 |
| 75                | 45               | 45                 | 45               | 45                 |
| 80                | 45               | 45                 | 45               | 45                 |

\*Approximate 25 lb of Insulating Sleeve required to meet stresses and strains at 2000 F.



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