A Complete Refractories Service

Linking the advantages of prompt service and thorough knowledge of local needs with the widespread resources of the most complete refractories service in the world.

GENERAL REFRACTORIES COMPANY
PHILADELPHIA, PA. • U.S.A.

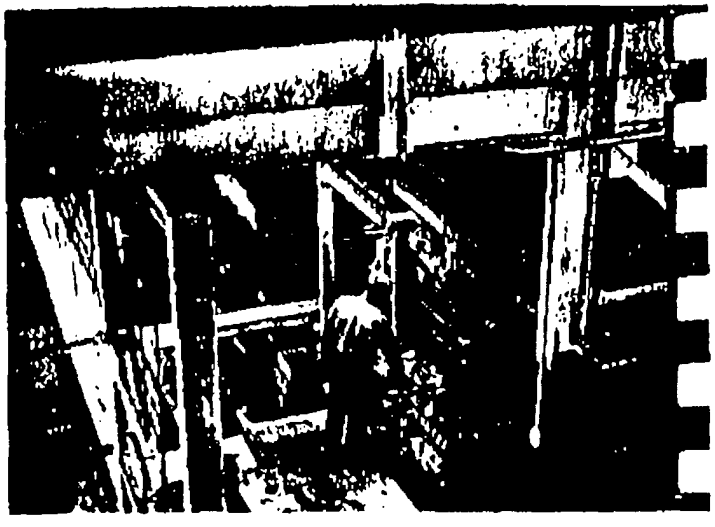
TABLE OF CONTENTS

FIRST EDITION

Printed in U.S.A. SP-37 5 M 1936

GENERAL REFRACTORIES COMPANY

Firebrick being pressed and placed on dryer cars



INTRODUCTION

A refractory is a material which stubbornly resists softening, fusion, the action of fluxes and slags, and other effects, physical and chemical, of high temperatures. In a broad sense, refractories are used wherever heat is utilized and high temperatures are encountered and contained.

Refractories are essential to the operation of virtually every industry. Our present day civilization could not exist without refractories. The production of iron and steel, copper, lead, zinc, nickel, aluminum, glass, electric power, chemicals, petroleum, drugs, textiles, and practically all of the products we use in every day life, involves of necessity the use of refractories. The refractories industry is truly a basic industry which can be considered second only to agriculture in our civilization.

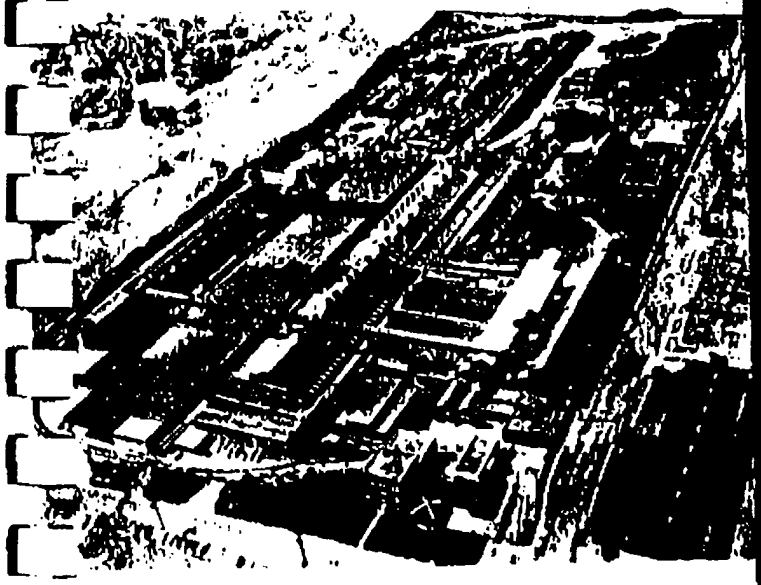
The General Refractories Company, founded in 1911, has grown with American Industry to a position of outstanding importance in the production of refractories. GREFCO'S facilities, distributors, engineers, chemists, ceramists and workers of many skills have pooled their abilities to create and execute this achievement.

GREFCO research has pioneered in the development of new and improved refractory materials. The Central Research Laboratory located in Baltimore is one of the best

GREFCO's Central Research Laboratory

equipped research laboratories for refractories in the world with facilities for basic research and also a pilot plant where full scale production of experimental refractories is carried out. Many GREFCO customers avail themselves of the opportunity to use GREFCO'S engineering and research facilities in the development of improved refractories particularly suited to their uses.

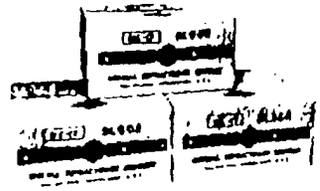
To serve the world's industries, General Refractories Company has an almost unlimited supply of raw materials, processed in scientifically controlled modern manufacturing plants. GREFCO maintains sales offices in all major industrial areas to facilitate ordering and shipment of refractories to users by rail, truck or steamer. Company owned warehouses, stategically located, provide a ready source of supply for users of refractories, via motor truck, and to help out any user in emergencies. Well established dealers in all the principal cities of the United States, and agencies in Canada, Mexico, Cuba, Australia, Philippine Islands, South Africa, Europe, and South America carry Grefco products wherever they are needed. The happy union of all these elements has raised the standards of quality and service in the entire Refractory Industry and assures, with GREFCO, A COMPLETE REFRACTORIES SERVICE.



Aerial view of GREFCO's Basic Plant at Baltimore

MX-17 BLOCK INSULATION

MX-17 BLOCK INSULATION is an efficient insulating material made of mineral wool and long fibre asbestos with a suitable binder. Used as a back-up insulating material, it is recommended for service at temperatures up to 1700° F. This block insulation is available in various sizes and thicknesses convenient for use. It can be cut with a knife or saw and shaped readily to suit the application. MX-17 BLOCK INSULATION is shipped in sturdy cartons containing forty-two, forty-five and forty-eight board feet, depending on the size and thickness of block.



MINERAL WOOL BLANKET INSULATION

CREFCO Blanket Insulation made of Mineral Wool is suitable for use at temperatures up to 1200° F. The blankets are widely used for covering such equipment as tanks, ovens, breechings, ducts and other heated vessels. The insulating value of this material is excellent. The blankets are fabricated with various types of metal fabric covering such as wire mesh and stucco lath, eliminating in many cases the need for any other reinforcing. Sizes 2' x 4' and 2' x 8' normally supplied.

W. P. PROTECTIVE COATING

CREFCO supplies a water-proof protective cement recommended as a tough surface coating for insulation that is exposed to the weather, or to fumes and gases.

It is a durable protection against the deterioration of insulating coverings due to adverse local conditions.

This coating dries to a smooth black surface which can be painted if desired with metallic pigment paint.

INSULATING CEMENT

CREFCO Insulating Cement is a bulk insulating plastic for use on irregular surfaces and for contours where block insulation cannot be readily applied. It is made of mineral wool, asbestos, and a suitable binder. Its insulating value is comparable to that of Block Insulation. This material is useful at temperatures up to 1800° F.

CREFCO Insulating Cement is easily applied, has excellent adhesive properties and can be troweled to a smooth finish. It contains a rust inhibitor which prevents rust or corrosion when applied to an iron or steel surface. It is shipped in fifty pound paper bags. Two bags (100 lbs.) are sufficient to cover fifty-five square feet of surface one-inch thick. The material is shipped dry, and when mixed with water is ready for use.

INSUL-FINISH CEMENT

CREFCO INSUL-FINISH CEMENT is a quick setting combination insulating and finishing cement suitable for temperatures up to 1000° F.

While used primarily as a finishing cement since it dries to an attractive white and hard surface, it also has good insulating properties. It will cover 35 sq. ft. 1" thick per 100 lbs. It is shipped in 50 lb. bags and is ready for immediate use after mixing with water.

INSULATIONS

Industrial insulation products available from Grefco are: Insulating Fireclay Brick . . . Insulating Adhesives . Insulating Cement . . . and Insulation Block.

A. Insulating Fireclay Brick — Maximum service from an exposed Insulating Firebrick lining depends on:

1. Strength
2. Low shrinkage
3. Resistance to spalling
4. Pyrochemical stability

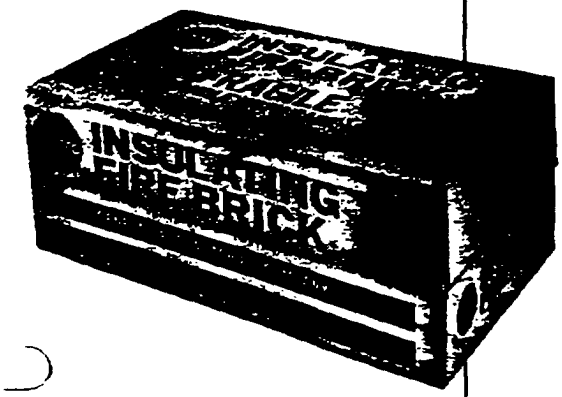
Grefco Insulating Firebrick have these properties plus low thermal conductivity and low heat storage which is essential for fuel savings, faster production, and accurate temperature control. Porous Insulating Firebrick also contributes to quiet furnace operation. They are ideal sound absorbers, greatly reducing furnace and burner noises.

Insulating Firebrick *should not* be used as linings in furnaces where they will be exposed to slags, molten metals, or severe mechanical abrasion. Under such conditions they should be used only as back-up insulation behind heavy refractories. In furnaces or heated equipment fired with gas, oil or electricity, all brands may be installed as exposed linings.

B. Insulation Block — manufactured from resilient mineral wool fibers and long fiber asbestos. Grefco block insulation is suitable for high temperature binders. It is used in most types of furnace enclosures where hot face temperatures do not exceed 1900°F (1040°C).

C. Insulation Adhesive — an air-setting, paste like adhesive. It is used to hold insulation block in place until permanent reinforcement of refractories can be installed.

D. Insulation Cement — an all-purpose insulating material made from high temperature mineral wool. It is used in many types of surfaces of heated equipment. When applied to an iron or steel surface it will not cause or accelerate corrosion. It is reclaimable if not heated beyond 1200°F (649°C). Material can be removed, mixed with water and again applied in the same manner as new material.



Insulation Block

Product: **MX-17**

Description:

Insulation block with a density of 18-19 lb/ft^3 maximum (0.29 g/cm^3). Virtually no moisture absorption. Service temperature limit 1900°F (1040°C).

Advantages:

Does not cause or accelerate corrosion to steel.

Applications:

Where Used	Typical Service
Blast furnace stoves	Wall insulation
Cement kilns	Firing hoods, clinker coolers, feed housings, preheater back-up insulation
Heating furnaces	Wall insulation
Incinerators	Back-up insulation

		GR 16-20	GR 20	GR 20-ES	GR 2
Chemical Analysis:	Al_2O_3	36.9%	30.4%	34.1%	30.4%
	SiO_2	43.0	60.3	59.4	60.3
	Fe_2O_3	0.5	0.7	0.8	0.7
	TiO_2	1.3	1.4	1.2	1.4
	CaO	17.6	6.6	3.4	6.6
	MgO	0.1	0.3	0.2	0.3
	Na_2O & K_2O	0.4	0.2	1.0	0.2
Physical Properties:	Temperature use limit (Normal oxidizing atmosphere)				
	Exposed Conditions:	1600°F 870°C	2000°F 1095°C	2000°F 1095°C	2300°F 1260°C
	Back-Up Insulation:	2000°F 1095°C	2000°F 1095°C	2000°F 1095°C	2300°F 1260°C
	Density, Avg. Lb/9 x 4½ x 2½ straight	1.7	2.0	2.8	2.1
	Lb/ft^3	29	35	47	36
	g/cm^2	.47	.56	.76	.57
	Modulus of Rupture: psi	95	100	210	125
	(kg/cm^2)	6.6	7	14.8	9.0
	Cold Crushing Strength: psi	145	115	350	135
	(kg/cm^2)	9.9	16	24	[illegible]
	Permanent linear change, %				
	@ 1950°F soaking temp. (1065°C)	0.0	0.0	0.0	–
	@ 2250°F soaking temp. (1230°C)	–	–	–	0.0
	@ 2450°F soaking temp. (1345°C)	–	–	–	–
	@ 2550°F soaking temp. (1450°C)	–	–	–	–
	@ 2750°F soaking temp. (1510°C)	–	–	–	–
	@ 2950°F soaking temp. (1620°C)	–	–	–	–
	@ 3150°F soaking temp. (1705°C)	–	–	–	–
	Reversible linear thermal expansion, % at 2000°F (1095°C)	–	0.5 to 0.6	0.6 to 0.7	0.5 to 0.6
	Hot load strength % deformation at 10 psi load for 1½ hours				
	@ 2000°F (1095°C)	–	0.1	0.0	0.1
	@ 2200°F (1205°C)	–	–	–	–
	@ 2400°F (1315°C)	–	–	–	–
	Thermal Conductivity BTU • in/ft^2 • hr • °F Mean Temperature				
	@ 500°F (260°C)	0.88	1.39	1.62	1.53
	@ 1000°F (540°C)	1.05	1.70	2.05	1.77
	@ 1500°F (815°C)	1.23	2.07	2.49	2.13
	@ 2000°F (1095°C)	–	2.48	2.92	2.58
	@ 2500°F (1370°C)	–	–	–	–

Shipping Information:

Stocking Location: Sproul, Pennsylvania

Packaging: 25 pcs per carton on pallet

The data are based on average results of control tests and *should not be used for specification purposes.* Significant variations in test data result from unusual product size, shape, or manufacturing process. ASTM procedures are used where applicable.

NR – Not Recommended

Rev. 11/77

Insulating
Fireclay
Brick

Product:

GR® 16-20
GR® 20
GR® 20-ES
GR® 23

Description:

A family of fireclay insulating brick.

Advantages:

The combination of refractoriness, thermal insulation and strength permits the selection of the product which will most economically meet the requirements.

Applications:

Where Used	Typical Service
Chemical process heaters	Insulation
Fluid bed reactors	Insulation
Glass furnaces	Insulation
Heating furnaces	Walls, roofs
Rotary kilns	Preheaters

GREFCO

ENERAL REFRACTORIES COMPANY
U.S. REFRACTORIES DIVISION
600 GRANT STREET Room 3000
PITTSBURGH, PA. 15219

GR'-25 GR'-26 GR'-28 GR'-30

Chemical Analysis: (Ignited Basis)	Al_2O_3	34.2%	38.9%	61.3%	68.4%
	SiO_2	61.5	57.7	36.4	29.8
	Fe_2O_3	0.7	0.7	0.5	0.3
	TiO_2	1.4	1.6	1.4	0.8
	CaO	1.6	0.4	–	0.2
	MgO	0.1	0.1	0.1	0.1
	Alkalies as NO_2O & K_2O	0.1	0.5	0.3	0.3
Physical Properties:	Temperature Limit: (Normal oxidizing atmosphere)				
	Exposed Conditions:	2500°F (1370°C)	2600°F (1425°C)	2800°F (1540°C)	3000°F (1650°C
	Back-Up Insulation:	2500°F (1370°C)	2600°F (1425°C)	2800°F (1540°C)	3000°F (1650°C
	Density, Avg.: Lb/9 x 4½ x 2½ straight	2.5	2.8	3.3	3.8
	lb/ft^3	43	48	57	65
	g/cm^3	.69	.77	.91	1.04
	Modulus of Rupture:				
	psi	140	150	180	200
	(kg/cm^2)	9.8	10	13	14
	Cold Crushing Strength:				
	psi	200	220	300	400
	(kg/cm^2)	14	15	21	25
	Permanent Linear Change, %				
	@ 1950°F soaking temp. (1065°C)	–	–	–	–
	@ 2250°F soaking temp. (1230°C)	–	–	–	–
	@ 2450°F soaking temp. (1345°C)	-0.4	–	–	–
	@ 2550°F soaking temp. (1400°C)	–	-0.4	–	–
	@ 2750°F soaking temp. (1510°C)	–	–	-1.2	–
	@ 2950°F soaking temp. (1620°C)	–	–	–	-1.0
	@ 3150°F soaking temp. (1705°C)	–	–	–	–
	Reversible Linear Thermal Expansion: % at 2000°F (1095°C)	0.5-0.6	0.65 to 0.75		
	Hot Load Strength % Deformation: @ 10 psi load for 1½ hours				
	@ 2000°F (1095°C)	–	–	–	–
	@ 2200°F (1205°C)	0.3	0.2	0.2	0.0
	@ 2400°F (1315°C)	–	–	–	0.3
	% Deformation at 12.5 psi for 1½ hrs. at 2730°F (1500°C)	–	–	–	–
	Thermal Conductivity: (Mean Temperature)	BTU • in/ft² • hr • °F			
	@ 500°F (260°C)	1.82	1.99	2.47	2.80
	@ 1000°F (540°C)	2.13	2.23	2.63	2.87
	@ 1500°F (815°C)	2.45	2.46	2.79	3.05
	@ 2000°F (1095°C)	2.75	2.69	2.95	3.31
	@ 2500°F (1370°C)	–	–	–	–
Shipping Information:	Stocking Location:	Sproul, Pennsylvania			
	Packaging:	25 pcs per carton on pallet			

The data are based on average results of control tests and *should not be used for specification purposes.* Significant variations in test data result from unusual product size, shape, or manufacturing process. ASTM procedures are used where applicable.

Rev. 10/75

Insulating
Fireclay
Brick

Product:

GR®-25
GR®-26
GR®-28
GR®-30

Description:

A family of fireclay insulating brick.

Advantages:

The combination of refractoriness, thermal insulation and strength permits the selection of the product which will most economically meet the requirements.

Applications:

Where Used	Typical Service
Chemical process heaters	Insulation
Fluid bed reactors	Insulation
Glass furnaces	Insulation
Heating furnaces	Walls, roofs
Rotary kilns	Preheaters

FIBROUS ADHESIVE

Technical Data:

Service Temperature:	500° F (270° C)

Shipping Information:

Stocking Point:	Sproul, Pennsylvania
Packaging:	6½ gallon (75 lb) drums – 24 drums per pallet, shrink-wrapped.

The data are based on average results of control tests and *should not be used for specification purposes.* Significant variations in test data result from unusual product size, shape, or manufacturing process. ASTM procedures are used where applicable.

Insulation
Adhesive

Product:

FIBROUS ADHESIVE

Description:

A strong, paste-like silicate of soda fibrous cement.

Advantages:

Holds insulating block such as MX-17, temporarily in position until permanent reinforcement or refractories can be installed. Easily applied and quick drying.

Applications:

Where Used

For temporary bonding of insulation to brick, concrete, metal or other surface as well as for bonding prefab fittings.

Insulating Cement

Product:

GREFCO® INSULATING CEMENT

Description:

Small, resilient pellets of high temperature mineral fiber, blended in dry form with binders and corrosion inhibitors. Service temperature limit 1700°F (925°C).

Advantages:

With water added, forms a highly plastic cement. Suitable for application, with good adhesion to a wide variety of surfaces. Dry form makes it easy to handle and store.

Applications:

Excellent for minor repair work on heated equipment already in operation.

Where Used	Typical Service
Boilers	Flues, ducts
Incinerators	Flues, ducts
Kilns	Flues, ducts
Ovens	Flues, ducts

GREFCO® INSULATING CEMENT

Technical Data:

Service Temperature:	1700°F (925°C)
Approximate Water/Cement Ratio:	10/5
Coverage (Wet):	115 ft/² ½" Thk/100 lb
Drying Shrinkage (Vol):	15.0%
Linear Shrinkage:	
750°F (400°C)	0.4%
1200°F (650°C)	1.6
1500°F (815°C)	1.9
Installed Density:	Approx. 24 lb/ft³ (0.38 g/cm³)
Fire Resistance:	Not Combustible
Compressive Strength:	14 psi @ 15% Deformation (1 kg/cm²)
Thermal Conductivity:	
Mean Temp	BTU • in/ft² • hr • °F
100°F (40°C)	.49
500°F (260°C)	.74
800°F (425°C)	1.06

Shipping Information:

Manufacturing Point:	Sproul, Pennsylvania
Packaging:	Valve type 50 lb bags — 18 bags per standard pallet, shrink-wrapped.

The data are based on average results of control tests and *should not be used for specification purposes*. Significant variations in test data result from unusual product size, shape, or manufacturing process. ASTM procedures are used where applicable.

Insulation Block

Product: **MONOBLOCK**

Description: Insulation block with a density of 13 lb/ft^3 maximum. Virtually no moisture absorption. Service temperature limit 1900°F (1040°C).

Advantages: Does not cause or accelerate corrosion to steel.

Applications:

Where Used	Typical Service
Blast furnace stoves	Wall insulation
Cement kilns	Firing hoods, clinkers, cooler feed housings, preheater back-up insulation
Heating furnaces	Wall insulation
Incinerators	Back-up insulation

GREFCO

GENERAL REFRACTORIES COMPANY
U S REFRACTORIES DIVISION
600 GRANT STREET Room 3000
PITTSBURGH PA 15219

MONOBLOCK

Technical Data:

Bulk Density:	13 lb/ft^3 (0.21 g/cm^3)
Service Temperature:	Up to 1900° F (1040°C)
Linear Shrinkage: 1900° F (1040°C)	Less than 5%
Flexural Strength:	40 psi (2.8 g/cm^2)
Compression Strength:	10 psi @ 10% deformation (0.7 g/cm^2)
Thermal Conductivity:	
Mean Temp	BTU • in/ft^2 • hr • °F
200° F (95° C)	.36
400° F (205° C)	.42
600° F (315° C)	.51
800° F (425° C)	.62
1000° F (540° C)	.75
1200° F (649° C)	.90
Standard Sizes:	
Length	18" and 36"
Width	6", 12" and 24"
Thickness	1" to 4" in ½" increments

Shipping Information:

Shipping Point:	Sproul, Pennsylvania
Packaging:	Corrugated boxes: 36 bd ft each

The data are based on average results of control tests and *should not be used for specification purposes.* Significant variations in test data result from unusual product size, shape, or manufacturing process. ASTM procedures are used where applicable.

Rev. 11/77

Insulation Block

Product: **MX-17**

Description:

Insulation block with a density of 18-19 lb/ft^3 maximum (0.29 g/cm^3). Virtually no moisture absorption. Service temperature limit 1900°F (1040°C).

Advantages:

Does not cause or accelerate corrosion to steel.

Applications:

Where Used	Typical Service
Blast furnace stoves	Wall insulation
Cement kilns	Firing hoods, clinker coolers, feed housings, preheater back-up insulation
Heating furnaces	Wall insulation
Incinerators	Back-up insulation

MX-17

Technical Data:

Bulk Density:	18-19 lb/ft^3 (0.28-0.30 g/cm^3)
Service Temperature:	Up to 1900°F (1040°C)
Linear Shrinkage: 1900°F (1040°C)	2%
Breaking Strength:	23 lb (1" x 6" x 10" span) (10.4 kg) (2.54 cm x 15.24 cm x 24.40)
Thermal Conductivity: Mean Temp	BTU • in/ft^2 • hr • °F
200°F (95°C)	.35
400°F (205°C)	.40
600°F (315°C)	.47
800°F (425°C)	.54
1000°F (540°C)	.63
Standard Sizes:	
Length	36"
Width	12"
Thickness	1", 1½", 2"

Shipping Information:

Shipping Point:	Sproul, Pennsylvania
Packaging:	Corrugated boxes: 36 bd ft each

The data are based on average results of control tests and *should not be used for specification purposes.* Significant variations in test data result from unusual product size, shape, or manufacturing process. ASTM procedures are used where applicable.