

NARCO

Cements
Mortars
Coatings

Service-Matched and Quality-Controlled to Serve Better

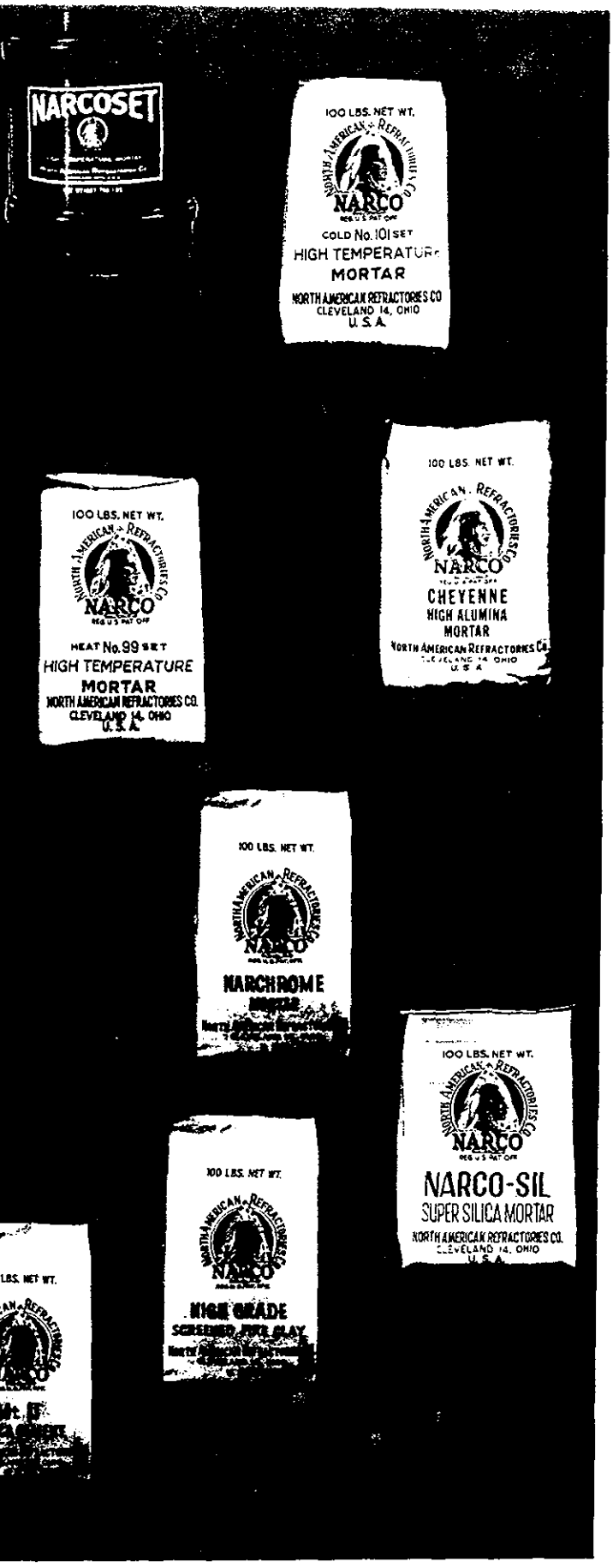
PLAINTIFF'S EXHIBIT NAR-4

North American Refractories Co.
Cleveland 14, Ohio

A Mortar for Every Need

The service conditions in today's modern furnaces are many and varied. This makes it impossible for any one refractory mortar to efficiently meet such multiple requirements. The demands placed on cements and mortars are in reality more exacting than those upon the brick itself. The jointing material must not only do all that is required of the brick in the way of resisting high temperatures, thermal shocks, high loads under heat and corrosive gases and slags but must, in addition to these, bond together the brick, forming a monolithic structure. The mortar or cement should conform in chemical properties to the brick with which it is to be used, and in physical properties to the intended service. Thus the necessity of a mortar for every need.

NARCO products were carefully developed by our modern Research Center, and utmost consideration was given to all properties that a good cement or mortar should possess; such as chemical compo sition, P.C.E., workability, grain size, as well as cold and hot bonding strength. These factors are closely controlled in producing all NARCO cements and mortars.



Considerations in Selecting Mortars

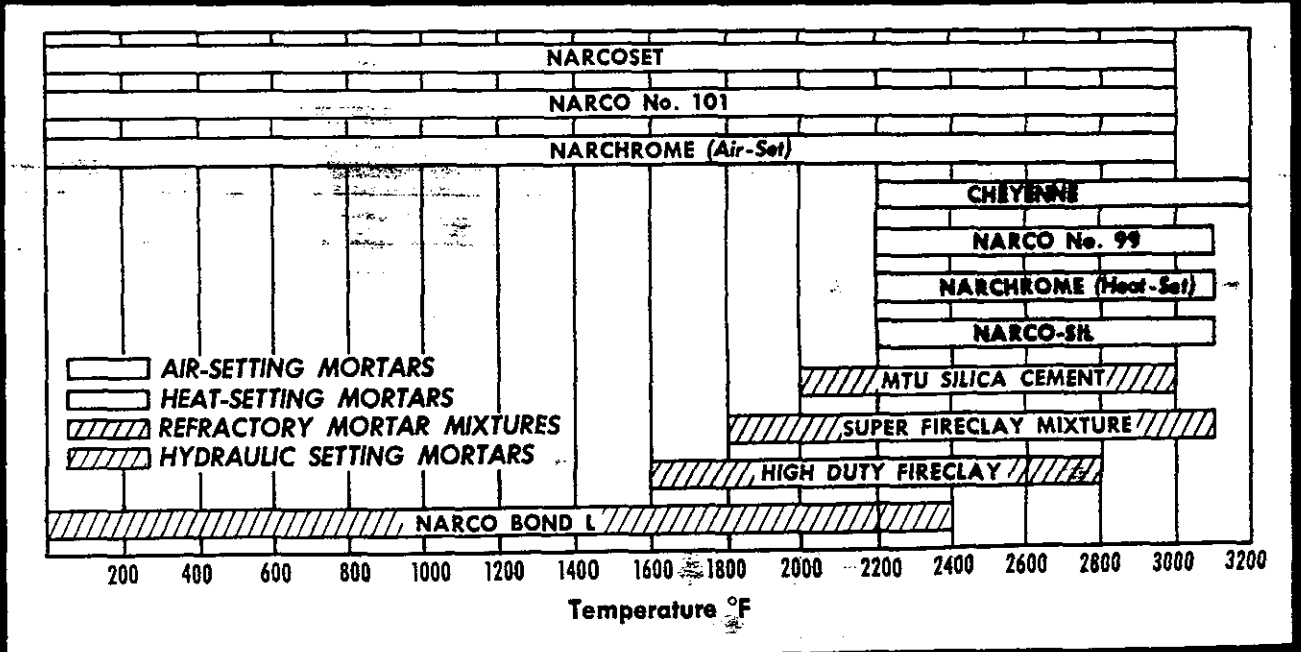
1. REFRACTORINESS is one of the most important properties of a mortar, since it establishes the maximum temperature of use. Beyond that temperature the mortar will squeeze out of the joints, due to the weight of the brick setting, thus permitting a wall to fall into a furnace or opening up passages to short circuit combustion gases, or permitting slag to attack the brick more readily. Therefore, refractoriness must be given primary importance.

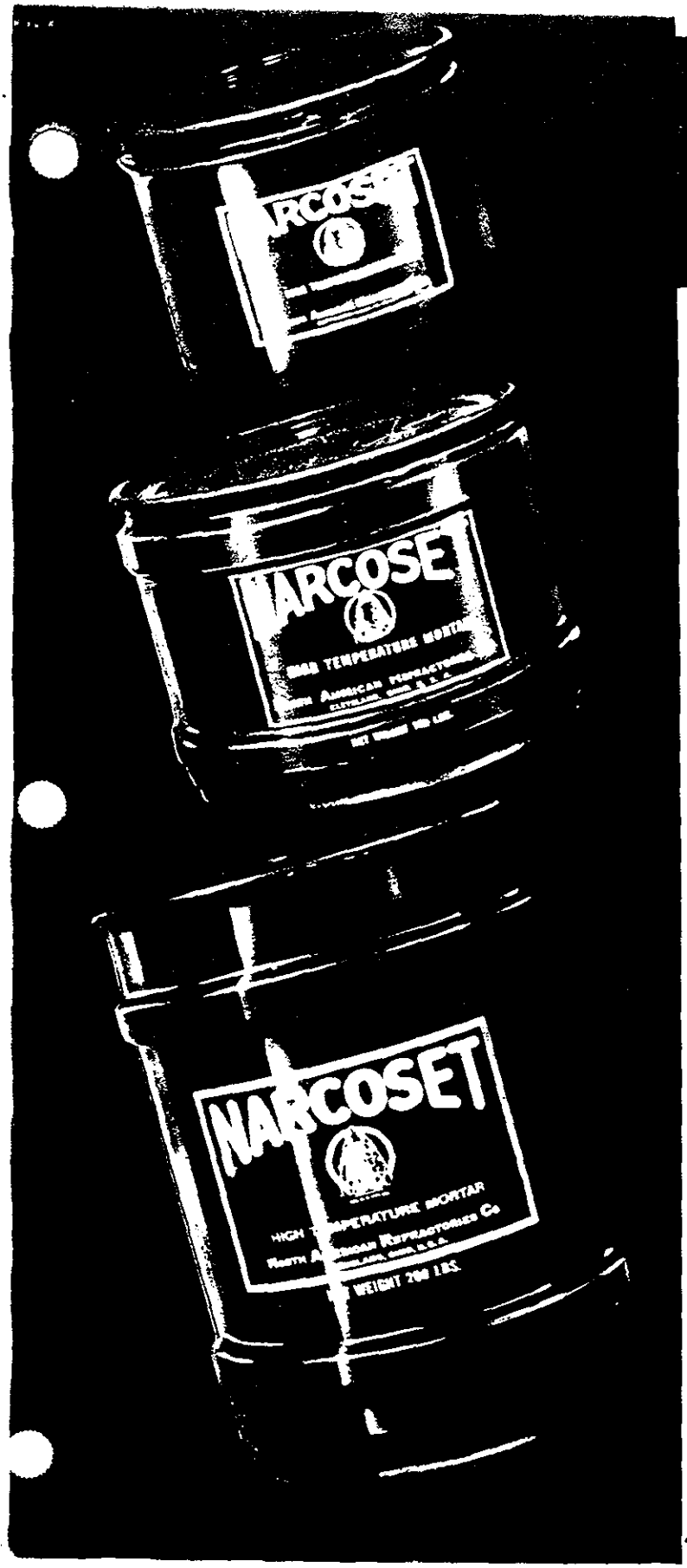
2. FREEDOM FROM SHRINKAGE is a major concern if service conditions are at all severe. Cracks in the joints permit overheating of the brickwork, followed by severe spalling and slag attack. In all cases, loss of heat through the walls or drawing in of excess air wastes fuel and may be expensive. For severe operating conditions or for maximum economy a mortar with low shrinkage is necessary.

3. THE BOND STRENGTH developed in a lining by a mortar controls the mechanical stability of a furnace, and depends entirely on the conditions of service. In some furnaces a good air-setting strength is required, because temperatures in some parts of the furnace are not high enough to develop a ceramic bond. In other furnaces a heat-setting bond is necessary.

4. ADEQUATE WORKABILITY contributes to sound construction. A short sandy mortar is difficult to handle, and does not permit good bricklaying even by the most careful workman. Similarly, mortars of extreme plasticity, particularly those of a sticky nature, make it difficult to lay brick properly. Mortars should be smooth enough to handle well, and flow readily to produce sound well-filled joints.

5. SLAG RESISTANCE is frequently a major consideration. First the joints must be well filled by a mortar of low shrinkage, good bonding characteristics, and adequate workability. Then it must have physical and chemical resistance to attack by the particular slag present, and must be impervious to penetration and erosion. As temperatures increase, the severity of slag attack rises sharply. Therefore, in zones of high temperature operation, slag resistance and high refractoriness are important.





NARCOSET

Wet, Air-Setting High Temperature Mortar

NARCOSET is an air-setting high temperature bonding mortar recommended for all types of fire clay brick. It forms a rigid bond at all temperatures up to 3000° F. NARCOSET is supplied ready to use, assuring maximum workability, strength and uniformity. As a result, NARCOSET is far superior to mortars mixed on the job.

NARCOSET has high strength, not only when hot, but also at room temperature when dry and at all temperatures between these limits. NARCOSET bonds the brick and tile in the walls throughout all temperature zones and produces a strong, well-bonded structure.

The remarkable workability of NARCOSET assures easy bricklaying, and results in well-filled joints. Cracked joints due to quick-set or shortness are thus eliminated. Fire brick of extreme porosity cannot destroy the smooth workability of NARCOSET.

A NARCOSET joint sets hard and dense under heat, resisting attacks by slags, fluxes and abrasive action or spalling. A NARCOSET joint is as effective as the brick itself. At the same time NARCOSET has low drying and firing shrinkage, resulting in a good, tight joint.

NARCOSET is produced from selected raw materials. Raw and calcined clays of special types are selected to give high refractoriness and low shrinkage along with easy workability and high strength.

While NARCOSET contains the right amount of liquid for most applications and is shipped at the right consistency for immediate use, it is nevertheless desirable to stir thoroughly before use because after an extensive period liquid may gather on top. Thorough stirring, which can be performed within the drum, develops smoothness in the material and promotes best results. After stirring, if the cover is replaced, NARCOSET will retain its smooth working quality for days without the necessity of further processing. Only water is required to make NARCOSET the right consistency for dipped or poured joints or surface coating.

NARCOSET is available in three consistencies of standard, medium and heavy. From this range it is possible to select a factory prepared mix to meet any given application.

Description

Standard consistency for most applications where an air-setting mortar is specified. Medium consistency for troweling vertical joints such as encountered in hot top work. Heavy consistency suitable for hand application. Particularly useful where thick joints are preferred, patching spalled sections, stopper rod assembly and immersion thermocouple work.

NARCOSET meets all classes ASTM Specifications C-178 for air-setting mortars.

CHEYENNE

Dry, Heat-Setting High Alumina Mortar

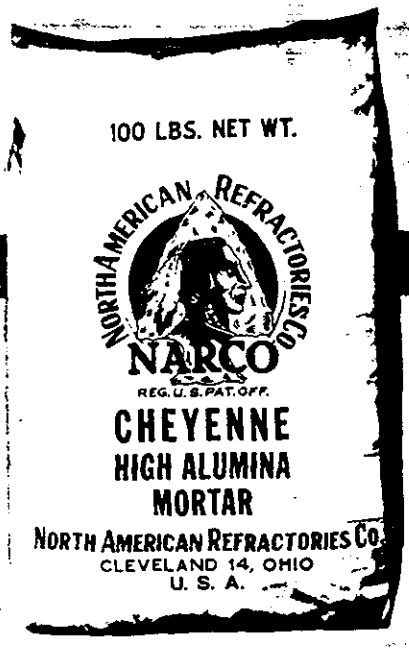
CHEYENNE is a dry, heat-setting kyanite base mortar designed for applications where joint erosion is unusually severe. Its primary use is for laying firebrick in furnaces or vessels where molten iron, steel or slag is encountered. CHEYENNE chemically resists solution by corrosive metals and slags. In addition CHEYENNE expands slightly at operating temperatures to keep the brickwork tight, and to prevent harmful joint penetration.

CHEYENNE mixes easily with water to a desirable smooth consistency. It has excellent water retention and remains in suspension, even when mixed thin enough for dipped joints.

Brick bonded with CHEYENNE are readily held in place during service, but may be easily separated when it is necessary to repair or replace the wall or lining.

CHEYENNE is recommended as a bonding material for blast furnace linings, hot metal mixers, hot metal transfer cars, malleable furnace sidewalls and bottoms, all types of metallurgical furnaces lined with high alumina brick, foundry ladles and as a protective wash coating for brickwork and ladle linings.

CHEYENNE is packaged in 100 lb. moisture-resistant bags for convenient use. It may be stored indefinitely, without deterioration.



NARCO No. 99

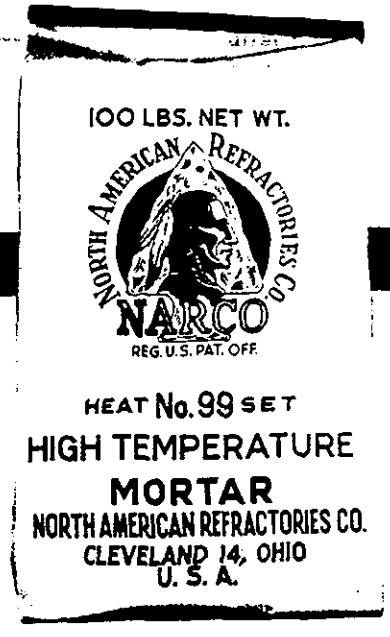
Dry, Heat-Setting High Temperature Mortar

NARCO No. 99 is a dry, heat-setting mortar of the highest quality with the maximum of refractoriness. A blend of selected raw and calcined clays plus correct grain sizing give the mortar a desirable balance of properties.

NARCO No. 99 possesses negligible shrinkage, has excellent workability and good resistance to solution and attack by slags. It develops a satisfactory bond above 2200° F. and find its greatest use between that temperature and 3100° F.

It has special applications in piers, division walls of boilers and furnaces, baffles, division arches and target walls where soaking heats are encountered and high refractoriness is demanded. It is also used widely in furnaces where alkali attack is severe.

NARCO No. 99 is shipped in 100 lb. moisture-resistant bags to assure safe arrival on the job. Since it contains no air-setting ingredients, it may be stored indefinitely without change. To use, it is necessary only to mix it with water and permit a short time for slaking of the plastic clay.



NARCO No. 101

Dry, Air-Setting High Temperature Mortar

NARCO No. 101 is a dry, air-setting high temperature bonding mortar which, when mixed with water, is similar to NARCOSET. It is manufactured from similar high grade materials and, therefore, is similar in refractoriness, workability, freedom from shrinkage and resistance to slagging. It is used widely for laying high duty, super duty, and insulating firebrick wherever a dry air-setting mortar is preferred. NARCO No. 101 is shipped dry but comes as close to possessing the desired properties of a wet air-setting mortar as it is possible to secure.

NARCO No. 101 is easily applied and begins to set soon after it is applied, forming a strong bond between the brick. This bond is maintained at industrial furnace temperatures.

NARCO No. 101 is shipped in 100 lb. moisture resistant bags to assure arrival on the job in excellent condition. To use, it is only necessary to mix the dry mortar thoroughly in a tight mortar box, and add sufficient clean water for the desired consistency.

NARCO No. 101 meets the refractoriness tests for all classes under ASTM Specifications C-178.

NARCO No. 101 is not recommended for use in furnaces where sulfur may be detrimental to the furnace or end product.

NARCOBOND L

NARCOBOND L is a hydraulic-setting mortar for use up to 2400° F. It is well suited for use in flues, stacks, foundations and similar parts of furnace structures, especially where water may be present during some emergency conditions.

NARCOBOND L is shipped in 100 lb. moisture resistant bags, ready for use after mixing with water.

NARCOBOND L should be stored in a dry location and kept free from moisture and high temperatures.

NARCHROME MORTAR (Air-Set)

NARCHROME MORTAR (Air-Set) is an air-setting, high temperature bonding mortar with a chrome ore base. The only preparation necessary is mixing with clean water to the consistency desired, thereby obtaining a mortar excellent for laying or coating all types of basic brick, as well as clay and high alumina, when these are in contact with highly corrosive slags or oxides.

NARCHROME MORTAR (Air-Set) has excellent workability and suspension characteristics along with a high refractoriness and good bonding strength. These properties are desirable for numerous applications over a wide temperature range. The air-setting ingredients, after drying, form a strong bond until a ceramic bond is developed at higher temperatures.

NARCHROME MORTAR is supplied in dry form and is shipped in 100 lb. bags.

NARCHROME MORTAR (Heat-Set)

NARCHROME MORTAR (Heat-Set), with chrome ore as its base, is a chemically neutral high temperature mortar of maximum refractoriness. This high refractoriness imparts maximum resistance to basic and ferrous slags. It possesses a small amount of air-set, but depends chiefly on high temperatures to obtain its permanent set in service.

NARCHROME MORTAR (Heat-Set) has high water retention and good plasticity which makes it ideal for all types of troweled joints. It is also widely used for patching small holes in furnaces or in NARCHROME PLASTIC. Strong adhesive characteristics make this mortar very suitable for bonding and spray-coating all kinds of refractories.

Furnished dry in 100 lb. bags, it requires only the addition of water before using.

NARCO-SIL

NARCO-SIL is recommended for use as a mortar when silica brick are used in a furnace and operating conditions are very severe. It is a super silica mortar of unusual balanced properties—extreme refractoriness, excellent workability, high resistance to erosion, negligible shrinkage, good bonding characteristics and high load-bearing ability. It contains no fire clay nor siliceous clay whatever, but makes use of other special ingredients to give it outstanding plasticity and bonding power.

NARCO-SIL possesses excellent workability, shown by a very satisfactory water retention period; and at the same time affords excellent body and freedom from stickiness. These properties, plus good bonding characteristics and resistance to erosion, make NARCO-SIL well suited for service in open hearth furnaces and glass tanks operating at the highest rates.

These same properties, plus a chemical composition practically identical to that of the best silica brick, give longer life to caps and upper structure of glass tanks as well as in coke oven construction.

NARCO-SIL is shipped in 100 lb. moisture resistant bags. It is ready for use by mixing with clean water either to a thick consistency for forming troweled joints, or to a thinner consistency for dipped joints.

Mt U SILICA CEMENT

Mt U SILICA CEMENT in both coke oven and open hearth grades are standard mortars for laying silica brick. Mt U Coke Oven Cement is used also in glass tanks as well as coke ovens. Both grades possess good refractoriness and are manufactured under close plant control.

They are supplied in bulk or in multi-wall paper bags of 100 lb. capacity.

FIRECLAY MIXTURES, FIRECLAYS AND CALCINES

NARCO SUPER FIRECLAY MIXTURE

Where service conditions in furnaces are not as severe as to require a high temperature bonding mortar, NARCO SUPER FIRECLAY MIXTURE offers an economical jointing material for laying high duty and super duty firebrick. NARCO SUPER FIRECLAY MIXTURE is a raw clay and grog mixture that greatly overcomes the shrinkage problems encountered with straight fire clays.

NARCO SUPER FIRECLAY MIXTURE is available in 100 lb. multi-wall bags as well as bulk.

RAW FIRE CLAYS

RAW FIRE CLAYS: NARCO offers a wide variety of raw, ground fire clays which may be used for mortar if extreme economy is desired. These clays are also used extensively for ceramic purposes, for preparing cupola daub and for packing between steel shells and brickwork. The wide variety of clays available permit the selection of these with the desired properties of refractoriness, dry and fired strength, and bonding characteristics.

For those who wish to prepare special mortar mixtures, NARCO will prepare, on specification, ground, raw plastic clays and ground calcined clays of various classes and screen analyses. These materials may be shipped in bulk or in multi-wall paper bags of 100-lb. capacity.

CALCINED FIRE CLAYS

CALCINED CLAYS: Various calcined fire clays are available for furnace work and for preparing ceramic bodies. These may consist of ground and screened high duty fire brick or of calcined virgin flint clay of high quality. They are shipped in heavy multi-wall paper bags, or if desired, may be shipped in bulk where extreme economy is necessary.

Coatings provide a means for periodically reconditioning refractory linings to partially compensate for non-uniform wear. Used primarily for maintenance of existing refractory construction, they materially increase service life of linings by reinforcing those sections on which wear is the greatest. NARCO coating materials are manufactured from various refractory bases permitting the selection of one to match the refractory material on which it is to be applied and the purpose for which it is intended. All NARCO coating materials are designed with good adherence qualities, low shrinkage, high refractoriness, and good slag resistance.

NARCOSET . . . for surface coating furnace walls by spraying, brush coating or trowelling. Seals joints against air infiltration and gas leakage; resists abrasion and spalling conditions.

CHEYENNE . . . for wash coating surfaces subjected to corrosive metals and slags. Gives added protection to linings.

NARCOLINE COATING AND MORTAR . . . for coating foundry ladles, runners, and spouts. Provides a non-wetting surface, keeping ladle linings cleaner.

NARCHROME MORTAR . . . for coating all types of refractories, particularly basic brick, as a protection against highly basic slags and oxides.

SUMMARY

NORTH AMERICAN REFRACTORIES COMPANY

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