



# Resco for the *Long Run*



## High Alumina Refractory Brick for Discharge and Calcining Zones



In rotary cement kilns, high alumina brick are placed on either side of the burning zone. Several refractory types may be used to increase resistance to the conditions that are present. High alumina brick (70% to 80%  $\text{Al}_2\text{O}_3$ ) can be based on bauxite, or on mullite ( $3 \text{Al}_2\text{O}_3 - 2 \text{SiO}_2$ ) grains for better alkali resistance. High alumina brick can have a ceramic bond for standard service conditions, or a phosphate bond for higher mechanical strength.

### DISCHARGE ZONE

The discharge zone can experience rapid temperature changes if the kiln is cycled frequently. High strength is favored for resistance to mechanical stresses, especially when bearing the load against the discharge retainer ring.



Discharge

**RESCAL™ 85B** - for wear resistance at the kiln discharge

- Phosphate-bonded for high mechanical strength and abrasion resistance
- Excellent thermal spalling resistance

**RESCAL™ 70D** - for standard service

- Very good alkali resistance
- Good strength

### CALCINING ZONE

In the calcining zone, the formation of free lime from the decomposition of limestone is completed. Higher alumina refractories are used to resist reaction with the free lime. Alkali attack can occur in other areas of the calcining zone.



Calcining

**RESCAL™ 80** - for service directly above the basic brick

- 80% alumina content for increased resistance to reaction with free lime
- Improved strength over 70% alumina class brick

**RESCAL™ 70D** - standard service

- Economical
- Very good alkali resistance

**SENECA™ 60P** - for alkali resistance

- Based on mullite grain for superior resistance to alkali attack
- Positive reheat test results for lining stability
- Phosphate-bonded with improved strength over 70% brick

## Basic Refractory Brick for Cement Kiln Burning Zones



The refractory lining of a burning zone in a modern cement kiln uses several refractory types that correspond to the different process conditions or requirements. Modern cement kilns extensively use magnesite-spinel refractories as the lining materials in the burning zone areas.

### LOWER TRANSITION ZONE

The lower transition zone is the basic brick area closest to the kiln discharge. Coating conditions are normally unstable. Refractory wear can occur from thermal stress, the infiltration of clinker liquids and alkali salts, and thermal shock from sudden coating loss.



Lower Transition

**RESCOMAG® 92** - for standard to moderately severe service in the lower transition

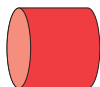
- High magnesia content for resistance to the clinker liquids
- Excellent thermal spalling resistance

**RESCOMAG® 92 FMS** - for very severe wear

- High content of fused grain for exceptional resistance to clinker liquids

### BURNING ZONE

The burning zone center features a thick and stable coating. Thermal stress can be a factor in refractory wear causing infiltration of the clinker liquids. Alkali salts can deposit in the brick pores.



Burning Zone

**GREENFREE™ 92** - for service in the burning zone center for non-dolomite users and precalciner kilns

- Economical
- Low spinel content for resistance to clinker liquids

**GREENFREE™ 92** - standard service in the upper transition

- Moderate thermal conductivity
- Excellent strength to resist shell stresses

**RESCOMAG® 85** - for reduced shell temperatures

- High spinel content for improved thermal conductivity
- Matrix spinel for resistance to alkali salt infiltration

### UPPER TRANSITION ZONE

The upper transition zone normally features a thin, unstable coating, or the coating is completely absent. Refractory wear occurs from the infiltration of alkali salts that weaken the brick structure as well as mechanical stresses from the second kiln support tire.



Upper Transition

**GREENFREE™** - for mechanically stressed areas

- High content of sintered spinel for lower thermal expansion
- High strength to resist mechanical stresses

# Monolithic Refractories in the Cement Clinker Cooler and Preheater

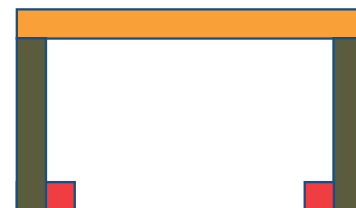
Monolithic refractories, especially castables and gunning mixes, are widely used in preheater towers and coolers in North America. Advantages of monolithic refractories include ease of application especially for complex geometries, ready availability, improved time for installation and good resistance to infiltration of dust and feed materials.

## Clinker Cooler

Most clinker coolers in North America have reciprocating grates. The refractory constructions are above the grates and consist of roof, sidewall and curb linings.

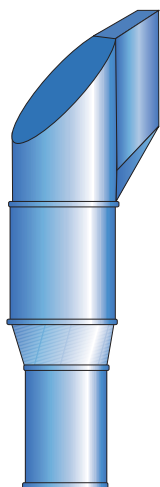
Product selection for the grate cooler includes:

|         | Roof            | Sidewalls                                                            | Curbs                                                   |
|---------|-----------------|----------------------------------------------------------------------|---------------------------------------------------------|
| Casting | VIBROCAST™ 60   | 1st Compartment<br>VIBROCAST™ 60<br>2nd Compartment<br>VIBROCAST™ 50 | VIBROCAST™ 60PC<br>or<br>PACOCAST™ 28LI<br>COARSE GRAIN |
| Gunning | RESCOCAST® 15GM | VIBROCAST™ 50G                                                       |                                                         |



Section through Clinker Cooler

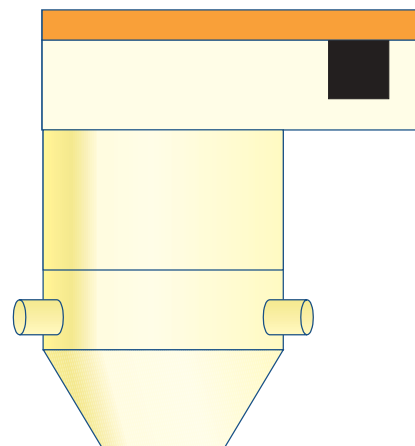
## Preheater Tower



Riser Duct

Preheater tower maintenance practices favor gunned installation for improved logistics and speed of application except where build-ups form. Cast linings with smooth surfaces help manage build-up formation and removal. 60% alumina low-cement castables and gunning mixes have a great deal of versatility and strong alkali resistance for use in most areas of the preheater, especially in the lower vessels and riser ducts.

In vessels that have lower temperatures, 40% to 50% alumina mixes are preferred. In areas where build-ups form, silicon carbide-containing castables and gunning mixes have been employed for their resistance to wetting by molten alkali salts and subsequent attachment of build-ups.



Cylindrical Calciner

Product selection for the preheater tower includes:

|                     | Feed End Housing and Riser Ducts - Lower Stages | Riser Ducts - Upper Stages        | Insulation      | Calciner Vessel                   | Cyclones                          | Roof            |
|---------------------|-------------------------------------------------|-----------------------------------|-----------------|-----------------------------------|-----------------------------------|-----------------|
| Casting             | VIBROCAST™ 60PC                                 | VIBROCAST™ 50PC                   | RESCOCAST® 3-35 | VIBROCAST™ 60PC                   | VIBROCAST™ 50PC                   | VIBROCAST™ 50PC |
| Gunning             | VIBROCAST™ 60G<br>RESCOCAST® 15GM               | VIBROCAST™ 50G<br>RESCOCAST® 15GM | RESCOCAST® 3-35 | VIBROCAST™ 60G<br>RESCOCAST® 15GM | VIBROCAST™ 50G<br>RESCOCAST® 15GM | RESCOCAST 15GM  |
| Build-up Management | VIBROCAST™ 56SCPC                               | VIBROCAST™ 56SCPC                 | RESCOCAST® 3A   | VIBROCAST™ 56SCPC                 | VIBROCAST™ 56SCPC                 |                 |



## Monolithic Product Descriptions

**VIBROCAST™** is Resco's low-cement castable brand name, available in pumpcast, normal vibration cast or gunning mix for fast, economical installations. These low cement products feature excellent resistance to alkali attack and withstand erosion at high temperature. Pumpcast (PC) mixes are used for shotcrete installations. Our unique additive package fully cures the product's cement to yield superior physical properties in shotcrete mixes for more strength in the long run.

**RESCOCAST®** and **PACOCAST™** are brand names for conventional cement- content castables, including insulating castables. In general, these products can be cast with vibration, gunned or trowelled.

| Brand                          | Raw Material Basis      | Application     |
|--------------------------------|-------------------------|-----------------|
| VIBROCAST™ 50G                 | Fireclay                | Gun             |
| VIBROCAST™ 50PC                | Fireclay                | Cast/Pumpcast   |
| VIBROCAST™ 60G                 | Mullite                 | Gun             |
| VIBROCAST™ 60PC                | Mullite                 | Cast/Pumpcast   |
| VIBROCAST™ 56SCG               | Silicon Carbide         | Gun             |
| VIBROCAST™56 SPC               | Silicon Carbide         | Cast/Pumpcast   |
| RESCOCAST® 15GM                | Fireclay                | Gun/Cast/Trowel |
| PACOCAST™ 28LI<br>COARSE GRAIN | Pyrophyllite/Andalusite | Cast            |
| RESCOCAST® 3-35                | Lightweight Aggregate   | Gun/Cast        |
| RESCOCAST® 3A                  | Lightweight Aggregate   | Gun/Cast        |

## RESCO for the Long Run

Founded in 1946, Resco has served its markets with specialized products ever since, initially, with the petroleum refining industry and later the steel industry. Innovations have been key to Resco's long success, including AA-22® and the original patent on semi-universal ladle brick.

The acquisitions of 2000 brought other distinctive capabilities to Resco, including a respected high alumina brick product line and a burned basic brick plant in Canada. These two elements make Resco particularly suited to serve the cement industry.

Resco's basic plant acquisition brings over 17 years experience in the manufacture of magnesia-spinel brick refractories for cement kilns. RESCOMAG® 85, RESCOMAG® 92 and RESCOMAG® 92 FMS are the latest innovations in this *long run*.

Other innovations include the RESCOBOND® 3000 family of phosphate-bonded chemically setting castable and gunning mixes. RESCOBOND® 3000 can be used as a utility patching mix or for a full lining. Capable of adhering to existing refractory surfaces, RESCOBOND® 3000 can help other refractories go *the long run*. And RESCOBOND® 3000 requires no curing period or dry-out, particularly useful when patching preheater tower linings.

The QUIKTURN™ family of strong, abrasion resistant castables and gunning mixes are cement-bonded and designed for use where curing and heat-up cannot be controlled. QUIKTURN™ 60PC and QUIKTURN™ 60G directly replace 60% alumina low cement castables (pump-cast) and gunning mixes respective. QUIKTURN™ 56 SC is available where conditions require a silicon carbide-containing refractory. With the capability to use process heat for dry-out, the QUIKTURN™ family brings you on-line more quickly for *the long run*.

**Resco** – special refractories since 1946 – successful over *the long run*.

**Resco** - a company highly experienced *for the long run*.

**Resco** – thinking of new products helping you *achieve the long run*.

**Resco for the long run.**



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