

Resco Products for

Lime Recovery Kilns

Rotary lime recovery kilns typically have four refractory zones (see Figure 1). These wet process kilns use chain systems in the charging area to dry the slurry feed. In the preheating zone, the mud feed is heated in preparation for the burning zone, and refractories range from fire-clay (40% Al_2O_3) brick up to 70% alumina brick.

The burning zone is the hottest location in a lime recovery kiln. Here dissociation of calcium carbonate occurs at

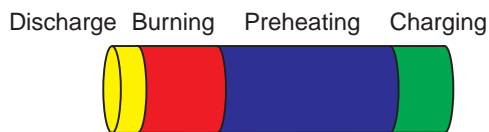


Figure 1. Refractory Zones in a Lime Recovery Kiln

high temperatures, producing the lime product.

Depending on the process, burning temperature can vary from below 2000°F (approximately 1100°C) to nearly 2500°F (1370°C), and this will dictate refractory selection for the burning zone. The discharge zone of a modern lime kiln contains a dam construction to increase retention time of the lime in the kiln.

More energy efficient lime reburning kilns were introduced to the North American paper industry in the 1980's. Efficient kilns feature high-density chain systems, kiln internals to increase heat exchange, dams for greater retention time, and two-layer insulated linings. These features allow reduced burning temperature, as the lime is calcined at a lower temperature but retained longer in the kiln. Because of the insulating brick, the alumina brick hot face layer must have greater alkali resistance due to the soda present in the mud feed (see figure 2).



Figure 2. Alkali spalling in an insulated high alumina brick lining.

Temperatures above 2250°F (1230°C) are common in lime kilns that have less efficient heat exchange. High calcining temperatures require basic burning zone refractories that are more compatible with the lime (CaO) charge than high alumina brick. Since the 1980's, magnesia-spinel refractories, composed of magnesite (MgO) and magnesia-alumina spinel ($\text{MgO-Al}_2\text{O}_3$), have become the preferred basic brick refractory for the rotary lime kiln.

Alumina Brick for Preheating and Burning Zones

60% to 70% alumina brick linings are often used in preheating zones and burning zones of many lime recovery kilns. 60% alumina brick are the preferred selection for insulated kiln burning zone linings. 60% alumina brick offer increased resistance to the expansive alkali reactions that can cause alkali spalling.

SENECA™ 60P exhibits excellent alkali resistance from the mullite ($3\text{Al}_2\text{O}_3\text{-}2\text{SiO}_2$) primary raw material (see figure 3). A positive reheat property in **SENECA™ 60P** improves the stability of the lining, as it tends to tighten during service. Phosphate-bonding gives **SENECA™ 60P** good mechanical strength.

ALUMEX® 60 HS is manufactured from more traditional raw materials, but maintains high strength, strong alkali resistance (scores a slight/moderate reaction in alkali cube test rating), a positive reheat property and affords good performance in lime recovery kilns.

For more traditional one-component recovery kiln linings, **RESCAL™ 70D** has been widely used in lime kiln linings and offers consistent, economical performance. For a 70% alumina class brick, **RESCAL™ 70D** maintains good alkali resistance and a positive reheat property for improved lining stability.



Figure 3. **SENECA™ 60P** (left) exhibits superior resistance to alkali cracking in laboratory cup test.



Basic Brick for the Burning Zone

For kilns that have not undergone improvements in heat exchange components, basic brick presents the capability for higher calcining temperatures. At elevated temperatures, lime can react with high alumina brick to cause fluxing that leads to the "duck nesting" appearance. Basic brick are much more compatible with lime, resist fluxing and offer extended lining reliability. Selection should be based on desired shell temperatures, frequency of cycling, and cost.

GREENFREE™ 92 is a 1st generation magnesite-spinel refractory brick with a medium content of in-situ spinel. Widely used in lime kilns, GREENFREE™ 92 is Resco's most economical basic brick for higher burning temperatures.

GREENFREE™ KF, a derivative of GREENFREE™ 92, features a high content of spinel and gives significantly lower shell temperatures (approximately 100°F lower than GREENFREE™ 92) due to improved thermal conductivity.

RESCOMAG® 85 is the option for the harshest conditions in the lime kiln burning zone. RESCOMAG® 85 features fused spinel and an enhanced matrix for high corrosion resistance, good thermal conductivity and strong thermal shock resistance.

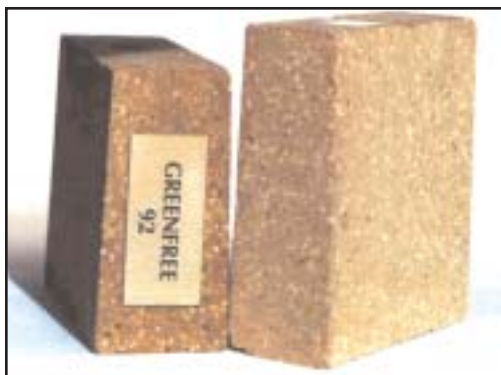


Figure 4. GREENFREE™ 92 and GREENFREE™ KF allow higher service temperatures in lime kiln burning zones. GREENFREE™ KF features better insulating value and offers lower shell temperatures.

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 in the steel industry. Innovations have been key to Resco's long success, including AA-22 and the original patent on semi-universal ladle brick.

Recent acquisitions have diversified Resco into many new refractory markets. The addition of NRMC product lines for the lime & cement industries allows Resco to offer a comprehensive range of products.



Resco Products, Inc
Penn Center West
Building 2, Suite 430
Pittsburgh, PA 15276

Phone: 888.283.5505
412.494.4491
Fax: 412.294.1080
www.rescoproducts.com



The End Zones: Chains and the Discharge

Monolithic (unshaped) refractories are often used in these zones to simplify refractory construction.

Castable refractories are used in the chain system for linings around the chain hangers. **RESCOCAST® 15GM** is a versatile, high cement content castable refractory that can be conventionally mixed and poured, pumped for a large lining section, or gunned for chain section maintenance between major relines. RESCOCAST® 15GM features high strength and good abrasion resistance.

For discharge zones, **RESCORAM® 70 BLUE** plastic can be used in discharge dam construction and features good low temperature strength, exceptionally good installation characteristics and ease of dry-out.

RESCOCAST® 15GM develops excellent strength for vibration-casting nose rings and dams. Resco's new **QUIKTURN™** castable products reduce curing time and are especially suitable for temporary repairs, thick pours and when dry-outs cannot be controlled.

The Process Boilers

The chemical recovery cycle in a Kraft-process paper mill includes a black liquor recovery boiler. Installers often place magnesia-based monolithic refractories in the boiler bottoms to help resist the erosion of the smelt. **RESCOMAG® GUN 90P** is a 90% magnesia content refractory that is installed by pneumatic gunning in the boiler lower sidewalls and bottoms.

Other areas in process and power generation boilers, including burner blocks and seals, may require 90% alumina castables. **RESCOCAST® 17A** is a high-purity, 95% alumina castable for very high temperature applications. For lower temperature applications such as ash hoppers, RESCOCAST® 15GM is selected for installation versatility and high strength.