

# THE BUZZ



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Hydrated lime does not dissolve. Be sure to continuously mix the suspension for better consistency!

## Hydrated Lime An Effective, Easy & Safe Shotcrete Activator

Have you ever asked yourself, why does Mt. Savage recommend hydrated lime as the activator for their **ULTRA-TEK** line of cement-bonded shotcrete products?

The answer is simple. It is the most effective, easy, and safe method for activating cement-bonded shotcrete. It exhibits better installed properties, longer working time from the mixer to the nozzle, and no additional material costs.

Two of the original patent holders for the refractory shotcrete process are affiliated with Mt. Savage. In this day of settled science, both agree that using hydrated lime is the most effective and safest way to activate shotcrete, with the greatest benefits.



In comparison to other activator products and systems, there are a few considerations to ensure an easy and successful installation.

First, a unique characteristic of hydrated lime is that lime will not dissolve in water and, therefore, needs to be kept in suspension. To keep the lime from settling in the bottom of the barrel, an air controlled bubbler is

placed in the barrel, and the amount of agitation is adjusted using a valve.

Second, the lime is pumped from the activator barrel and injected into the nozzle air supply line at a connection about fifteen feet back from the nozzle. It is also important to remove any needle valves

used at the nozzle, as lime can plug such small orifices. The lime activator flow rate should be controlled at the activator pump. Unlike other activator products, once the flow rate of the lime is dialed in, very little adjustment will need to be made throughout the installation.

Finally, choose a sufficient activator pump. Mt. (continues on page 4)

## Pumpable Lightweights

Finding a reliably consistent pumpable lightweight castable used to be much like trying to find Bigfoot. Many have claimed that they had one, only to be proven wrong by a dewatered pug of lightweight casta-

ble in a pipe. Fortunately, those days are behind us. Mt Savage leads the way in this technology, offering four, reliably pumpable **DELTA t CRETE** castables, ranging in density from 60 to 110 pcf!

As most installers can likely attest, it has been preached for years that pumpable castables need to be mixed at the absolute lowest water content, to maximize physical properties like density (continues on page 4)

## Steam Spalling

Steam spalling is caused by steam pressure that builds up inside of a refractory faster than the material's permeability can release it, and the steam pressure exceeds the tensile strength of the refractory. Steam Spalling is generally associated with the dry out of monolithic refractories but can occur in any refractory material containing water.

The easiest way to prevent steam spalling, at least from the perspective of a refractory supplier, is to slow heating rates to prevent developing excessive internal pressures that can cause such a spall. Unfortunately, a longer heat-up schedule is not always desirable or even feasible for furnace operators.

The density of water is nearly 1600 times higher than the density of steam at constant pressure. That means that without applying pressure, one cubic inch of water will fill almost one cubic foot when it evaporates. When evaporation occurs in a constant volume,

such as in the porosity of a newly cast monolithic refractory, tremendous pressure builds up. As the temperature increases beyond the boiling point, the steam will want to occupy an even larger volume, yielding even higher pressure inside the refractory's porosity. In the case of cement-bonded monolithics where water is released from the cement at temperatures well above its boiling point, it comes off as super-heated steam, and the expansion it undergoes is tremendous. To withstand these great pressures, a refractory needs to have enough permeability to dissipate the steam as it is being generated, or be strong enough to withstand the steam pressure without failing.

Increasing permeability is relatively simple to accomplish. Most refractories today are available with some variety of dry out fibers to enhance permeability. These fibers are generally organic and shrink on heating to open up fine pores within the

refractory. While these fibers are effective at increasing permeability, adding too many fibers to a mix can make the product difficult to install and can ultimately lead to lower density and strength.

Increasing strength is also pretty easy to do, but comes with a bit of a tradeoff. Generally, adding more bonding agent, like cement, will increase strength at lower temperatures where steam pressure is a concern. Unfortunately, cement is often the highest cost component of the mix and is generally the component most responsible for lowering the permeability of the refractory. Increasing low temperature strength in cement-free products can be a bit more of a challenge as their low temperature bonds are not as strong as cement bonds. To their advantage, however, cement-free products do not suffer from the release of superheated steam since the water all comes off near its boiling point!

*The density of water is nearly 1600 times higher than the density of steam at constant pressure.*

## MSSR Plastic

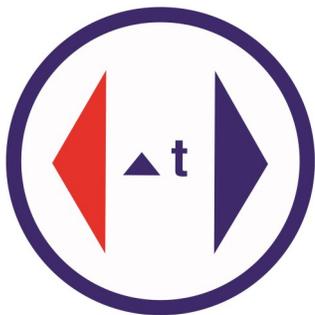
Plastics are a well-known refractory type, for both their use in small patch jobs, as well as building large walls and roofs. What makes one plastic better than another? MSSR believes that good plastic has the correct chemistry for a given application, good shelf life, and workability that make

it easy to install.

When it comes to the production of a variety of plastics, Mt. Savage's **SAVAGE RAM** product line has you covered, from fireclay to high purity alumina, and everything in between. MSSR has SiC plastics for slag re-

sistance or high thermal conductivity. For thermal shock applications, MSSR offers **SAVAGE RAM FS**, a fused silica plastic that is immune to wide temperature swings.

(continues on page 4)



## Savage X & X-II

Shotcreting has become a very common installation method in the refractory industry for several reasons. It is much faster to install than casting or laying brick. There is no need to spend days building forms and pulling them out afterward. With Mt. Savage's **SAVAGE X** and **SAVAGE X-II** cement-free shotcretes, you get all the benefits of shotcreting, as well as ease of pumping, plus the ability to be installed in a wide range of ambient conditions. They also offer improved hot strength, excellent alkali, and acid resistance, and, in the case of **SAVAGE X-II**, faster dry outs compared to standard cement-based shotcretes.

If you know how to shotcrete, the installation of **SAVAGE X** and **SAVAGE X-II** shotcretes is pretty simple and will go off without a hitch if you follow a few simple recommendations.

Mix your shotcrete acti-

vator in advance! Both **SAVAGE X** and **SAVAGE X-II** use a salt solution in water for activating. This salt solution is non-hazardous; you could literally soak your feet in it after a day of shotcreting. It is a salt that can take some time to dissolve, and thus it is a good idea to mix it up a few hours before you plan to start pumping and continuously mix the solution to ensure it stays in solution. In really cold weather, using warm water can help the salt dissolve a bit faster!

When done properly, shotcreting only requires a small amount of activator. We suggest setting the activator flow rate at the activator pump to improve consistency. Activator solution should be supplied through ¼" high-pressure hose and should be mixed into the air line feeding the nozzle. Keep in mind you may need someone at the activator pump to turn

it on and off or to make flow rate adjustments through the pump valve.

Installing **SAVAGE X** or **SAVAGE X-II** in hot environments is not an issue. Both products can be made more fluid with water additions, which can help ease pumping. The heat will not cause any flash setting issues with these cement-free products. Cold environments, on the other hand, introduce some necessary precautions, especially for **SAVAGE X-II**. The colloidal silica binder used with **SAVAGE X-II** should not be allowed to freeze. Once frozen, colloidal silica cannot be used, even after thawing it out.

As you can see, shotcreting is an invaluable tool for speeding up material installation, and the **SAVAGE X** and **SAVAGE X-II** product lines are just what "Dr. Dirt" ordered!

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## Abrasion Resistance

An abrasive process environment can make short work of a refractory lining if the proper material is not used to combat the "scraping" away of the surface. So, what keeps the refractory from being so vulnerable to this aggressive wear? The bond that holds the aggregates together and the aggregates themselves seem like a good place to start!

The refractory bond may be the most im-



High density calcined bauxite can provide exceptional abrasion resistance

portant feature, lending itself to abrasion resistance. There are many bonding systems

around, from conventional cement bond, which, among other differences, contains more cement than more modern low and ultra-low cement bonds. There are a few other bonding systems, but let's focus on the differences in abrasion resistance between the conventional and low cement bonding systems.

The conventional cement bond does a great job fending off abrasion

(continues on page 5)



## Hydrated Lime (From Page 1)

Savage recommends that the activator pump has an outlet pressure greater than 200 psi and an adjustable flow rate between 10-20 gallons per hour.

Some pumps like the electric Milton Roy have an adjustable flow control valve. While others like the pneumatic Graco Fireball 300 barrel pump have been successfully used by putting a regulator on the inlet air with a quarter-inch diameter,

high-pressure outlet hose to control and limit the

flow of the activator.



Milton Roy Pump



Graco Fireball 300 Pump

## Pumpable Lightweight (From page 1)

and strength. While this is still true for dense castables used in working linings, lightweights need all of the water that a manufacturer recommends. Lightweight aggregates tend to suck up some water over time, and even though the mix might look too wet at first, it will settle into a nice smooth pumping mix after a couple of minutes.

While strength is cer-

tainly an important consideration for any refractory castable, the primary function of a lightweight castable is to insulate. Insulating value is inversely related to density, meaning as density goes down, the insulating value goes up. Whereas water, added to a dense castable is used to hydrate the cement and add fluidity, in a lightweight, the water serves a third,

very important purpose. It occupies space. After the bond sets and the castable dries, the space once occupied by the water becomes porosity, lowering the density and increasing the insulating capability. To be sure that the desired density, and therefore insulating value is achieved, be sure not to skimp on the water!

## MSSR Plastic (From page 2)

For abrasion, **SAVAGE RAM ABR** has a very low, abrasion loss. Mt Savage also offers air and heat setting plastics, in addition to the phosphate bonded, to ensure your plastic sets up the way you need it to. Regardless of the type of plastic you need, MSSR offers it made with both quality and value. Proof of this is MSSR's participation in sales to steel

mills, iron foundries, aluminum plants, minerals processing, boilers, and many more applications.

MSSR always looks to be responsive to customer needs and strives to continuously improve our product offerings. With input from customers, changes to our plastics have included packaging adjustments for easier customer use, improvements in shelf life, and

workability.

At MSSR, we know that plastics have a wide variety of uses across many different applications and that there is no one plastic to fix all your problems. Call your local MSSR rep today to find out which **SAVAGE RAM** plastic will provide the best solution for your needs!

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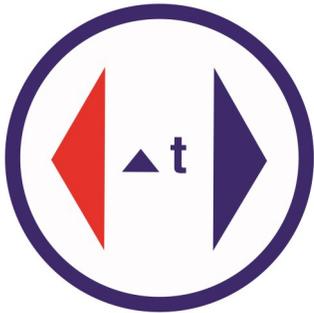
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Since 1975 Mt. Savage Specialty Refractories has been supplying the highest quality refractory specialties. With two manufacturing locations able to produce a wide array of product types, we can easily fill your order for one pallet or multiple truckloads without delay. Call Mt. Savage today to discuss your specialty refractories needs!

- Conventional Cement Castable & Gun Mix
- Low & Ultra-Low Cement Castable, Gun Mix & Shotcrete
- Cement-Free Castable, Gun Mix & Shotcrete
- Air-Set, Heat-Set & Phosphate Bonded Plastic & Mortar
- Lightweight Castable, Gun Mix and Shotcrete

## Abrasion (From Page 3)

as the higher cement content promotes more strength, especially at low temperatures. Conventional cement-bonded systems have been around for ages and are very easy to work with. What choice would one have when a conventional cement-based material is expected to combat abrasion at a higher temperature? Low cement

technology is the answer!

A low cement refractory starts with enough strength to take on an abrasive environment while continuing to build its strength as it heats up. With lower cement content, we see higher hot strengths from the refractory, which allows the low cement material to keep its strength and, therefore, its abrasion resistance through a wide temperature range.

The type of refractory grain and aggregate mix also lend in creating an abrasion-resistant package. Just like the bond, the grain should have strength as well; it should be hard and dense. Bauxite would be associated with a strong abrasion resistance since it is very

hard and dense and would serve better than other grains like mullite or fireclay.

When it comes to abrasion resistance at low temperatures, we have an excellent product called **HEATCRETE 23 EST**. It is a conventional cement-bonded refractory with strong and dense grains, and it is available as a castable or a gunning mix. For higher temperature applications, look to bauxite based products such as our low cement, **ULTRA-TEK ABR GM**, or our phosphate bonded, **SAVAGE RAM ABR** plastic. All three products are excellent performers in abrasion environments. Just can't wear them down!

