Mt. Savage Specialty Refractories

THE BUZZ
MT. SAVAGE
SPECIALTY REFRACTORIES

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See Page 2 for the Shotcrete Challenge!

Pumpable Lightweights are here. Mt. Savage has successfully pumped over 150 tons of a lightweight castable into a reheat furnace subhearth. See details on page 3.

Back by Popular Demand, Ask Dr. Dirt, the Dr. Phil of the Refractory Industry, for answers to your refractory questions! See page 4.

Mt. Savage Specialty Refractories

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Do you find that when you do a count for a lightweight gunning job that you always run short of material? Buy from Mt. Savage and use the tricks on **page 2** and that won't happen anymore! See the tricks you need in "**Lightweight Gunning**".

Dust, what dust?
This picture taken from above a shotcrete installation shows that dust at the nozzle can be a thing of the past. The lack of dust allows separate trades to work in a unit at the same time, compounding the speed advantage that shotcrete has over gunite. Contact your local Mt. Savage representative to find out how you can get in the game!

Lightweight Gunning

When gunning a dense refractory material, the key is water pressure. As the water only has a small amount of time to mix with the material before it hits the wall, high water pressure allows the water to mix more efficiently, reducing dust and rebounds and giving better installed properties. For lightweight mixes, the trick is not necessarily pressure, but volume. These materials take a lot of water to wet up, and often standard water ring arrangements don't allow enough water to get to the material to properly wet them up.

When setting up to gun a backup lining, the rule of thumb is, the more insulating the material, the more volume of water you will need to get it wet. Dr. Dirt recommends that you always start by predampening lightweights. It is true that if you get enough water at the nozzle that it will appear to gun OK, but the hardest material to wet up is the lightweight aggregate and not predampening will cause more lightweight aggregate to bounce off in the rebounds, causing higher than desired gunned densities. That doesn't help the bottom line when you need to order another truck of gun mix because you think your count was wrong! By predampening, you wet up the fine aggregate which tends to coat the lightweight grains, reducing their tendency to bounce off the wall.

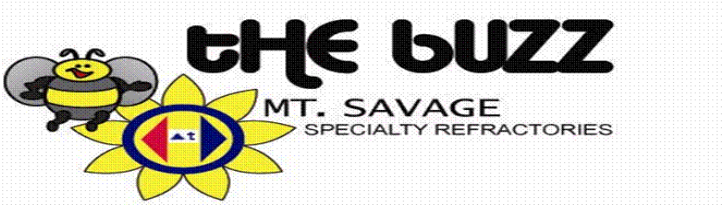
The next step is to check the water volume, the higher the better. Try to tap into a main line and use larger water lines to the nozzle. Look at where water is constricted. This will often be at the nozzle itself, make sure that if you have a water ring with holes in it that the holes are large enough to allow enough water in. If you start gunning and you can't get the material wet enough, drill out the holes in your water ring to allow more water in. For curtain water rings, make sure there is enough play in the ring to allow a good stream of water to get in the nozzle.

The next key to gunning a lightweight is air pressure. With dense mixes, you want enough air pressure at the nozzle to densify the material on the wall to help build strength. With lightweights, the air is only a conduit to get the material there. High air pressures will cause densification of the lightweight aggregates; leading to a call to your friendly refractory supplier for yet another truckload of material (We love nozzle men who gun lightweights at high pressures!). Proper technique is to stand a little closer to the target, gun at 90 degrees as closely as possible, and use just enough air pressure to get the material to stick properly on the wall.

Usually when you get enough water at the nozzle, lightweights are relatively easy to gun. The nozzleman is not being beaten up by high air pressures and the high water volumes tend to suppress dust to a large degree.

Allow for a little extra material when gunning overhead as you will need a little more air pressure to get the material in place, and thus the density of the same material overhead will be a little higher. If gunning down, a practice also known as slobber casting, make sure the material is very wet as it is hard to get too much water on a lightweight. This will help incorporate any rebounds in the body and unlike dense castables, higher water amounts will only help the main reason for lightweights, which is its insulation value.

Finally, remember that lightweights need their own anchors when gunning. Standard anchor design is that the anchor is 80% the refractory thickness. If your furnace is a two component lining, stagger anchors for the materials with the lightweight anchors spaced in between the anchors for the working lining. Following these guidelines, and buying Mt. Savage Lightweight Gun Mixes will allow you to install an excellent insulating lining with good properties without the need for large overages to an accurate count.



The Shotcrete Challenge

At Mt. Savage Specialty Refractories, we are confident about our shotcrete products. This confidence comes from shipping over 1,000 tons of shotcrete every month with none of it getting returned for quality reasons. We like to think that our shotcrete products are the best, most reliable shotcrete products anywhere in the world. Saying that, however, doesn't necessarily make it true. Thus, we are throwing out the Shotcrete Challenge!

What we propose is this; to any contractor out there that uses other companies' shotcrete materials, we propose an in house demonstration. Our standard low cement product using our standard activator system against any other companies standard 60% low cement product with their standard activator. We challenge any company to supply 1,000 pounds of shotcrete material to the contractor along with activator. The contractor will shoot panels that will be sent to an independent laboratory for testing. When the results are in, the company that has the lower density (and probably strength) will pay the bill to the contractor for their time, the testing for the samples, and a dinner party for the contractor and their crew. We don't think we will be paying for anything any time soon, because we think our products generate the best properties. We also think our competition knows this and no one will take up this challenge, but ask them anyway!

Lightweight Pumping

Imagine you are at the Olympics at the high diving competition. The lithe 16 year old Chinese girl is on the 10 meter platform. She flexes, then jumps, turning and twisting in the air until she gets her body vertical before almost silently slipping into the water with nothing but a small ripple. The crowd goes wild and the judges post very high scores with approving looks on their smug faces. All of this makes you think that water is a very soft pliable material that gives way to the slightest pressure.

Now imagine this scenario. Dr. Dirt is in a helicopter 10,000 ft above the ocean traveling around spreading the word of Refractories. A jealous competitor who snuck on the copter pushes him out the door when he isn't looking. His large, not so graceful body accelerates toward the water reaching terminal velocity. The resultant impact wouldn't matter much if he hit water or a high strength refractory concrete. In other words, when water is placed under very high kinetic energy, it becomes hard. This is very important to remember when trying to pump lightweight refractory materials!

Most lightweight specialty refractories consist of a very lightweight aggregate like perlite or vermiculite which is the material you may buy for potting soil to allow aeration. These aggregates are very soft and pliable. The remainder of the refractory consists of dense fine aggregate and dense cement phases. The lightweight aggregate is actually lighter than water. What happens with a conventional lightweight when you try to pump it depends a little on the pressure the pump is putting on the mixture. At low pressures, the water acts like it does for the Chinese diver, like a soft material that moves freely, and thus acts as a good media for the refractory aggregate, carrying it along nicely to its designated resting place in some reheat furnace backup lining. When the pressure becomes high, however, the water becomes hard! Harder, in fact, than the lightweight aggregate and the water will move more readily than the porous aggregate, leaving dry lightweight aggregate stuck somewhere in the pipe. The result isn't quite as bad as Dr. Dirt hitting the water a terminal velocity, but usually results in plugged pipe or hose which is a major pain to break apart and clean up. Experience says that once a plug in lightweight occurs, you are usually in for a long day!

To prevent these pumping problems, scientists at Mt. Savage Specialty Refractories have developed a system that prevents the water from being pumped through the lightweight aggregate. Specially designed additive packages are put into the dry material that when the mixture is wet up and mixed, coats the lightweight aggregates and prevents the water from being pumped through them. Thus, when pressure is put on the water, it will carry the aggregate and not plug the lines. To prove they had this down to a science, the first major "trial" of this concept was performed at WCI Steel in Warren Ohio, where over 150 net tons of lightweight castable was pumped up to 300 feet into a reheat furnace subhearth.

So, what have we learned from this article? First, don't push Dr. Dirt from a helicopter into the water, it could be very ugly. Second, though not quite as ugly, don't try to pump a lightweight castable unless it is specifically designed to be pumped! Even then, start out slow and prevent high pressures from making the water become "hard"

POWER

Next to steel, power is the industry that Mt. Savage sells the most product to. MSSR offers a wide range of products for ash hoppers through cyclone boilers. Ask your sales rep for a copy of our Power Brochure.

Construction Joints

Mt. Savage is often asked the question when to use construction joints with specialty materials. Unlike with brick that have all initial sintering shrinkage burned out of them, monolithics will expand much less on initial fire up than on subsequent heat ups. Thus, it is usually not necessary to include joints for the purpose of allowing for expansion. Still, construction joints can play an important role in the longevity of any monolithic installation.

If the unit that is being installed will see any stresses caused by movement, extreme temperature swings, or large expanses of refractory, construction joints are needed. Construction joints control where the cracks occur or continue. For construction joints in cement bonded materials and plastics, a rule of thumb is to have one joint for every eight feet horizontally and vertically. For smaller areas, construction joints will help contain the cracking of the monolith and if lucky, minimize or eliminate cracks completely.

The Bee says "control cracking in monolithic installations by creating construction joints every 8 feet or so."

Dear Dr. Dirt: What is the difference between a brick head and a mud head? **John from Frostburg, MD**

Dear John, a very astute question. In the refractory business, like in most other businesses, people tend to specialize. The natural division in refractories is between brick and specialties. Obviously, each of these categories has sub-divisions, but this is the largest one. Being more knowledgeable about one or the other, does not make someone a brick head or a mud head by itself. What does that is the person becomes entrenched in thinking that one or the other is the only way to go for a certain application. A brick head, for instance, would never consider specialties a viable option for a steel ladle while a mud head wants to shotcrete a BOF (not a good idea by the way). When talking to a refractory company representative, it is important to recognize if they have a tendency to exclude viable options because of them being a brick or a mud head. When looking at building a furnace, a smart engineer will consider all of their options, brick and specialties.

Dr. Dirt

Dear Dr. Dirt: What is going on with these Chinese raw materials? **Lew from Andersonville, GA**

Dear Lew,

Who thought the Chinese would become so capitalistic? In 1979 Dr. Dirt himself evaluated one of the first samples of Chinese bauxite ever sent to this country. The first research report on the subject rejected its use as not equivalent to Guyanese bauxite and not to use it. What did the Chinese do? They lowered the price, again, and again, and again. Pretty soon it got so cheap, you had to buy it. At one point, calcined Chinese bauxite was landing in New Orleans at about $85 a ton. Today, it costs over $100 a ton just to ship it here plus a lot more to buy it. The Chinese have taken a page from old man Carnegie's book and cornered the market then raised the price!

OK, it is not quite that simple, there are a lot of things that have gone into the price of Chinese raw materials that have to do with the dynamics of world markets. Let's face it, if Dr. Dirt were smart enough to figure out world markets he wouldn't play with dirt for a living! But all raw materials that have been dominated by the Chinese the last couple of decades have soared in price. This includes bauxite, lower grade magnesite, brown fused alumina and silicon carbide. This has correlated in the very real rise in refractory costs this past year. Domestic sources have not gone up as much, but like George Bush says, it is a world market out there and everyone is going to charge what they can!

Dr. Dirt

The Phosphate-Bonded Advantage

Refractory technology in cement bonded castables has improved significantly in the last 20 years. Low and ultra-low cement castables in this century are now stronger, more refractory, easier to use, and more reliable than their 20th century predecessors. Still, there are significant advantages to phosphate bonded systems in some applications. These include faster cure and dry out, excellent intermediate temperature strength, and a better ability to bond to used refractory compared to their cement bonded counterparts.

There are two types of phosphate-bonded specialties, plastics and castable/gun mixes. The castable/gunable versions also come in two ways, single and two component systems. Listed below is a brief description of each of these systems:

Plastics (and their dryer partners **Ramming Mixes)** consist of a refractory aggregate with a matrix of calcined alumina and phosphoric acid with an acid compatible plasticizing agent such as bentonite. These materials are rammed into place usually with an air hammer and start to form excellent strength when they see temperature causing the phosphoric acid to react with the alumina to form alumina-phosphate. Mt. Savage products that use this technology include **SAVAGE RAM 70 M** and **SAVAGE RAM 85.**

Two Component castables and gunning mixes consist of dry, bagged material and a liquid component. The two components are added together at the job site and cast or gunned into place. The dry component contains a catalyst that reacts with the rest of the dry material and the liquid phosphate to give a hard set like a cement containing castable or gun mix.

Single Component phosphate bonded dry specialties also have refractory aggregate and calcined alumina, though in this case they include a dry alumina-phosphate material and a catalyst for the bond. When mixed with water, the alumina phosphate material and the catalyst will react and cause a set just as they do in the two component system. The advantage of this system is that all you need to add at the job site is water. The disadvantage is that the dry phosphate is very expensive and does not generate the same amount of strength as the two component systems.

Mt. Savage's two component system can be purchased under the **Q-TEK** trade name. The suffix of the two component system relates to the temperature limitation of the product, thus **Q-TEK 30** would represent a 3000°F castable or gun mix. Mt. Savages single component system is also designated **Q-TEK** but the suffix represents its nominal alumina content. Thus **Q-TEK 60** would be a single component system that has 60% alumina. These products are available from 50% alumina through 98% alumina and can include additives for aluminum penetration resistance. See your Mt. Savage representative for more information.