THE BUZZ

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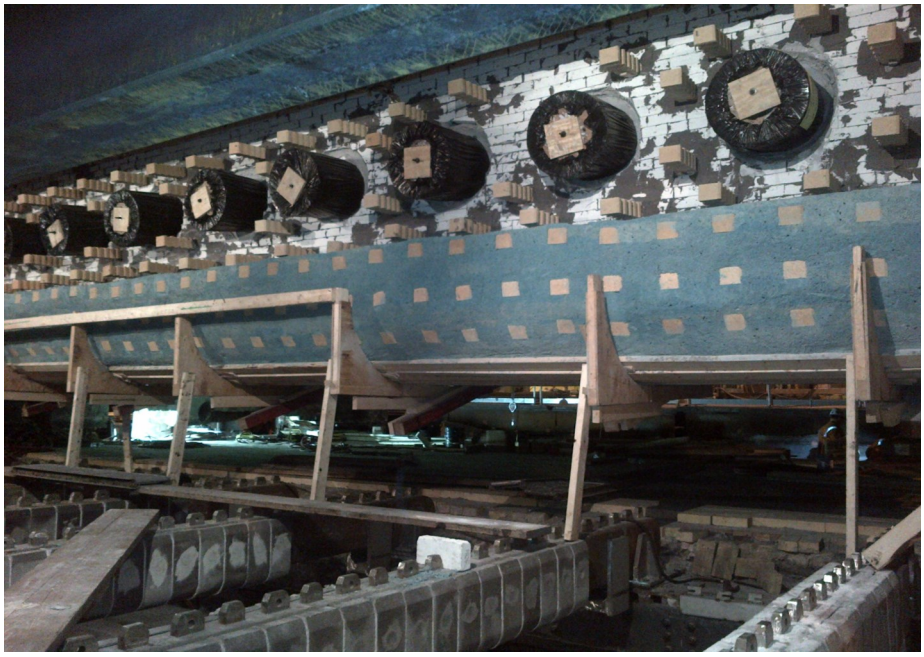


A reheat furnace bull nose rammed with SAVAGE RAM 70M BLUE. Related story on Page 3, see New Mixer.

Steel Industry Slow Down

Integrated steel operators are shutting down blast furnaces and many electric furnace shops are running fewer heats. There are a variety of factors contributing to this. Steel pipe production is down due to drops in oil and gas prices. The strong dollar has also led to an influx of cheaper imports, cutting into steel sales. Mills, burned by long term slowdowns in the past, are quick to cut production so as to not build inventory, which would further cut prices in the market. Combined, these factors have dropped steel production and decreased refractory sales to the steel industry. Projects are also being delayed until steel production increases again. How long will the slow down last? It isn't clear at this time, but at least through the first quarter.

An electric arc furnace (EAF) teeming into a steel ladle. Production of both EAF steel and integrated steel is down country wide.

Thermal Expansion

When you heat a material up, it will tend to expand. There are exceptions, water, for instance, when it goes from solid to liquid (ice to water) shrinks. Ceramic products, like most other products, expand as they get hotter. How much they expand is an important consideration when designing a furnace lining, as failure to account for this expansion could have catastrophic consequences.

There are two kinds of expansion, reversible and permanent. The reversible expansion means just that, you heat it up, it grows, you cool it back down, it shrinks. Permanent expansion is what is left in the sample after heat up and cool down, and could be negative (shrinkage). The permanent expansion is easy to measure. Simply measure it at ambient, heat it to a given temperature, allow it to cool, then measure it again and the difference is the permanent expansion for a given temperature.

Reversible expansion is a little trickier. A product is heated up and measured at a variety of temperatures with the use of an instrument called a dilatometer (see picture). This then measures the length of the sample at any given temperature, and plots a curve showing the expansion characteristics. Various refractories expand differently, thus some need more expansion allowance than others. When designing a furnace, total expansion must be accounted for to prevent failure of the lining.

A dilatometer that measures the length of a refractory sample as it is heated through a temperature range.

A Water Booster Pump

Mt. Savage generally recommends a water booster pump for all gunning mixes, but even more so with low cement and cement free systems like **SAVAGE X™** and **Q-TEK™ SUPER** gunning mixes. Some contractors that have gunned material for years without using a water booster pump sometimes fight this, saying we didn't use one before, why do we need to use one now? Well, the mixes you are gunning have changed, and the performance of these new gun mixes is dependent on a high and consistent water pressure.

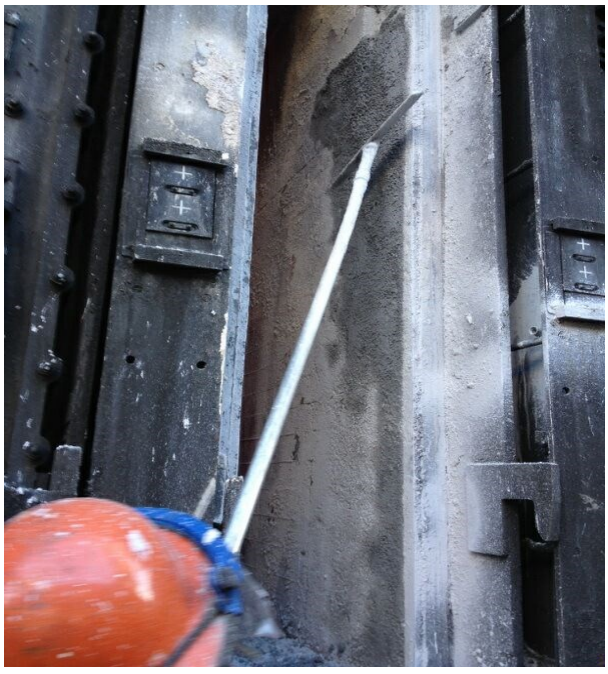
Low cement gun mixes and **SAVAGE X™** Gun Mixes have small amounts of soluble chemicals in them to help them become sticky on the wall. Water is introduced at the nozzle and it is required to dissolve these chemicals for the product to become sticky. These products also have somewhat lower water ranges than high crude clay mixes, with the tradeoff being that the installed properties are considerably better than with high clay mixes. Thus, to dissolve the chemicals quickly and to keep the material from being too wet or too dry, a consistent amount of water with high pressure is required.

The only way to assure both high pressure and consistency of supply is to install an in-line water booster pump that gives a consistent feed and pressure at the nozzle. Plant water, even when tapped at high pressure, will often fluctuate as water demand changes in the plant. The average fire hydrant may have plenty of volume, but often has pressures way below what is desired. Shooting with lower water pressure could cause a wet/dry gunning operation that will increase rebounds and dust and lower installed properties. Thus, to get the best out of your **ULTRA-TEK**, **SAVAGE X™**, or **Q-TEK™ SUPER** gun mixes, use a good and reliable water booster pump!

New Coke Oven Repair Process

Coke ovens, both pusher and non-recovery, are lined with silica brick. Silica brick is used because of its excellent volume stability through a large temperature range, its high strength and load resistance, and relatively high thermal conductivity. These brick have expected lives in a coke oven of 25 to 30 years with little maintenance needed. Unfortunately, a lot of the coke ovens in the U.S. are older than the expected life of the brick, and silica brick are a lot harder and more expensive to get.

SAVAGE X™ FS GM is a new product to repair coke oven sidewalls, both pusher and non-recovery, that has been developed by Mt. Savage Specialty Refractories. This material is based on fused silica, has no cement, develops excellent hot strength and abrasion resistance, and sticks to used silica brick like glue! Working time even in a hot furnace, allows installers time to trim the material flat preventing stickers in operation. Initial trials of the material in pusher furnaces were conducted in the summer of 2013, and all material installed is still there. No stickers (plunger getting stuck because of non-smooth surface) are reported and furnaces that have been repaired have the lowest opacity readings of any of the mill's furnaces. All for less than half the cost of previous repair methods!



Trimming of SAVAGE X FS GM furnace repair.

New Mixer for Plastic Line

A serious revamp of the Curwensville plastic line has been done. The key to the improvement was an Eirich DV-22 mixer. This high intensity mixer has a higher capacity and a more intense mixing action than the older mixer, allowing increases in production. An elevator system simplifies batching allowing one man to keep up with feeding the system. A longer and wider feed belt to the extruder allows for full mixes to be dropped and a new mix to be started. Finally, a chopper/shredder system feeds the extruder allowing for increased efficiency of the extruder and giving more uniform clots of plastic for the customer.

The new high intensity mixing system will also allow the production of resin bonded plastics for iron and foundry applications. With production of the line doubled compared to the old line, it is possible to produce both aqueous and resin bonded plastics.

The new system has come on line just in time as the phosphate bonded mixes have become very popular in the steel industry. **SAVAGE RAM 70M BLUE,** for instance, has become a staple in the integrated steel reheat furnace market for its ease of installation and consistent properties. Mt. Savage will now be able to bid on large plastic opportunities with much less lead time than in the past. Faster production, higher quality, shorter lead times. A win across the board!

ASK DR. DIRT

Dear Dr. Dirt: I notice that Refractory Companies sell materials from 99% silica to 99% alumina with pretty much everything in between. Why all of these different products? Can't you make up your mind and stick with one? **Confused in Illinois.**

Dear Confused: Different applications have different requirements. In general, the higher in alumina you go, the more refractory your product and certainly the more resistant it is to molten steel, the single biggest user of refractories. Though lower alumina refractories actually work better than higher alumina ones in many applications, as a general rule of thumb, the higher the alumina content the longer it will last. It is also true that, generally speaking, the higher the alumina the higher the cost. The curve is also not linear, with costs going up much higher with the ultra-high purity alumina materials. Thus, from experience, a refractory is chosen that will give the most cost effective service based on total cost of installation and down time. Your knowledgeable Mt. Savage salesman can guide you with proper refractory selection or he can call someone who can. Dr. Dirt

Dear Dr. Dirt: The back up linings of our steel ladle are collapsing at the slag line area after only a couple campaigns of working linings, while the rest the back up lining still looks untouched. Could the slag be getting through the Mag-Carbon brick of the slag line and attacking the castable backup? **Crumbling in Arkansas**

Dear Crumbling: Good for you using castable back up linings, we have had a lot of success with them. You likely, however, are using the wrong castable. The hint you gave was the Mag-Carbon slag lining, and the fact that the backup lining was crumbling. The carbon from the brick along with the heat in the ladle is likely forming carbon monoxide gas (CO) that is attacking the iron in the castable and causing "CO bursting", a very destructive interaction. I am guessing here that you are using a bauxite based castable currently in the back up lining. This can easily be solved by relining the slag line, if not the entire back-up lining, with a CO resistant ultra-low cement castable like our **ULTRA-TEK 70 UL.** This should solve your problem and extend your back up lining life!

"Carrie Sleeps" painting by Peggi Habets

Blast Furnace Repairs

There are far fewer blast furnaces today than there were 40 years ago, but they still play a critical roll in the process of making steel in integrated mills. The blast furnace (BF) combines iron ore pellets, lime and coke to produce metallic iron which is further processed into steel. Refractory repairs are made mid-campaign to extend the life of these furnaces and to shorten down time minimizing lost production.

The most common way of repairing a BF in mid campaign is to shotcrete a refractory castable on the wall. Properties that are important for good performance include ease of installation and dry out, alkali, abrasion, and CO resistance, and good thermal conductivity to allow cooling. Cost, obviously, is also a factor.

Mt. Savage has several approved BF materials for both lower and upper sidewall repairs, contact your local MSSR representative for more information.