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January 2010

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A Valuable Lesson

**COLEEN MACHIEL BURDGE,
BRICKING SOLUTIONS, USA,
PROVIDES A LIGHT-HEARTED
PERSPECTIVE ON THE
IMPORTANCE OF UTILISING
THE MOST MODERN TOOLS
AND METHODS AVAILABLE FOR
REFRACTORY MAINTENANCE OF
A ROTARY KILN.**

Introduction

The scariest, white-knuckle roller coaster is a walk in the park compared to teaching a teenager to drive. As a seasoned driver, there is probably not a more uncomfortable spot in your car than the passenger seat. Despite the cringing as they turn a corner just barely missing the car parked on the side of the road or lurching forward as they get the feel for the gas pedal, the ride can be a great teaching moment.

One afternoon as my daughter was driving to work and I was white-knuckling in the passenger seat, we began to feel an unbalanced drag at the back of the car, as though we had suddenly hit a puddle of molasses. With gigantic eyes, my daughter turned to me asking what she had done to break the car. I nonchalantly instructed her to pull into a nearby parking lot and take a look. As I thought, the back tyre was very flat. I became excited at the prospect of a great teaching moment. I will humbly admit I am not a mechanic, nor do I often fix a flat tyre. I knew the basics: put the emergency brake on, jack up the car, unscrew the lug nuts, remove the tyre, put on the spare, and reverse the process. Easy, if you have been lifting weights and have the



Figure 1. Lightweight kiln access ramp at Tilden/Cliffs Mines, Michigan, USA.



Figure 2. Personnel Protection Tunnel provides safe haven at Lafarge Seattle, USA.



Figure 3. Brokk demolition machine reduces tear out time.

grip of a gorilla, as the tyre had been installed utilising those wonderful power tools at an auto shop.

We found ourselves staring at a jacked-up van trying to figure out how we were going to unscrew lug nuts using caveman tools. I understood the reason guys keep almost a full tool store in the back of their car. Luckily for our manicured nails, the parking lot we had pulled into was at an aeroplane hanger manufacturing plant. Two ladies looking at a jacked up van caused a little bit of attention. The two burly guys who came to save the day also thought they would be able to use our caveman tools to release the lug nuts. They, too, soon learned our tools were not adequate. Luckily they had access to more modern tools in their shop. Although the final outcome had us driving away on the spare tyre headed for the local tyre store, the process had been slow and laborious.

Our caveman tools were sufficient for the job if you had enough strength and perseverance, but having the best tools available really made the task so much safer, easier, and quicker. If we had performed preventative maintenance and checked the tyres regularly, the process would have been even less taxing. My daughter learned there was more to driving than just pressing on the gas pedal. Those lessons are not very different from what could be learned when looking at modern tools and methods available for refractory maintenance of a rotary kiln.

Modern technology

Like our caveman tools, outdated refractory installation methods and tools can perform refractory maintenance, but these poor systems and equipment often result in 50% of unplanned outages responsible for lost revenue and profits. The best tool for reducing unplanned outages is preventative maintenance utilising the most modern technology available. The key is to utilise the modern technology in all aspects of the cement plant rather than only in corporate headquarters and plant control rooms. Modern technology seems to have been stopped cold at the hood door, even though the kiln is a vital and critical element to producing cement.

Attention to detail

Productivity and profits can be greatly improved with relatively low capital costs by paying attention to the smallest details of refractory installation and maintenance. Refractory lining accounts for roughly 5% of the capital cost to operate a plant. Choosing the right refractory is only one small detail. Proper installation has a significant impact on refractory life; however, modern refractory installation is actually the last step of a larger circle. The Circle of Refractory Maintenance is a systemic approach to these smaller details, which involve more than just laying brick. This approach begins with proper access to the kiln, safe inspection equipment and techniques, modern tear-out equipment and methods, proper installation techniques, including radial alignment, efficient material handling and modern installation equipment, and ends with good records and benchmarking. A preventative maintenance programme like a pre-outage machine evaluation completes the approach nicely.

Using the best tools

There is more to a cement plant than just a kiln. In like manner, there should be more to refractory maintenance than just refractory installation equipment. Proper tools result in proper maintenance. Granted there are many different types of tools made by different manufacturers, each with their

own reason for using theirs above others. If needs be, even a butter knife can pass for a flat head screwdriver, however it often cannot handle the torque needed for the job. Securing the best tools to provide the safest, most efficient maintenance approach, as well as the need for speed during outages of any kind, eliminates many of the competition. Those manufacturers that can supply a full range of tools all wrapped up in a matching toolbox have a better grasp on the entire process.

The ultimate scenario for changing our flat tyre would have been to have our own NASCAR pit crew with their fancy tools, expertise, skill, and astoundingly fast reaction speed. Our rescuers' expertise was helpful, but again, our archaic tools affected the ultimate end process. (Not to mention the fact that a US\$80 tyre totally shut down a US\$30 000 machine for an extended period of time, causing my daughter to be late for work, which could have meant a loss of her job, creating a monetary depreciation, affecting her goal of attending college. Talk about a loss greatly affecting the function of a domestically engineered system.)

The ultimate scenario for refractory maintenance would be to never have to worry about it. Given the fact that cement is really messy, thus necessitating refractory maintenance, the next best scenario is the availability of the best tools for each step of the maintenance process. An added bonus in choosing the best tools is the cost savings. For instance, there are many materials that could be used to construct a kiln access ramp. One way is from steel, strong structurally but also very heavy¹. Tilden/Cliffs Mines in Michigan, USA reduced its ramp installation time from three hours to 30 minutes by changing to a lightweight 6061 T6 aluminium ramp. That is a 2.5 hour savings.

Safety first

Cost savings are important during an outage, but even more important is the safety factor. In an effort to access upper transition zones for inspection and repair without removing coating, plants have looked for ways to provide safe passage under unstable and unpredictable coating where repair and inspection are needed. Lafarge Seattle's plant found portable personnel protection tunnels manufactured from the same 6061 T6 aluminium provided the required safe passage when coating was its scariest. The company's lightweight yet 3:1 safety factor strength rating allowed two men to move each tunnel section into place efficiently and safely.

Expertise and technology

Like our burly rescuers, expertise of duty coupled with proper tools provides a very efficient combination. Such a combination is invaluable when it comes to tear out and debris removal². Utilising a radio-controlled electric demolition robot and a curved radius bucket mounted on skid-steers shaved 24 hours off previous kiln outages at St. Lawrence Cement in Quebec, Canada.

With refractory only costing 5% of the capital cost and yet being the main reason for up to 50% of emergency shutdowns, quality and proper installation of refractory again supports the reason for utilising the best tools for the job³. Premature brick failure can be reduced immensely when bricks are properly aligned. Radial alignment laser tools ensure accurate marking methods for radial aligned installation. The outcome for using a radial alignment laser is longer brick life further reducing emergency outages.



Figure 4. Radialign laser ensures bricks are properly aligned.



Figure 5. Port-A-Trac system provides consistent brick to masons.

Safety and efficiency

Unlike refractory maintenance, changing a tyre requires only one item – a spare tyre, which is always located in a fairly simple and easily accessible place. Unfortunately, refractory maintenance can entail thousands upon thousands of refractory bricks. A kiln holds no hidden spare brick compartments. Refractory brick must then be handled in some manner in order to supply the masons working on the installation process. Brick, not being made of rubber like a tyre, creates another dilemma: the possibility of broken or damaged brick due to man handling, not to mention injuries incurred by the handler from the brick itself.

Any refractory maintenance system should include a safe and efficient method for supplying brick for installation. Conveyor systems or manually pushed rail systems incorporated into bricking machines significantly reduce material handling and

worker fatigue and injury. Keeping workers refreshed and safe reduces possible lost man hours as well as damaged refractory brick, a double saving from just one properly utilised tool.

The pièce de résistance is the installation tool – the torque wrench. Improper use could mean stripped threads, distorted brake rotors, damage to the wheel, and possibly shearing off the lug stud. (Now I did mention I am no auto mechanic. However, the World Wide Web has a wealth of knowledge and I deferred to it for the previous information – necessary to ensure my credibility.) Although useful for auto repair, the torque wrench would be useless to install refractory brick.

Using the best technology available

It is not enough to use the highest quality tool if it is not the proper tool; a good rule of thumb for any job, but particularly important with regards to refractory installation. Refractory materials have enjoyed an enormous development over the years, as has installation technology, but while no cement plant should consider using yesterday's refractory brick, 90% of plants choose to stick with outdated installation methods. The top reason to take such a decision is often: if it is working, why make a change? It was true our caveman tools had the ability to remove the lug nuts, however utilising a torque wrench reduced fatigue, injury, and downtime.

In this same respect, jack and timber, pogo sticks, timber and bolt, etc. are all methods for installing refractory brick, but they do not reduce fatigue, injury, or downtime. A bricking machine is designed with safety, efficiency, and quality in mind. Its limiting factor is how fast brick can be staged⁴. Ash Grove Midlothian located in Texas first utilised a single-arch bricking

machine. They averaged 18 - 20 courses of brick in a 10 hour shift. Upgrading to a dual-arch bricking machine ultimately increased the average to 40 - 45 courses per 10 hour shift. The speed was aided with a material handling rail system, which consistently fed undamaged brick to the masons. Utilising the bricking machine also increased the quality of installation, improving life of refractory brick and further reducing unplanned outages.

Conclusion

There is more to driving a car than just pressing on the gas pedal and there is more to running a cement plant than just purchasing brick. Maintenance plays an enormous part in keeping any car or plant chugging along. Even more important are the tools chosen to do the job. Even though there are many tools that could maintain a rotary kiln, choosing the best tools to provide the safest and most efficient approach in the least amount of time is just good business. Plant managers who realise there is more to installation than a bricking machine will only add to the productivity and bottom line of the company. ☺

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