
IMPROVING BOILERS UPTIME THROUGH REFRACTORY INSTALLATION INNOVATION

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Introduction

Iron & Steel, Cement, Boilers & Incinerators, Foundry, Petrochemicals & Refineries. Many of these industrial segments use refractories to help their equipment withstand extreme temperatures and working conditions. Power plants are also major consumers of refractories for the maintenance of boilers. The challenges they face when repairing or revamping their equipment is unlike any other segment. The dismantling of refractories takes place on the water wall tubes, a delicate part of the equipment. Developing a new technique for the dismantling of refractories can eliminate the damages of dent formation or even prevent them. By adopting faster installation methods, we can also reduce the refractory installation time and reduce the downtime of the boiler.

In this article, we'll focus on the following innovation techniques:

1. Hydro Jetting method: Faster removal of the refractories in the water wall tube / header tube area
2. Shotcrete method: Faster installation of dense refractory castable

Dismantling of refractories by using the Hydro Jetting method

Today, the removal of old damaged refractories over the water wall tube is done with the help of tools like electrical or pneumatic chipper or breaker. This technique has been used for many years in those specific areas however, it presents a lot of disadvantages. First of all, this method requires a large number of personnel, tools and tackles. There is also a high possibility of hitting the chisel on the water wall tubes which results in the formation of dents and punctures on the tubes. This means a longer shutdown period is needed to identify defects, filling or changing the water wall tubes.

To avoid these problems, we have been looking into the Hydro jetting demolition method. How does that work? The refractory removal by Hydro jetting is carried out using ultra-high-pressure water jetting equipment. This technique is much faster and more efficient than the traditional refractory removal technique. This demolition

technology leaves the delicate tube undamaged and perfectly clean, ready for the new installation of refractory material. It reduces the overall turnaround times for this critical maintenance task.

Let's dive into the details. Some of the advantages of dismantling the refractory lining by using the Hydro Jetting demolition system are:

- Typical removal speed is 0.75 sq.m per hour
- More efficient with less down-time for maintenance work
- No damage to the water wall tubes (no dent or puncture)
- Clean from dust or any loose particles on the metal surface and ready for application of new refractory material
- Produces a perfectly clean surface which is free from any chemical contamination.
- Creates no percussive noise or vibration
- Does not cause micro cracks in the adjacent good condition refractory panels
- No damages to steel reinforcement like studs or metallic anchors and can be reused

📌 Case Studies for Hydro Jetting demolition system

Recently, our teams in India executed two major refractory revamping projects in water cooled cyclones. One was carried out with the traditional way of dismantling old damaged refractory lining in November 2017 while the second one was done with Hydro Jetting demolition tools in July 2018.

	Dismantling of refractories by traditional method	Dismantling of refractories by Hydro Jetting Demolition
Area of dismantling	600 Sq. M	230 Sq. M
No. of tools used	8 Nos of Electrical chipper, 5 Nos of heavy duty breaker, 10 Nos of pneumatic chippers / breaker with more than 250 Nos of chisels	One unit of ultra high pressure water jetting machine with 2 Nos. hydro jetting nozzle
Duration of dismantling	45 days	15 days
Damages to the tubes	800 dents were identified for repairs and 200 Nos of tube puncture	No dent or puncture was identified
Additional days consumed for rectification of tube damages	60 days	0 days

Table I: Comparison between traditional & hydro jetting demolition methods

Figure I: Dent, puncture and damages in the water wall tubes when using the traditional way of dismantling



Figure II: Dismantling of refractories by using hydro jetting demolition tools and finished surface



Faster installation by using the Shotcrete method

As a product, Shotcrete is in the class of deflocculated castable, which is amenable to mechanised installation. As a consequence, the characteristics of installed mass is virtually similar to those of Low Cement Castable (LCC), whereas its installation rate is significantly higher than that of LCC. Table I reports the installation related aspects of various mechanically installed monolithic refractories. It is evident from the reported data that the Shotcrete method offers more advantages over other methods. Lower rebound loss, safer and also more eco-friendly, it allows a high installation rate. Our experience shows Shotcrete installation rate can be as high as 10 MT / hour.

The actual installation rate of shotcrete depends largely on-site condition, type of vessel and elevation. Our experience, however, shows that the rate of Shotcreting can be 5 ~ 7 tons / hr, when installed manually. When installed with a machine, it can be as high as 8 tons / hr. Among the numerous advantages of Shotcrete, over other



mechanically installed monolithic materials, its high installation rate is easily the most important one.

Characteristics	Casting	Gunning	Ramming	Shotcrete
Rebound	No	High (10 – 15%)	-	4 – 5%
Dust Generation	No	High	No	Negligible
Porosity	Low	Higher	Higher	Low
Setting Time	3 Hrs – 5 Hrs	Immediate	N/A	Immediate
Installation Rate (one team)	4 – 5 Ton/12 h	2 – 3 t/h	1 – 2 t/h	5 – 7 t/h
Shuttering	Large amount	Minimal	Large amount	Minimal
Manpower Requirement	High	Low	High	Low
Disadvantages	Slow installation	High Dust, High	Slow installation, White finger	Not possible for lesser quantity installation

Table II: Comparison between different Installation methods

Comparative properties of shotcrete and other mechanically installed monolithic refractories are illustrated in Figures 3 and 4 below. It is evident from the data that Shotcrete is virtually comparable to LCC in all respects, including their CaO content. The latter implies that the refractory properties of Shotcrete would be similar to that of LCC. In short, Shotcrete yields the features and properties of LCC but with a significantly higher installation rate.

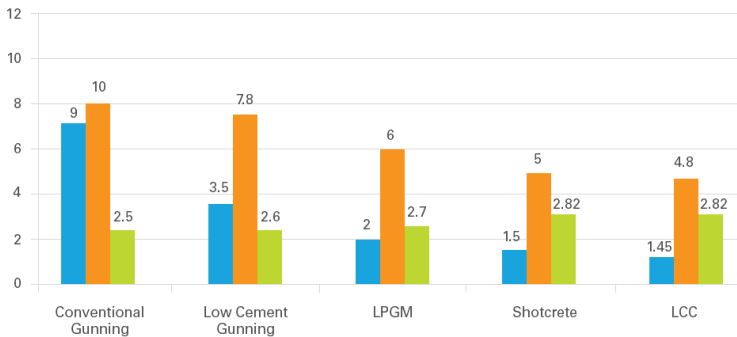


Figure 3: Comparative characteristics of different class of monolithics

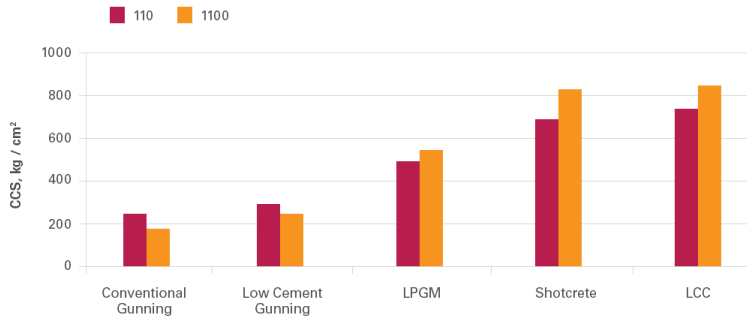


Figure 4: Comparative strength parameters of different class of monolithics

Conclusion

Hydro Jetting demolition and Shotcrete proved to be technologies that improve the refractory installation. With the help of in house Innovation and application expertise, we are able to complete the job faster while reducing costs and downtime with excellent quality and performance.

Are you interested in these technologies for your refractory installation? Get [in touch](#) with us!

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