# Bricking Solutions

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# Refractory Installation by Machine
# (Speed, Safety or Quality?)

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Since installing refractory by machine began nearly 40 years ago, rotary kiln operators have invested in Pneumatic Bricking Machines mainly for two reasons: increased installation speed and improved safety for the installation crews.

In the cement industry, operators with longer wet kilns observed an immediate return on investment. Even just calculating the installation time savings over other methods, many cement plants, citing the decreased down time, reported that their initial investment was returned the first time the bricking machine was used.

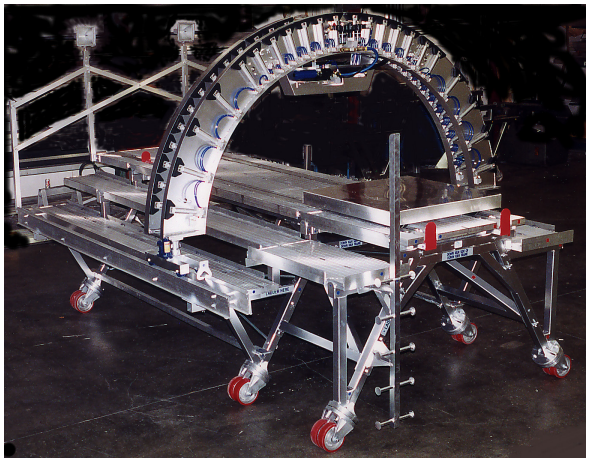

Photo 1: Modern Bricking Machine with trailer attachment.
Trailer is used to increase weight capacity & work space.
Facilitates simultaneous use of two shapes of brick during installation

Over the last decade however, with the advent of preheat towers and shorter kilns, the installation of refractory in the kiln was no longer the critical path and speed of installation was no longer the prime factor in justification of the use of a bricking machine. We have observed however, that an increasing number of kiln operators have added a third factor when considering the investment in a bricking machine.

This factor is the long term savings due to improved installation quality when installing with a bricking machine and the subsequent decrease in consumption of refractory per ton of clinker produced. The savings in refractory material have by far surpassed the savings in down time.

A case study at Cemento Melon in Chile, along with several others, including the one documented in this article, have since confirmed the reported savings in time and materials.

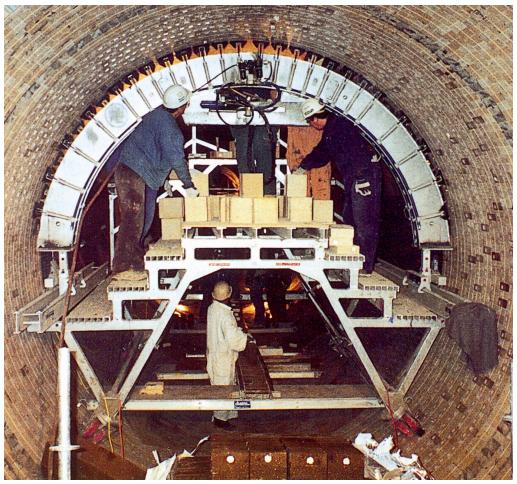

Photo 2: Brokk Bricking Solutions Mult-O-Ring® (photographed without the detachable trailer) at work in a kiln.

**Case Study of the Lime Kiln at Celarauco (Chile)**

Poor refractory performance over a number of years was the main reason why two years ago Celarauco agreed to test a Brokk Bricking Solutions[1] (formerly Pneumat O Ring International) Bricking Machine for the first time. Previously the masons at Celarauco installed brick utilizing the Lock-Pin (Swedish) method, which is nothing more than a variation of the jack and timber method. As with the jack and timber method, the Lock-Pin method requires that the kiln be turned during the installation job. This method is still widely used around the world in both cement and lime plants.

Photo 3

Photo no. 3 (Before) shows a brick section in the burning zone of the lime kiln in Celarauco, Chile. The brickwork was installed using the Lock-Pin method. The bricks shown in the photo have been in service for a period of approximately 12 months. Phenomenon as the one shown on the photo, as well as events like spiraling are well-known by rotary kiln operators, and are often the cause of premature brickwork failure.

As is the case with many plants, Celarauco personnel found the immediate benefit of the machine was that installation time was decreased more than 50% compared to the Lock-Pin method. In addition, the bricklayers also said they found it considerably easier to maintain radial alignment. Furthermore, they observed that keying with the bricking machine caused much less fatigue and that, in spite of producing twice as much as they did before using the bricking machine, they went home less tired.

[1] Brokk Bricking Solutions has sold over 700 bricking machines world wide. In addition to the bricking machine supplies equipment for a complete refractory installation "system" From a "Brokk" tear out machine to the " Radialign" laser refractory alignment device.

Photo nos. 4 & 5 (After) show the same kiln section during the April 2002 shutdown. After one year in service, the brickwork is still intact and the previous problem with twisting and spiraling is practically eliminated.

We have made similar observations in virtually all of the kilns where the Pneumatic Bricking Machine has replaced other methods of installation. Even in kiln sections exhibiting serious shell deformations, resulting in brick failures, we have observed that performance has greatly improved with brick installed by machine.

Photo 4

Photo 5

There are several logical reasons why a device like Brokk Bricking Solutions Bricking Machine contributes to better refractory performance. One is obvious; the bricking rig makes the job physically easier for the masons. With less fatigue, it is easier to concentrate on doing a good job. In addition to reduced worker fatigue when working with the bricking rig, all bricks are pressed firmly against the shell all the time by the pneumatic cylinders before a ring is keyed. A hydraulic jack is also employed to hold the unkeyed ring when moving the machines double arch system; this jack provides additional pressure outwards in the keying section, resulting in even tighter keying. Only when the keying is finished are the pneumatic cylinders released. Consequently, the risk that the brickwork is loose, i.e. that there are air gaps between shell and brickwork, is essentially eliminated.

Such precision installation cannot be obtained with installation methods that require turning of the kiln during the installation job, simply because a large amount of unkeyed brick will be positioned straight up while the keying section is at the kiln's waistline. Also, even if the keying is perfect, gravity will inevitably cause the unkeyed brickwork to sag down. Even a minimum of open space between shell and brick will permit unwanted brick movement, as illustrated by photo no. 3.

Quality of the keying is essential, and the logical area for keying rotary kiln brickwork is straight up-wards. Using the bricking rig, the keying mason has a clear view of the previously keyed ring, as shown in photo no. 6.

Photo 6

He can easily build the brickwork with this ring as a guideline. Any open space between bricks is immediately visible. Any bricking error will show up when releasing the pneumatic cylinders, because if they are not correctly installed, bricks will sag down. Be aware that when using any of the varieties of the jack and timber method, bricking errors (especially keying mistakes) are invisible until all the keying is finished and the jack and timber is removed. Once having reached that point in the installation job, the only remedy is the use of additional steel plates to make the brickwork firmer.

Finally, when utilizing a Brokk Bricking Solutions Bricking Machine, it is considerably easier to maintain radial alignment of the brickwork, a key factor of installation quality that many times is overlooked. Correctly aligned brickwork will absorb the pressure from uphill refractory uniformly. Each ring must be 100% free from interlocking with adjacent rings.

Photo nos. 7 & 8 are from a kiln in which a few bricks fell out after only ten days in service. A series of installation errors were committed, including using a poor installation method, jack and timber. Not only did rings interlock, but there was also a severe air gap between brickwork and shell. (Photo 9) As this repair was located immediately over a kiln tire, mechanical stress caused the faulty brickwork to fall out almost immediately, provoking a costly kiln stop. This failure would not have occurred and the emergency outage would have been unnecessary if a pneumatic bricking machine had been used for the installation job.

Photo 7

Photo 8

Photo 9

The bricking machine employed in Celarauco has, over a period of less than two years, given such good results that the plant can actually run their kilns for 18 months between outages; compared to 12 months between scheduled maintenance prior to employing a Brokk Bricking Solutions Pneumatic Bricking Machine. The experience in this plant is only one in a long list of Brokk Bricking Solutions customers that have experienced increased safety and decreased downtime. They also enjoy the long term benefits of improved refractory performance.

Anders Karlgren – Anders has been solving problems in rotary kilns and installing refractory brick since 1974. He has installed over 7000 m of brick in over 79 kilns world wide. Anders is currently the South American Sales Manager for Brokk Inc.

Bill Barraugh – Bill is the president of Brokk Bricking Solutions and, with the recent acquisition of Bricking Solutions by Brokk AB of Sweden, is responsible for taking advantage of the synergism of the two companies product lines to develop refractory solutions for the cement and lime industries (Brokk tear out machines and Bricking Solutions refractory installation machines and accessories)