THE KEY TO KILN MAINTENANCE

Heather Harding, Bricking Solutions, provides an insight into the necessary considerations of safety, efficiency, and cost savings when maintaining kilns.

Introduction

From brick tear-out to installation, there are a lot of opportunities for safety, efficiency, and cost savings to fall through the cracks during kiln maintenance. Whether the challenge rests with plant personnel or a subcontractor, planning ahead and having the right equipment can prove both beneficial and profitable.

Accessing the kiln

The first thing plant managers or subcontractors must consider is what kind of ramp they will use to provide safe and efficient access to the inside of the kiln. While many may think a ramp is a ramp, some models can actually improve productivity and safety.

For example, ramps made with 6061-T6 aircraft aluminum are 50% lighter than steel versions but just as strong, with a 15 000 lb (6800 kg) live-load capacity and a 3-to-1 safety factor. This means they can be easily and quickly maneuvered into place and will provide ample capacity for a forklift or skid steer and materials. In addition, these types of ramps are often custom designed and modular, allowing installers using a forklift to assemble them in as few as 1.5 – 2 hours, 40% faster than alternative aftermarket or self-assembled ramps. They also allow remote-controlled demolition machines to break off the bridge section. A custom-designed aluminum ramp can be used year after year, providing a return on investment in as little as two years.

Many plants with large kilns that have a big cooler face another challenge: how to safely and efficiently install the bridge sections in the remaining 20 ft (6 m) of kiln length. This is often too difficult and unsafe for a forklift to install without assistance and, as a result, many plants continue to use an outdated bridge installation method. This method uses an overhead electric hoist, along with a forklift and rigging, to sling the bridge section across the cooler span into the kiln, which is not safe. It also requires one or more access openings in the top of the kiln hood.

For kilns with a large cooler span, a load fixture is a safer and more-efficient bridge installation method. A load fixture is a frame secured to the burn floor and door frame that features

adjustable-height horizontal support beams. The beams back the bridge section of the ramp using cables while it is being extended across the cooler chamber. Installers can roll the bridge section into place manually or by using a forklift to guide the load fixture and lower the bridge onto the kiln lip with the cable hoist. The load fixture can also be used to easily raise the bridge section during kiln rotation for other repairs.

Kiln access ramps that are custom designed, modular, and made of lightweight aircraft aluminum, can be assembled as much as 40% faster than aftermarket or self-assembled ramps.

Bricking Solutions' personal protection tunnel withstands impacts of up to 112 kg dropped from 455 mm.

Remote-controlled demolition machines are the safest and quickest way to remove refractory brickwork.

Inspection

Once the method for accessing the kiln is determined, plant managers or contractors must decide how to safely inspect the kiln for hot spots and list necessary repairs. Inspection can be incredibly dangerous, as it either requires the removal of coating or operating under potentially loose brickwork. The only way to significantly reduce the risk of injuries, while inspecting a kiln during an outage, is with a safety inspection cage. With a safety cage, masons entering the kiln remain protected from potential falling brick. Cages can also be attached to one another to provide a safe passageway through a burn zone when small tear-outs and repairs are required in the upper transition zone.

The most common safety inspection cage is made with lightweight, high-quality aluminum and is designed for two workers to carry into the kiln. One style of cage weighs approximately 200 lb (90 kg) and features two shoulder harnesses that place the weight on the workers' torsos rather than arms. These units also feature flip-up handles for balance control and can only be used in the kilns for which they are sized. The newest style of safety inspection cages, however, offer great versatility. They weigh just 125 lb, do not require safety harnesses, and can be used in 13 – 19.5 ft (4 to 6 m) dia. kilns. The cages can be assembled in about 15 min. and are rated to handle 250 lb (113 kg) dropped from 7.5 ft (2.3 m), while a three-to-one safety factor and shock-absorbing panel further increase safety.

Refractory brick removal

Concerns for employee safety, however, extend beyond inspection and into the brick removal process. Handheld breakers – often used for brick removal – cause operator fatigue, lead to repetitive strain injuries, and leave operators vulnerable to falling brick. Remote-controlled demolition machines provide safer and more effective refractory removal. The machines are designed specifically for working in confined spaces and come in a wide-range of sizes. The series is compact – as small as 1.9 ft wide and 2.8 ft tall – electronically powered, and lightweight to meet all international safety standards. Operators use the machine's remote control to move its three-part arm 360°, while a breaker attachment quickly and effectively removes brick. The equipment provides optimal precision and does not fatigue, dramatically reducing the chances of inadvertent kiln shell damage or damage to good brickwork. This method also reduces tear-out time by at least 50%.

In addition to more efficient brickwork demolition, kilns using a skid steer with a curved-bottom bucket attachment can more quickly load demolished refractory. The curved bottom of the

A laser alignment device gives masons a point of verification throughout the entire length of installation, ensuring proper radial alignment of the refractory.

Bricking machines made from strong, yet lightweight, modular aluminum components can be installed by a skilled crew in just 60 – 90 min. as opposed to 6 – 8 hours for all-steel models.

bucket matches the curvature of the kiln, allowing the operator to capture more material and leave a cleaner surface in one pass. The bucket typically comes with a universal quick-hitch to fit most skid steer models and features a 0.5 in. (12.7 mm) T-1 steel bevelled edge for long wear life and optimal strength.

Equipped with a remote-controlled demolition machine and a skid steer with a curved bucket, plants can save considerable time. St. Lawrence Cement, an Albany, New York plant, for example, shaved 24 hours off its outages using this combination.

Refractory brick installation

Refractory installation is another task where the right approach and equipment can save considerable time.

To ensure proper radial alignment of refractory, installers should ensure the brick begins its long journey up kiln the right way. This means confirming the retaining ring is perpendicular to the kiln's radial axis, which is crucial to refractory longevity. The best way to do this is with a laser alignment device, which will not only check the location of the retaining ring, but can also be used to place marks along the refractory path every 5 – 10 ft (1.5 – 3 m), giving masons a point of verification throughout the entire length of installation.

One issue many installers may not consider during outages is the amount of refractory handling that takes place when moving the material to the bedding crew. The more refractory brick is handled, the more damage it can incur before it is installed. There are many manual methods where the risk of brick damage from handling is high, including passing brick to one another manually, gravity feed roller conveyors and belt conveyors. Every move creates some form of damage to the refractory. A cart that travels on tracks below the bricking machine to the bedding area minimises brick handling and allows crews to install top and bottoms. In addition, because pre-stocking of bedding brick is not required, it reduces worker fatigue, resulting in faster and safer installation.

The most critical item for installation is of course, the bricking machine. When considering a unit, there are many items to account for in terms of safety, setup, and productivity. A skilled crew can install a machine made from strong, yet lightweight modular aluminum components in just 60 – 90 min., as opposed to 6 – 8 hours for all-steel models. That is nearly a full day of lost revenue in setup alone.

A double arch bricking machine design allows a second ring to be installed as the first is keyed, speeding up installation. This design can also feature a cut-away front arch to enhance visibility and further speed up installation, as key masons get clear access to place key bricks, rather than trying to reach around the arch. The cut away section also allows masons to see the previously keyed ring and use it as a guide, enabling quick discovery of bricking errors. In addition, using a machine that can be adjusted within the kiln to accommodate distortion, conical sections, or ovality can help shave downtime and ensure a tight installation. The double arch bricking machine's features ensure a fast, high-quality brick installation, as quick as 3.3 ft/hour (1 m/hour) of brickwork, considerably faster than other machines.

Conclusion

Kiln maintenance is inevitable, but forgoing safety, efficiency, and profits does not have to be. With specialised maintenance equipment designed for each step of the process, crews have greater control of the entire project, their safety, and bottom lines.

About the author

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