Kiln lubrication made easy

Expensive kiln repairs can be significantly reduced if a preventative maintenance culture, including proper lubrication, is instilled by the plant's leaders and personnel. In the case of the kiln's inside tyre bore, lubrication is a crucial and high-priority maintenance task to ensuring the reliable function of the kiln, extending its production life.

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Preventative maintenance, particularly proper lubrication, is key to ensuring the kiln in a cement plant operates reliably.

Impacts of insufficient lubrication

Insufficient or improper lubrication of the kiln's inside tyre bore can lead to significant damage, including wear pad erosion, cold welding, ovality, wear and refractory loss.

Wear pad erosion

As the kiln shell rotates, the tyres rotate independently while supporting the shell. When in motion, kilns endure extreme metal-to-metal stress that causes sliding and rolling friction, resulting in wear and other damage. Though wear pads are designed to be sacrificial and worn away with time, serious damage is possible if their upkeep is overlooked. Lubrication can extend the life of these wear pads, protecting kiln components for longer than their normal life expectancy.

Proper lubrication of inside the kiln's tyre bore is crucial to kiln performance and longevity

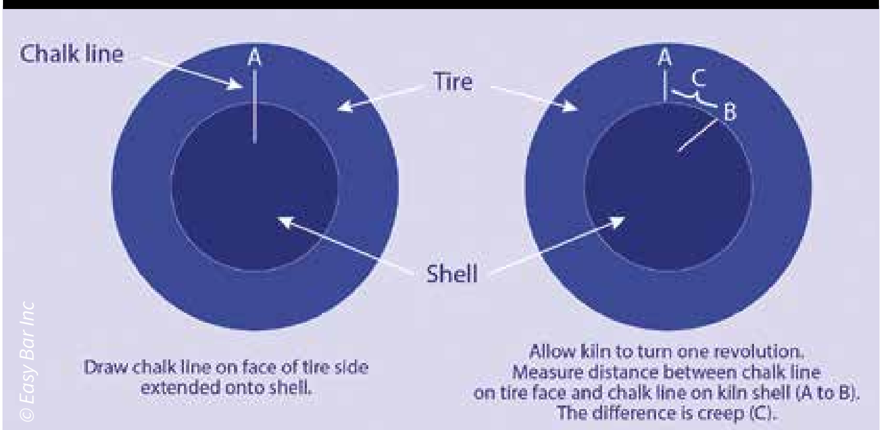
Cold welding

Many kilns suffer from cold welding, or the process of two metals fusing on contact. Problems like this can lead to expensive damage that requires immediate repair and, therefore, a major halt in production. This form of damage is especially obvious if the surfaces are not properly lubricated.

Ovality and refractory loss

Ovality is the measurement of shell deformation during kiln rotation. Erosion of the wear pads will result in increased creep, which in turn allows ovality conditions to occur. In other words, increased creep can lead to a flattening effect at the top of the kiln shell and the tyre. As the shell shape evolves from a circle to an oval, the mechanical integrity of the refractory is compromised to the point of collapse. The cost to repair refractory damage can be upwards of US$80,000 per 3m (10ft) section. Additionally, these maintenance costs do not include the unscheduled halt in production required to make the necessary repairs.

Simple procedure for measuring creep (exaggerated for clarity)



Measuring and assessing creep

The simple answer to addressing increasing creep measurements is lubrication. Creep that increases beyond originally designed-for measurements indicates insufficient lubrication. Whenever a quality lubricant is not present, metal-to-metal contact causes erosion of the wear pads. To determine a kiln's average creep, the operator marks the shell and tyre with soapstone. After 10 revolutions, they check

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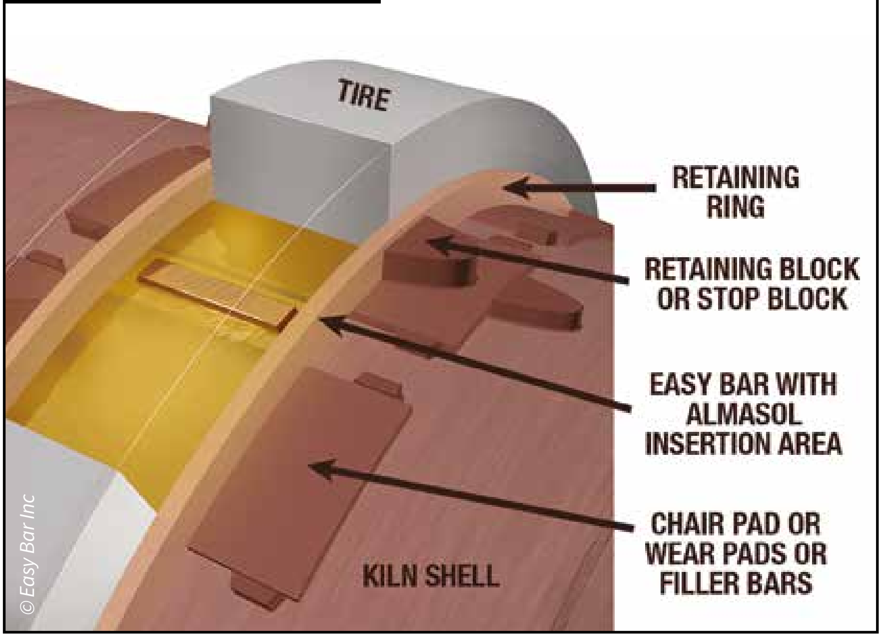
Kiln parts, including a lubrication bar



the distance separating the mark on the kiln tyre and the mark on the kiln shell. This measurement is then divided by 10 to determine the average creep distance. The goal should be to maintain the original creep distance mark for optimal kiln operation. Otherwise, wear pads are being worn and will require repair or need to be replaced.

A large amount of creep (more than 2.5cm or 1in) is usually an indication that the wear pads need repair or replacement. Significant creep can result in the loss of refractory brick. Without proper tyre lubrication, wear pad surface wear will undoubtedly continue at a rapid rate.

Conversely, while a small amount of creep is desirable, zero creep is extremely problematic and needs to be avoided. If the kiln has zero creep, the shell of the kiln has expanded against the tyre and becomes locked. Shell expansion beyond the designed limits results in "coke bottling" and deformation of the kiln shell. Proper lubrication can keep the tyre and shell rotating to allow control of the kiln and prevent locking and coke bottling.

Importance of weekly lubrication

Case study 1

In the first example, the second pier (from the hot end) of a four-pier cement kiln had to have the shell under the riding ring and the riding ring replaced. The kiln had been in operation for approximately 10 years, and the gap between the shell and tyre had grown to about 6.35cm (2.5in). This was an intolerable condition and severely damaged the refractory, considering only a 3mm (0.125in) gap is considered acceptable.

Once the old components had been removed, the extent of damage was fully exposed. The gouges scarred from both the tyre bore and surface of the pads were profoundly deep. Some of the shell support pads were almost cut in half because of it. The mating surface on the inside of the tyre was in a similar condition. It looked as though an ice cream scoop had been scraped across the surface. It is believed that no lubrication was ever applied to the mating areas of the tyre and its support elements. If lubrication had been used, these issues would have been prevented.

Case study 2

In the second example, the second pier (from the hot end) of a four-pier lime kiln had to have the shell under the riding ring changed out. This kiln had also been in operation for about 10 years. However, the gap from shell to tyre was normal. Improperly proportioned shell plate thickness and lack of tapers where the plate thickness changes had caused severe weld cracking on either side of the tyre. Because these cracks continued to reappear, the shell under the tyre was replaced and the tyre was reused.

Once the tyre was put back to allow removal of the damaged shell, its bore was fully visible. The exposed mating surfaces were as remarkable in appearance – for opposite reasons – as those described in the first case study. These surfaces were not only smooth and relatively unmarked, but the inside of the tyre had the appearance of being chrome plated.

The result was striking thanks to the regular application of a lubricant. Further investigation showed that the grease in use was a commercially-available lubricant specifically formulated for kiln tyres. After 10 years of operation, the condition of these surfaces was visibly better than the originally-machined surfaces – once again proving that it is better to lubricate than not.

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Proactive lubrication and choosing right lubricant

In the long run, a proactive approach to lubrication will lower costs and increase production, simply by reducing wear. Very little action is required to enhance the kiln's components and rate of operation. All that is needed are weekly applications of the right lubricant to maximise the longevity of equipment.

"Lubricant bar application is extremely easy and takes less time than traditional methods, making solid bars a popular choice for kiln lubrication. Application involves inserting a solid bar between the filler bars of the kiln."

Solid lubricant bars are a popular choice for kiln lubrication

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Not all kiln lubricants are of the same quality and provide the same results. Some made with poor-quality ingredients can cause dangerous fire hazards and offer very little lubrication benefits for protection against wear and tear.

Researching the ingredients of a lubrication product before applying it will ensure that your kiln avoids possible component damage, long-term repair costs and unscheduled shutdowns.

When choosing the best product to lubricate kiln tyres, some research and consultation from lubricant manufacturers should be undertaken to ensure the products deliver the benefits desired. Simply buying the cheapest option is counter-productive, as it will lead to larger repair costs and unscheduled downtime.

Solid lubricant bars

Lubricant bar application is extremely easy and takes less time than traditional methods, making solid bars a popular choice for kiln lubrication. Application involves inserting a solid bar between the filler bars of the kiln. Tools such as the Easy Bar Lubricator are available – although not required – to make this process even easier. For best results, bars should be applied weekly, with the quantity determined by the kiln's specific measurements at each tyre.

Solid lubricant bars are formulated with lubricants, additives and a solid binder that will melt upon contact. When the bar is placed between the tyre bore and shell, the binder melts – leaving no residue – and the rolling action of the kiln distributes a solid film of lubrication that coats the surface of the filler bars, ring bore and stop blocks.

Placed between the tyre bore and shell, a solid lubricant bar will melt, coating the parts with a film of lubricant

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This thin temperature-resistant film creates a barrier between these moving surfaces, filling in microscopic imperfections and providing protection against cold welding.

Care should be given in selecting the right lubricant bar. While bar sizes can vary slightly across various brands, performance characteristics vary dramatically.

Given the kiln's high shell temperatures, the lubrication bar's auto-ignition point should be of utmost consideration for protecting workers from dangerous flame-ups, blowbacks, and other hazards. Binders that contain waxes or oil, whether petroleum-based or agricultural-based, have auto-ignition points of around 288-371˚C (550-700˚F). Such low tolerance can create safety concerns for workers and prove to be useless overall – wasting time and money on an inefficient product.

The chemical composition and lubrication characteristics also must be a factor when deciding which lubricant works best for the kiln. Based on the manufacturer and its chosen binder and composition, kiln shell temperatures of 200˚C (392˚F) or higher can impact the lubricant's ability to protect components from wear and erosion.

However, when the proper, high-quality lubrication bar is selected, operators will note the extended lifespan of wear pads, protect the refractory and maintain desired creep. In addition, dangerous flame-up will be avoided, ensuring safety. ■