Lubrication: proaction pays

by C&C Oil Co, USA

A proactive approach to lubrication can yield significant cost savings and avoid unscheduled kiln shutdowns. The selection of an appropriate lubricant is a key element in this task. The use of high-quality lube bars results in kilns operating as designed, delivering their optimum productivity.

We all sometimes have a tendency to react to a problem or wait until the last possible second before we look into fixing it. The same reactive approach is often found in the cement industry when it comes to maintaining important and costly equipment. If statements like, "We do not need to lubricate the tyre, the kiln turns fine!" or, "We add lube in every now-and-again, what's the big deal?" sound familiar, then these reactive practices will certainly prove costly in the long run. In fact, reactive practices will actually cost a cement plant more money in continuous repair work, production loss and unscheduled downtime. The importance of keeping the kiln running is paramount as maintenance managers struggle to stretch the interval between maintenance.

One of the best ways to maintain equipment is proper kiln tyre lubrication, a practice often minimised or overlooked altogether despite the well-known documentation on the subject. As early as 1979, Pulp and Paper published an article by Donald P Giencke, an engineer with Allis-Chalmers Corporation (now AC Services), that stated: "If the riding ring bores are not lubricated properly, an accelerated wear and condition will occur. This will eventually cause excessive clearance and will result in a cyclic deformation on the shell."[1]

What could really go wrong?

The potential cost of reaction

By not properly maintaining and protecting machinery, the wear components will have to be repaired more often. Simply trying to save money by not buying enough or the right lubricants will result in plants simply reacting to broken equipment leading to large repair costs.

The constant repairs and replacement of the kiln's wear components will increase the maintenance costs and ultimately lead to loss of production while these repairs are being made. The cost of reacting to maintenance problems are enormous compared to the costs of preventative maintenance with quality lubrication. Table 1 is an example of just some of the potential costs a plant could incur if the proper lubrication levels are not maintained.

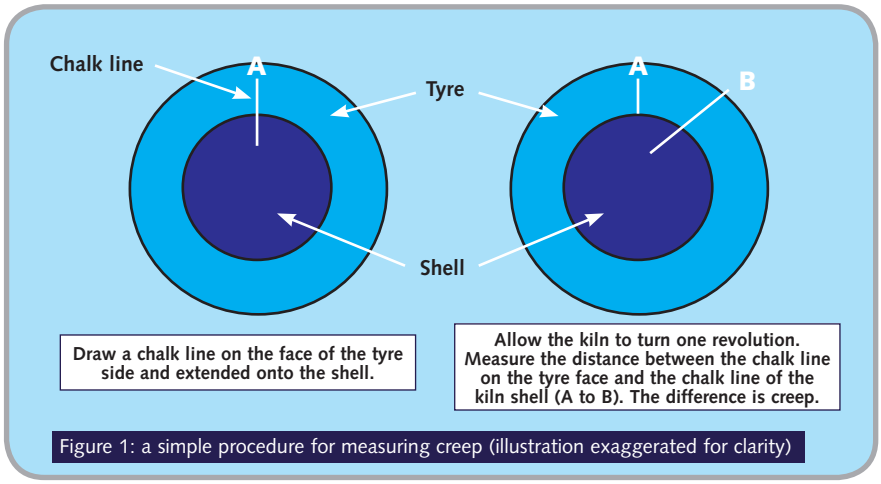

Figure 1: a simple procedure for measuring creep (illustration exaggerated for clarity)

Know the basics

As the kiln shell rotates, the tyres (rotating independently) cradle the kiln shell, resulting in intense pressures and severe friction. The heavy loads associated with cement kilns result in extreme metal-to-metal stresses, including sliding and rolling friction that results in cold welding, galling, and wear of the wear pads and kiln tyre. Designers mitigate potential kiln tyre damage with sacrificial wear pads. The longer the life of the wear pads is extended and the originally designed creep maintained, the longer the kiln's components will last. Proactive protection of kiln components through weekly applications of optimum lubricant levels will maximise longevity of equipment, reducing costs and increasing production.

Creep: important indicator

Creep is the difference between the distances travelled by the tyre and the kiln shell during a single revolution of the kiln. To get the average creep, most plants mark the shell and tyre with soap stone. After 10 revolutions, the distance separating the mark on the kiln tyre and the mark on the kiln shell is measured. This measurement is divided by 10 to give the average creep. Maintaining the originally-designed creep is another vital component for optimising kiln operation.

Table 1: potential maintenance cost of inappropriate lubrication levels

Potential maintenance work	*Potential maintenance cost (US$)*
Wear pad replacement	20,000-45,000/tyre
Wear pad repair	10,000-40,000
Refractory damage	80,000/10ft section
Refractory repair time	+ 4 days (x) cost of lost production
Weld fracture repairs	Labour personnel @ 65/h x number of hours to perform repairs

Excessive creep can be an indication that the wear pads are in need of repair or replacement. Worn wear pads will result in ovality and can result in the loss of refractory brick. The amount of creep a kiln experiences is a strong indicator for the current status of wear components. However, creep measurements are only one indication of wear component status (see Figure 1).

Without proper tyre lubrication, the wear of the mating surfaces will continue. Just because you have 'good creep' does not mean that your wear pads are not eroding away before your very eyes!

Lubricant trends

As the benefits of kiln tyre lubrication spread, many plants turned to oils and greases that were not designed for tyre-bore lubrication. Unfortunately, these ideal solutions proved to create more problems, including sticky varnish trapping debris and flame-ups, than they solved and actually contributed to additional wear on the equipment.

Simple and proactive

In response to the problems experienced from applying antiquated oil and grease mixtures to the kiln tyre, the lubrication industry developed a new solution around 1996: lubrication (lube) bars. Lube bars are safe and easy to apply.

A lube bar is a supply of solid, dry lubricants encased within a carrier agent. The carrier agent can be a wax, polymer or other compound. This agent generally has a melting point of less than 93°C (200°F) and, when placed adjacent to the heated kiln shell, melts and releases the lubricants. Turning of the kiln causes these lubricants to flow over the wear pads and inside of the tyre bore, coating the mating surfaces.

The application of a lube bar to a tyre bore is a safe and easy operation. While the kiln rotates, the operator simply inserts the recommended number of lube bars in the filler bar gaps between the tyre and the shell. Lubrication of the entire inside-tyre bore is crucial for effective lubrication. Some lube bar suppliers recommend applying anywhere from 8-25 lube bars for each tyre every week. Other suppliers recommend as few as three or four lube bars/tyre/week – a number that can be easily inserted in a single revolution of the kiln, and will maintain creep for the entire week while protecting equipment.

While larger lubricant bars are able to deliver enough lubricants to fully coat the inside tyre bore in one application, smaller lubricant bars have to be applied two to three times each week. Typically, these smaller bars do not have an adequate lubricant volume to coat the entire tyre bore. This lack of lubricant coating across the inside tyre bore area allows for metal-to-metal contact and wear damage.

Not all lube bars are equal

While all lube bars would seem to meet all the lubrication requirements, not all are of sufficient quality to do so. For starters, the composition of the lube bar is very important.

While most lube bar manufacturers use graphite, carbon and metallic metals, the concentration percentage of each in addition to the binder chosen to deliver these components vary greatly in performance. Binders that contain waxes or oil (whether petroleum-based or agricultural-based) have auto-ignition points around 550-700°F, which can create safety concerns.

Furthermore, when these oil binders melt, the bars become slick and tend to drip, immediately sliding to the low side of the tyre where the bar can actually fall onto the ground or spill onto the kiln shell instead of the inside tyre bore where lubrication is needed.

At the other end of the spectrum, higher-quality lube bars contain a significantly higher percentage of high-quality graphite, custom mineral and metallic components. The proprietary binder on these bars has an auto-ignition point of +1000°F/+586°C, ensuring worker safety. When a high concentration of these unique components are applied, the lubricant benefits are immense. With a protective layer of premium lubricant spread across the entire tyre bore, the metal-on-metal contact is minimised and the lubricant becomes the sacrificial component that is worn away instead of the costly wear pads. Proper lubrication will allow to maintain the originally-designed creep while greatly minimising the likelihood of scoring, galling and cold welding damage of the kiln's components.

By proactively lubricating the kiln with a quality lube bar that offers optimum lubrication, the plant will not only save money on repair or replacement costs, but it will also minimise unscheduled loss of production. With proactive lubrication the life of wear pads, a critical component of maintenance programmes, can be extended. It is both more labour- and cost-efficient to take the proactive approach of applying quality lubrication bars than to simply react to potential problems of repair and replacement. Consistent use of a well-designed, well-formulated product will result in kilns operating as designed for optimum productivity.

Table 2: benefits and cost savings with the use of quality lube bar

Potential maintenance work	*Potential maintenance cost (US$)*	*Benefits and cost savings*
Wear pad replacement	20,000-45,000/tyre	Plant benefits by longer-lasting wear pads that no longer require replacement
Wear pad repair	10,000-40,000	No loss of production as wear pads are intact and do not require replacement
Refractory damage	80,000/10ft section	Wear pads in serviceable condition ensure that shell ovality is minimised and premature refractory damage is not incurred
Refractory repair time	+ 4 days (x) cost of lost production	No unscheduled loss of production or kiln shutdown. No kiln repair needed
Weld fracture repairs	Labour personnel @ 65/h x number of hours to perform repairs	No repair needed. Results in lower operations cost