KILN SHELL REPLACEMENT

Long term, trouble free operation of a cement kiln requires proper care of the shell,and sometimes this means the timely replacement of a damaged or distorted section. Bill Hankes, A-C Equipment Services, USA, explains how shell replacement can result in increased production and smoother operation.

INTRODUCTION

Uptime is critical to the success of any processing operation. The urgency to maintain production can lead to a plant operating equipment in need of repair for longer than practical (Figure 1). There are few large pieces of equipment for which the consequences of doing this are more costly than a rotary kiln. Continuing to operate a kiln with a damaged shell generally results in excessive unscheduled downtime, increased refractory costs and could lead to a complete failure of the shell. There is also the potential to injure site personnel and cause consequential damage to surrounding equipment if the shell catastrophically fails. The way to avoid these issues is to replace damaged shell sections in an orderly, planned way.

Figure 1. Reinforced shell: this practice should be avoided.

BACKGROUND

The primary purpose of the kiln shell is to support the refractory inside. Refractory replacement costs are a significant operating expense. The shell must be maintained in good condition or the life of the refractory is drastically reduced.

A bent (dog legged) section of shell can also cause process and operational problems. These problems include drive system overload, gearing damage (bottoming out the gear teeth), and damage to tyres, rollers and bearings due to eccentric cyclical loading (high localised contact stresses).

INSPECTION

There are a number of methods a cement plant can use to monitor the condition of a kiln shell. The typical kiln shell inspection techniques include the following.

- Visual (include photographs).
- Ovality measurements.
- Temperature measurements.
- Thickness (with ultrasonic).
- Runout (polar charts).

An operating and maintenance routine that includes these inspections will prevent catastrophic failures and minimise unplanned shutdowns.

Figure 2. Hot spot.

CAUSES

There are many causes for kiln shell damage including loss of electrical power, process problems, drive and support system failures, and missing refractory/hot spots (Figure 2).

An unscheduled outage due to a power or equipment failure can cause significant damage to a kiln shell. Extreme shell temperature differentials can bow the shell

Figure 3. Catastrophic kiln shell failure.

Figure 4. Removing an existing shell section.

to the point of lifting the tyres off the rollers. This will lead to a reduction in the life of the refractory and to further on-going maintenance and process issues. The destructive cycle of shell damage causing refractory failure and refractory failures causing more shell damage must be avoided.

SAFETY

If a damaged shell section is not replaced in time, a catastrophic failure can occur (Figure 3). If this happens there is a possibility of injuring someone. A catastrophic shell failure will also take significantly more time and be more costly to repair. The reasons for this include having to make temporary repairs to get replacement shell ordered and delivered. Also, additional shell may have to be replaced and consequential damage to the surrounding equipment and structure may have to be repaired.

Figure 5. Installing new shell section.

INSTALLATION

Replacing shell sections is not a difficult task for properly trained and equipped field service personnel. The proper removal of the existing section (Figure 4) is critical to allow the new section to be correctly installed.

Issues that must be considered and properly addressed to correctly replace shell include:

- Accurate shop manufacture of the replacement section.
- Proper support of the replacement section during transport to site.
- Supporting the existing shell.
- Precise layout and cutting.
- Removal of the damaged section.
- Fitting and alignment of the replacement shell.
- Tack welding and final welding.
- Realignment of the kiln.

All of this must be carried out safely and without delay.

Experienced field personnel are the key to the correct installation of new shell sections (Figure 5) and to maintaining the repair schedule. Incorrectly installed shell sections will have runout and radial mismatch that can negatively affect the life of the refractory and the operation of the kiln.

CONCLUSION

Shell replacement, as part of a scheduled shutdown, can increase uptime and reduce equipment, maintenance, and power costs. This means more production and smoother operation for the plant.◆