Reducing shutdowns

by ICR Research

No company wants to contend with setbacks such as forced shutdowns or increased plant maintenance costs, which can lead to profit losses. However, when Lafarge Cement UK decided to make some production changes, it had to deal with these obstacles. Fortunately, Lafarge found a solution that could accomplish its original production intentions.

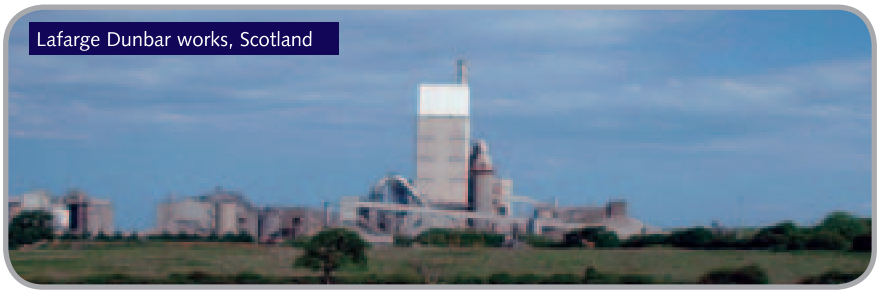

Lafarge Dunbar works, Scotland


Figure 3: material build-up/ fouling on fan blades up to 50mm thick

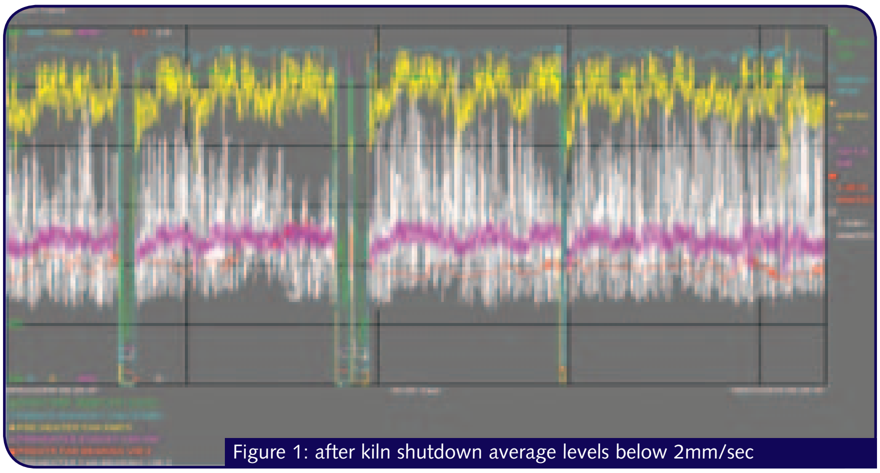


Figure 1: after kiln shutdown average levels below 2mm/sec

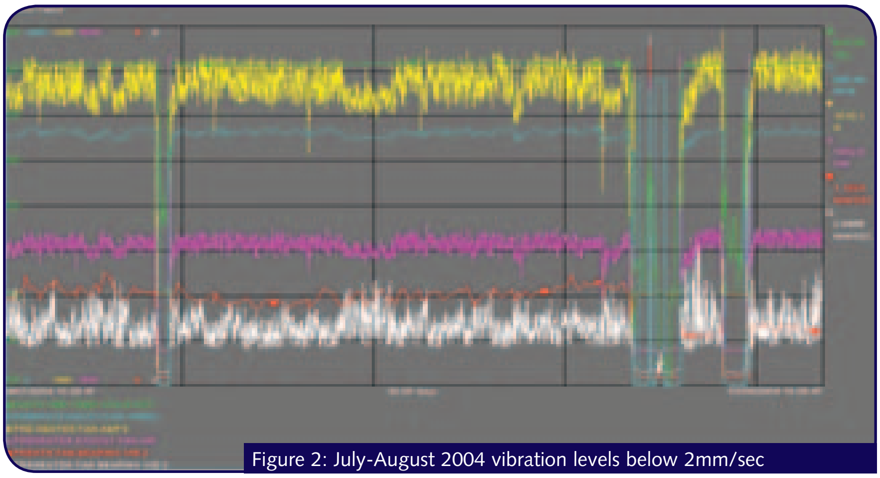


Figure 2: July-August 2004 vibration levels below 2mm/sec

In 2005, in an effort to increase capacity, Lafarge decided to undertake several process changes at the Lafarge Dunbar Works, the only cement plant in Scotland. While the changes helped improve the efficiency and output of the process, the original goal was unattainable because of unscheduled shutdowns caused by vibration.

An unexpected side effect of the modifications was a severe material build-up and associated excessive vibration levels on the preheater ID fan. This was caused by material build-up on the fan blades, up to 50mm thick (see Figure 3), forcing Lafarge to make several unscheduled shutdowns to clean the rotor. With no forced outages in 2004, four forced shutdowns caused by fan vibration and build-up in 2005 certainly caught Lafarge by surprise. Production losses amounted to 12,000t of clinker and nearly 100 hours of time was lost. Furthermore, the outer edges of the fan blades were wearing, and the excessive vibration caused a failure in the motor's white metal bearings in July of 2005.

Lafarge knew that the problems faced in 2005 (see Figures 5-7) could not continue and had to find a way to resolve the problem. Brief consideration was given to reversing the process changes to see if it would correct the build-up and corresponding vibration problems, however, Lafarge did not want to make any changes that would result in a reduction of output.

"We made the production changes to increase the level of output," said David Pepper, maintenance manager at Lafarge Dunbar. "However, there were also some negative effects. Reversing the changes would have taken us right back where we started, losing valuable time and profits. We needed to find a way to fix the fan vibration problem and achieve our original objectives."

Lafarge began investigating options to control the fan vibration and solve this problem. It came across information about the LORD online fan balancing

Figure 4: unscheduled forced shutdowns to clean fan. Four kiln stops in 2005

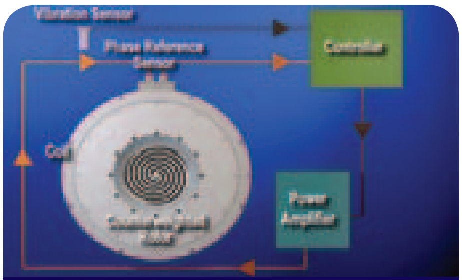


Figure 8: basic configuration of online fan balancing system

system and contacted the LORD United Kingdom distributor, T.E.V.A. Ltd to determine if the system would allow Lafarge to keep the fan running at low vibration levels and eliminate the unscheduled shutdowns that took place in 2005.

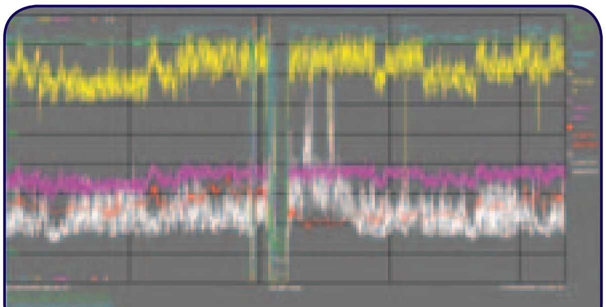


Figure 5: after shutdown period – 2005

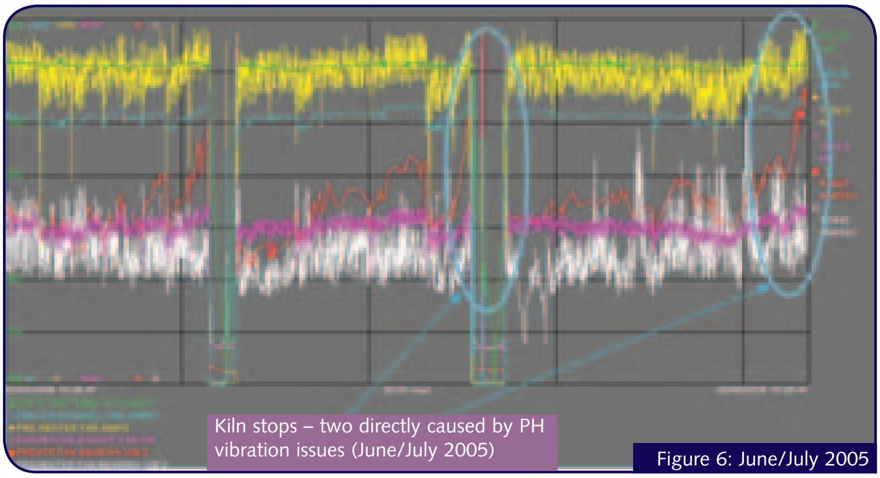


Figure 6: June/July 2005

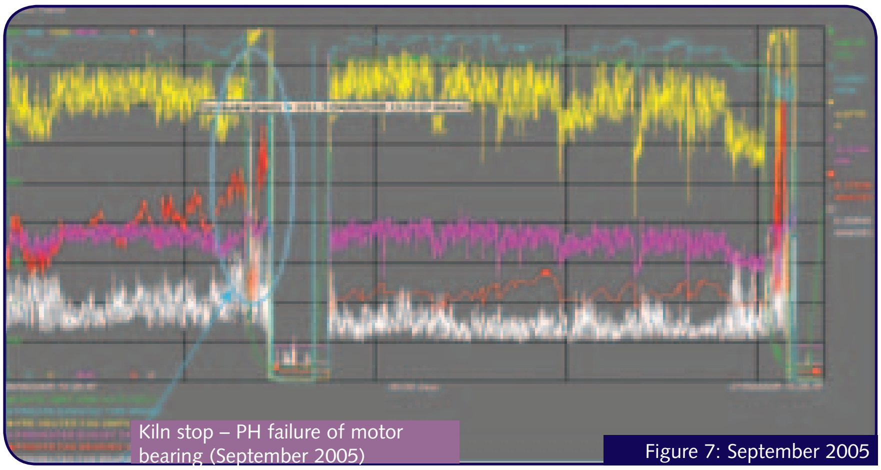


Figure 7: September 2005

After analysing the balancing system specifications, Lafarge chose to install LORD Corporation's Fan Balancing System during its spring 2006 outage (see Figures 8 and 9). As a world leader in the management of vibration, motion and noise, LORD developed a balancing system comprising a permanently-mounted device that continuously monitors fan vibration levels and corrects for imbalance while the fan is running. Although LORD Corporation has a variety of vibration control products, the balancing system was recommended because of its ability to make rapid balance corrections and withstand the harsh environment surrounding the ID fan.

The system is set up to monitor fan bearing vibration levels and the vibration phase angle in order to automatically correct for unbalanced conditions. This is achieved while the fan is running at operating speed, eliminating costly downtime to clean and manually balance the fan. Once levels reach a pre-set high trip point, the system switches on, commanding balance mass inside the shaft mounted system to adjust as needed to counteract the imbalance and reduce the vibration.

The balancing ring of the system mounts directly to the fan shaft and houses counterweights that can be repositioned to offset the imbalance detected in the fan rotor. Utilising vibration sensors, the system monitors the fan bearing vibration. Vibration signals are received and processed by an 'Adaptive Influence Coefficient' control system, which then determines the adjustments that are required. The controller relocates the counterweights to the desired position to minimise the vibration levels. This process continues until the controller senses that balance has been restored. Typical balance cycle times range from 30-120 seconds, depending on operating speed.

LORD Corporation developed and patented the actuator coil assembly used in its balancing system. The actuator coil is traditionally mounted to support brackets located on the bearing pedestal. The non-contact power supply used in the actuator coil eliminates the need for maintenance, sending power across an air gap between the stationary actuator coil and the rotating balancer ring.

According to Andy Winzenz, LORD Corporation's global project manager, they were confident that the balancing system would be a success. "Lafarge expected the system to end unscheduled plant stops, prevent motor bearings failures, and allow for longer run times between scheduled stops," said Winzenz. "After evaluating the data associated with the problem we knew it could accomplish these things."

The installation, performed in conjunction with LORD Corporation's UK distributor T.E.V.A., involved a two-plane balancing system installed on inboard and

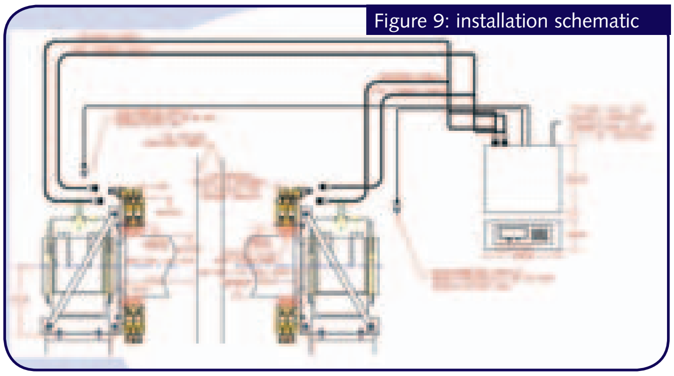


Figure 9: installation schematic

Table 1: summary

	2004	2005	2006
Kiln Operation Temp	810°C	800°C	800°C
Fan Speed	853 RPM	893 RPM	893 RPM
Avg. Vibration Levels	<2.0 mm/sec	3-4 mm/sec 4.5 mm/sec (Max)	<1.5 mm/sec
# of Forced Shutdowns due to PH Fan Vibration	0	4	0
Motor Bearing Failures	0	1	0
Hours Lost	0	99	0
Clinker Lost	0	12k tonnes	0
Outages Avoided Due to Balancing System Installation			4

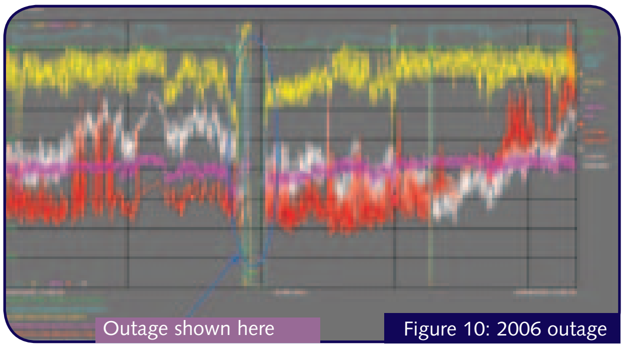
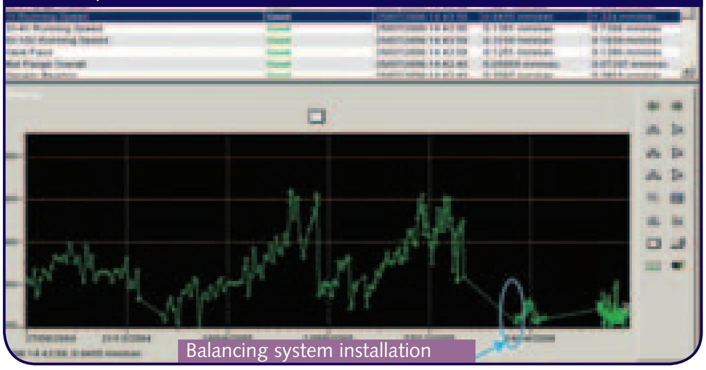


Figure 10: 2006 outage

Figure 13: MCT system – average 1x vibration. 2004-06 vibration analysis – 1x fan speed



outboard sides of the fan. The anticipated vibration offset was approximately 12-14mm/sec with a 2,888,000g-cm (4000 oz-ins) correction capacity per balancer plane. Lafarge also opted for a control set up that only makes balance corrections when initiated by an operator—a manual balance mode. With balancers installed permanently on the shaft of the rotating equipment and the stationary coil assembly mounted on the bearing pedestal, the system is based on a 'Sense-then-Adjust' concept. The sensors monitor vibration levels which send signals to the controller, who can then signal the balancers to make an adjustment. Trim balance corrections are made while the fan is in service which compensates for one x (shaft synchronous) vibration.

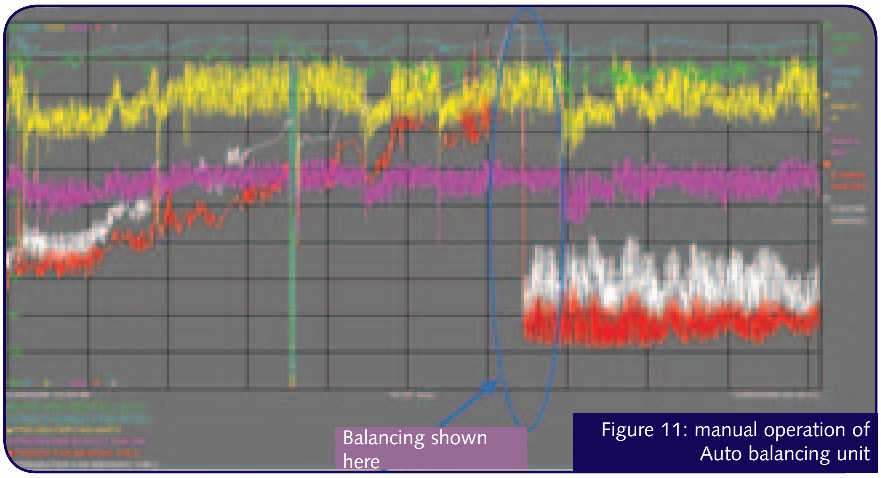


Figure 11: manual operation of Auto balancing unit

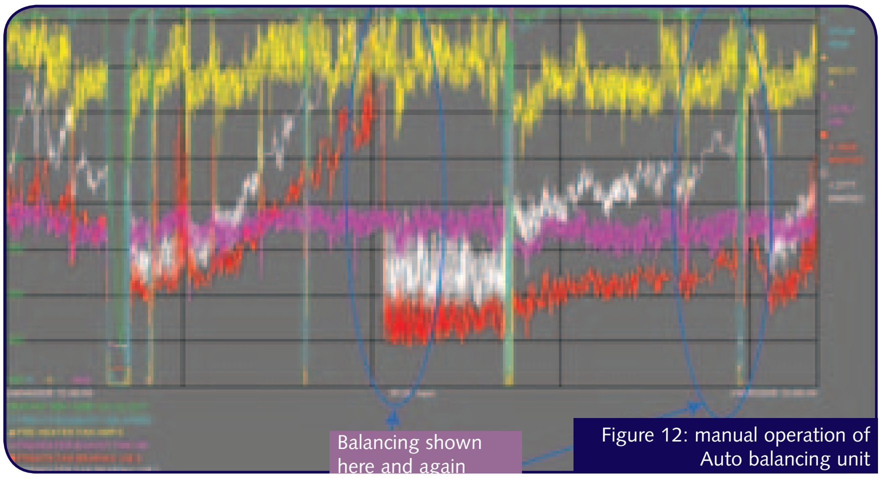


Figure 12: manual operation of Auto balancing unit

Because of the integration of LORD Corporation's balancing system, shutdowns from excessive vibration are a thing of the past (see Figures 10-12). As of September, Lafarge had identified at least six scenarios when the balancing system was able to make a correction and avoid an unscheduled shutdown. The balancing system not only allows the fan to run at extremely low vibration levels but it also keeps the plant from having to deal with unscheduled stops (see Table 1). For Lafarge, what is equally as important as the reduction of downtime is that it could continue to increase output.

"We are very happy with the results," Pepper stated. "The average vibration level is now 1.5mm/second, which is the lowest it has ever been. We also haven't had to make any further adjustments to the temperature and fan speeds."