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BETWEEN HOT KILN SURVEYS

A hot kiln alignment is normally performed once every 1-2 years. Routine measurements between these surveys can help maintenance teams identify changes earlier.

Cement plants are expected to improve equipment reliability while keeping maintenance costs under control. For this reason, many plants are moving from fixed maintenance schedules towards condition-based maintenance. More checks are also being carried out by plant personnel instead of waiting for the next external service visit.

Hot kiln alignments and mechanical surveys remain important aspects of rotary kiln maintenance. The parameters measured typically include shell run-out, ovality, tyre migration, tyre axial run-out, roller shaft deflection, girth gear run-out and the position of the kiln axis at each support. The results are used for alignment work at major shutdowns.

The limitation is the time between surveys. A kiln may continue to change because of wear, changes in operating temperature and/or unstable process conditions. A small mechanical change may therefore remain unnoticed until the next scheduled survey. For some parameters, one measurement every 12 or 24 months is not enough. Routine measurements performed by the plant team can reduce this gap.

Tyre migration should be checked regularly

Tyre migration is the relative movement between the tyre and the kiln shell during one revolution. It is affected mainly by the clearance between the tyre inner face and the shell or supporting pads. Because this clearance changes with wear, tyre migration should be checked regularly.

Wear of the supporting pads, tyre blocks or tyre inner face may increase the clearance at kiln piers. When the clearance becomes too large, the shell may move more inside the tyre. This can increase shell ovality and place more stress on the refractory lining and the shell under the tyre.

A very low migration value can also be a problem. If the clearance becomes too small, the tyre may restrict the shell as it expands. For this reason, operators should watch out for both increasing and decreasing migration trends. A change in migration does not prove that damage has occurred. It shows that the condition at the tyre and shell interface may be changing. Further checks may then be required.

Migration values must be taken alongside temperatures

Migration should not be evaluated without temperature information. The tyre and shell do not always have the same temperature, and they may expand by different amounts. The same mechanical condition can therefore produce different migration values under different operating conditions.

Shell and tyre temperatures should be measured at the same location each time. A hand-held pyrometer can be used for this purpose. The temperatures should be recorded together with the migration result.

This allows the maintenance team to compare readings taken under similar conditions. It also helps separate a possible mechanical change from a change caused mainly by operating temperature.



Diameter measurement with the MMD Kiln Inspection Tool.

Run-out and roller shaft deflection

Tyre axial run-out is the side-to-side movement of the tyre during rotation. It may be affected by the tyre, the shell, the supports and the condition of the retaining components. A rising trend should therefore be thoroughly investigated rather than explained away by one cause alone.

Roller shaft deflection can also change during each kiln revolution. Repeated measurements may show whether the loading pattern at a support is changing. When tyre run-out and roller shaft deflection both increase, the area may need closer inspection. The important point is not one isolated result. The value comes from repeating the same measurement at the same location and comparing the results over time.

What should be measured?

Kiln manufacturers and service companies commonly recommend regular checks of tyre migration, shell temperature, axial position, lubrication, drive condition and gear condition. The difficulty is often not the maintenance plan itself. The difficulty is obtaining repeatable measurements with the same method each time. Once a repeatable method is in place, the following points can be used as a practical guide:

- Migration moving towards zero may indicate that clearance is becoming too small. This requires attention, especially during kiln heat-up;
- Migration increasing over several measurements may indicate wear at the tyre, supporting pads or tyre blocks;
- Increasing tyre axial run-out may indicate a change in the tyre, shell or support condition;
- Increasing roller shaft deflection may indicate a change in dynamic load at the support;



- One reading should not be used alone. Results should be compared with earlier readings taken at the same location and under similar operating conditions.

Indicative values should be taken from the kiln manufacturer's manual and from the plant's own history.

Routine measurement in practice

Portable measurement equipment allows plant maintenance teams to perform these checks between specialist surveys. The purpose is not to replace a hot kiln alignment. The purpose is to identify changes earlier and to decide if and when a more detailed inspection is needed.

Table 1: Typical kiln inspection and maintenance schedule

Parameter	Typical Interval	Performed by	Purpose
Tyre migration (with shell and tyre temperature)	Daily	Plant staff	Check changes in tyre-shell clearance
Tyre axial run out	Weekly or monthly	Plant staff	Check changes in tyre shell or support condition
Tyre diameter	Periodically	Plant staff	Monitor wear and dimensional change
Roller shaft deflection	Monthly	Plant staff	Check the dynamic load at the support
Girth gear axial and radial run-out	Periodically	Plant staff or Specialist	Monitor gear-pinion
Full hot kiln alignment	Every 1-2 years	Specialist	Detailed mechanical survey and alignment check
Detailed mechanical inspection	When required	Specialist	Find the root cause and plan corrective work



Tyre migration testing.



The MMD Kiln Inspection Tool is a portable measurement system for rotary kilns, dryers and similar rotating equipment. Depending on the setting, it can be used for tyre migration, tyre diameter, tyre axial run-out, roller shaft deflection and girth gear axial and radial run-out. Inductive sensors are used for close-range displacement measurements. A laser sensor can be used where access is difficult or where a non-contact measurement is preferred.

For tyre diameter and migration work, the measuring wheel is placed against the rotating surface. The diameter result is shown on the device. Migration is then determined from the relative movement between the tyre and shell reference during one full revolution.

For run-out and deflection measurements, sensor signals are sent to the Alpha Kiln Measurement Software on a PC. The software displays the measurement curve, ignores the surface variation, calculates the result and stores the data for later comparison.

The MMD does not measure temperature. Shell and tyre temperatures must be taken separately and recorded alongside the migration result.

A routine MMD check takes approximately 10 minutes. A traditional chalk-mark migration check takes approximately 1 min. The main benefit, however, is repeatability and reliability. The same device and procedure can be used for each measurement.

Case study: increasing tyre axial run-out

The maintenance team started to use the MMD for routine mechanical checks between specialist service visits at a European cement plant, which continued to use an external service company for its scheduled kiln surveys.

The first tyre axial run-out measurements were used as a reference. Later measurements were taken on the same tyre, from the same side and with the same procedure. Over approximately 12 weeks, the peak-to-peak result increased from about 1.2mm to 2.6mm.

The increase was seen in several measurements, not just one. The plant therefore arranged a closer inspection of the affected pier during the next planned stoppage. The measurement curves and trend data were also shared with the specialist service team.

The inspection identified thermal instability and came up with recommendations for the next shut-down. The required work - the installation of several fans to cool the kiln under the tyre - was completed during the planned maintenance period. The routine measurements did not replace the specialist inspection. They showed that the condition was changing and helped the plant decide that a detailed check was indeed needed.

In summary

A hot kiln alignment and mechanical survey remains necessary for detailed assessment and alignment work. However, it is normally performed only at set intervals. Between these surveys, plant teams should regularly check tyre migration, tyre axial run-out, roller shaft deflection and other selected parameters. When the same method is used each time, the results can show whether the kiln condition is changing.

The specialist survey and routine plant measurements have different roles. Used together, they give the maintenance team more information between service visits and allow possible problems to be checked earlier.

