By Joseph L. Robertson

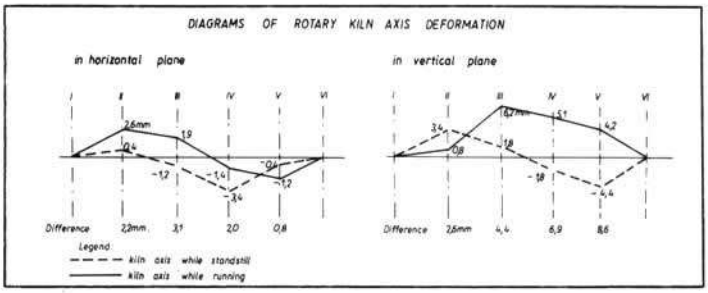
Kiln Alignment Method Allows Corrections While Operating

Indirect optical and non-contacting techniques have been developed for determining rotary-kiln alignment and roller-setting corrections during kiln operation. This "hot" method differs from a conventional survey since all data collected and used for the calculations are obtained while the kiln is operating. Statistical and mathematical analysis calculates the corrections needed on the individual rollers, and also permits immediate assessment of the calculation's accuracy.

This hot-alignment technique uses the principle of two off-set lines, located outside the immediate kiln environment, to provide a stable kiln measuring base, unaffected by kiln dynamics. The measuring data is collected with the aid of specially-designed instruments, always in reference to the outside off-set line. These instruments are electronically synchronized, and the collected data is fed into a computer that transfers the data into roller-corrections values. After the corrections are made, the kiln is re-measured for final verification.

Using this technique, the accuracy of the measurements is said to fall between 0.5 mm and 1 mm, well within the 3 mm tolerance envelope described. The key to the method's accuracy lies in the accuracy of the measurements made, rather than the instruments used. Although the tools used are high-precision instruments, the concept of aligning the kiln has nothing to do with the development of ultra-high precision instruments or powerful computers.

The ability to make a complete study of the kiln shell's rotation axis during full operation has the advantage of allowing the operator to schedule an alignment/survey whenever it is required rather than waiting for a kiln shutdown. Determining the kiln's physical characteristics while operating permits component adjustment to their optimum in order to minimize wear and shell deflections. Refractory failures normally attributed to misalignment are minimized, and the life of tires, rollers, and bearings is extended.



The results of measuring a kiln twice, first cold and then after a short interval, hot, is shown in this chart. The shell axis is shown in both the horizontal and vertical planes to support the contention that measuring a kiln in a static condition does not provide sufficient accuracy for optimum adjustments.

If roller adjustment is required, the effects on the position of the axis of rotation can be determined immediately. This would be impossible under conventional methods until sufficient time passes to allow the kiln to heat up again and to detect a change in equipment condition. By that time, if the changes are incorrect, the damage is done. Also, the accuracy of hot-kiln measurements exceeds the manufacturer's minimum requirements, regardless of kiln length or number of supports. It is also true no matter the age or condition of the kiln components.

It is necessary to define two essential criteria and the expected accuracies to achieve acceptable kiln alignment. The first criteria is the rectilinearity of the rotating axis of the shell. Or, if the centers of rotation of the shell at each kiln tire were joined by straight lines, how straight would this line have to be when viewed from the horizontal and vertical planes? Most kiln manufacturers require the entire axis to fall within an envelope of 3 mm diam or smaller.

The second criteria involves the rotating axis of each of the support rollers (defined in the horizontal and vertical planes) expressed in the terms of their deviation from the slope and parallelism of the axis of shell rotation. Slope variation should not exceed 0.2 mm/meter. (Kiln slopes may vary in slope specification and be less than 0.2 mm/meter.) Parallelism is usually not a requirement but a slight skew of each roller to equalize the thrust load of the kiln is necessary. All rollers must be skewed equally in the right direction. Kilns with full thrust or hydraulic thrust mechanisms ideally will be parallel to the shell axis with tolerances of 0.2 mm/meter slope.

In the conventional survey method, two important factors are missing. The first is temperature. A kiln temperature profile is complex, and is seldom measured when making a conventional survey. Expansions are based on temperatures measured at a few points or are assumed, which is not sufficient. With the hot survey

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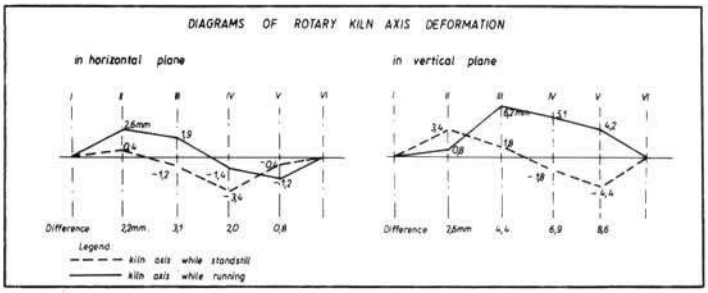

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