CaliView® mobile measuring system for pipe and tube mills

SMS Group has developed a mobile measuring system, CaliView®, for checking the contour, position and alignment of passes in tube rolling mills without the need for elaborate manual measurements. Deviations detected by the system can be corrected easily and quickly before they manifest themselves in rolled product. CaliView® enables rolls that have the same pass to be aligned optimally with one another and in relation to the pass line. It also enables the hydraulic capsules or the mechanical screw down systems to be recalibrated in-line in premium quality finishing lines and multi-stand pipe mills. The system also checks the rolls on extracting mills and in sizing and stretch reducing mills, and can also be used in cross-roll piercing mills where it reliably indicates whether the rolls are correctly positioned in relation to the mandrel, and in stand workshops.

Author: Frank d'Hone
SMS group GmbH

Fig 1 Set-up of CaliView® in the stand workshop

Roll chocks, mill stands and contact faces in rolling mills become dirty and worn during use. Typically, mill stands are inspected and checked for alignment in a separate calibration stand or in a workshop. Following their re-installation in the mill housing, until now, it has not been possible to ascertain whether the passes were precisely aligned until the end product was checked. For example, if tube wall thicknesses or outside diameters were non-uniform, it was necessary to perform recalibration on a step-by-step basis until the correct setting of the passes was found. This is expensive in terms of time, materials and money. Over the past two years, SMS group has developed a solution to this problem called CaliView®.

This measuring system gauges roll contours for each pass in-line in the mill housing and their alignment can be monitored quickly and easily. This makes it possible for tube mill operators to perform recalibration directly, and erroneous settings can thus be detected beforehand rather than becoming noticeable only after tubes are manufactured.

The measuring system determines the alignment of the passes visually in Premium Quality Finishing Lines and Multistand Pipe Mills (PQF®, MPM or SM/stretch-reducing mills). This is also now possible in cross-roll piercing mills and in stand workshops (see Figure 1). CaliView® is the only system that can measure the position of the rolls in longitudinal rolling mills after each roll change, thus allowing them to be aligned immediately in an optimised manner on the basis of the ascertained data. In cross-roll piercing mills, only this measuring system reliably indicates whether the rolls and guiding elements are correctly positioned in relation to the mandrel (see Figure 2).
In longitudinal rolling mills CaliView® measures the contours of rolls that have the same pass in a non-contact manner, two-dimensionally in a plane surface, normal to the rolling direction and passing through the point of the groove root. In cross-roll piercing mills, the highest point of the rolls is ascertained.

The mobile system comprises a light source, a camera, a control device and a computer for configuring the measurement parameters and evaluating the results. The light source and the camera have been developed specially for SMS and designed specifically for the conditions in tube mills. The light source backlights the passes individually in the mill, enabling a shadow image of each pass to be obtained. This shadow image of the LED light is captured by a digital camera, which passes the data on to a control device. Figure 3 shows the individual components and Figure 4 the arrangement during measurement. The camera can be positioned at either the entry or the exit side of the rolling mill. During the measurement, the control device receives the data from the camera via WiFi or LAN and prepares them for display. The control device has an operating duration of at least four hours and, with a WiFi connection, a range of up to 100 meters. The results can thus be viewed directly in the mill control pulpit and hence used for correcting the passes.

The parameters required for measurement, such as the distances between the mill stands to be measured, references for pixel factor and the defined pass line, design data for the roll contour, or the set pass, are entered into the configuration computer beforehand and once per rolling mill. The spatial orientation of the rolls for two-, three- or four-roll systems can be selected by the operator via a drop-down menu in the CaliView® software. The rolling mills to be gauged are created in the configuration and evaluation software. The data is entered in the following order: rolling line, rolling mill with pass data and, finally the setting plan. The contour of the rolls can be defined by means of various input masks and be viewed directly. A configuration contains all the significant data of the respective rolling mill, for example, the quantity of measuring positions, quantity of rolls per stand and the pass diameters (see Figure 5).

For measurement purposes, the control device and the camera constitute one unit and are connected via a WiFi or LAN interface. All the camera functions are guided and visualised via the control device, which receives the configuration of the rolling mill from the configuration software. Besides the possibility for adapting the configuration data, the software offers the option of viewing the measurement results during measurement in the same format as in the evaluation software. Deviations in the pass and from the pass line and from the diameter are displayed directly during the measurement. Overlays for evaluation...
ranges, contour recognition and inscriptions can be switched on as required for a better overview. In order to document changes made to the rolling mill, several measurements can be taken following a once-only definition of the references.

Optical gauging can be performed for passes with diameters from 20mm to 577mm. For diameters less than 250mm this can be done with a precision of +/- 0.1mm, and with diameters from 250mm upwards the precision is +/- 0.2mm.

The system performs several measurements sequentially, simultaneously or at given time intervals, and also with various configurations. Following a measurement, CaliView® analyses the pass design and calculates erroneous settings. On the basis of this analysis, the operator can immediately set the pass with a view to optimising product quality.

The system requires a maximum of 30 seconds per pass for recording and evaluation and, thanks to specially programmed software for pass analysis, it is irrelevant whether two, three or four rolls per stand are used and how the stands are arranged in the mill. CaliView® evaluates the symmetry of the two, three or four rolls and deviations from the ideal position are represented numerically and graphically by the system, both on the control device during the measurement and on the configuration computer following completion of the measurement. The system indicates the radial and axial roll off-set against the initial setting and the pass line (see Figure 6). Necessary corrections can then be initiated by the operating personnel. CaliView® can easily be retrofitted.

**SUMMARY**

In practical application the system provides convincing results:

- It reliably measures incorrect pass alignments and helps minimise them, for example, by means of roll position corrections, both between stands and in the stand itself.
- Measurement results are stored in a database which enables pipe makers to establish a comprehensive history and compile statistics on the causes of errors.
- It helps the operator localise erroneous settings of mill stands and passes, caused by grease layers of varying thickness between the coupling surfaces of mill housing and mill stand, by contamination on the V-guides or by manufacturing and assembly tolerances of the stands.
- Roll wear can be closely monitored.
- The effects of repairs on the positions of the passes can be monitored. **MS**

Frank d’Hone is with SMS group GmbH, Mönchengladbach, Germany.

**CONTACT:** frank.dhone@sms-group.com