Case Study METSO Karlstad
Portable Metrology Provides Quick & Easy Solution for Paper Mill Machine Alignment
When paper is racing through the roller maze at more than two kilometers per minute, everything has to be aligned perfectly. And that is exactly the challenge faced by Metso Paper, a world leader in pulping and papermaking. Its facility in Karlstad, Sweden specializes in the design and manufacture of lines well known for their high-quality towel and bathroom tissue grades.

And then there are the rollers, probably the most recognizable parts in any paper machine. When paper is racing through the roller maze at more than two kilometers per minute, everything has to be aligned perfectly. And that is exactly the challenge faced by Metso Paper, a world leader in pulping and papermaking. Its facility in Karlstad, Sweden specializes in the design and manufacture of lines well known for their high-quality towel and bathroom tissue grades.

The same type of measurement is then performed for the other end of the roller, after which the roller is aligned to gravity using a level, assuring alignment. The distance between individual rollers is determined using a simple gage instrument.

A typical paper line machine may have in excess of 20 rolls needing alignment. Anywhere between 20 and 40 meters in length, it may weigh more than 250 tons. The red line traces the paper path in the machine.

A skilled operator with an eagle eye will perform the positioning well, an operator who is either less experienced or less meticulous in performing his judging work performed by the operator. The abovementioned method is heavily operator-dependent. During all crucial measurements, the accuracy of the results relies on the good vision and judicious work performed by the operator. Change the operator and you will change the error deviation, as no two sets of eyes are the same. Plus, the operator may get physically tired if performing several hours of measurements at one time, which also may negatively influence the integrity of the results produced. And the main restriction of this traditional method of aligning rollers is that rather than working in the three-dimensional space, it only accounts for two dimensions: parallelism and plumb of the roll.

The position of the insertion axis and its parallelism to the rollers is checked with a reflector. The Total Station can automatically locate the reflector, significantly shortening the inspection times and removing the human error factor from the equation.

After the parallelism of the roller has been checked using the theodolite, a level is used to check its height. The physical positioning of the theodolite may take up to 10 minutes, depending on how much experience the operator may have under his belt. And this positioning needs to be repeated for each consecutive roller being checked; the operator needs to invest about 10 minutes of his time to reposition the theodolite for each new point needing inspection.

The operator aims at the front of the roller to the best of his ability. Depending on how much out of place the actual position of the front of the roller is, the theodolite will produce an angle readout indicating the deviation from the ideal position, or the difference will be read out on a scale on the roller itself. The front position of the roller is then physically adjusted until the desired position is achieved.

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An endless belt of running wire mesh is used to form the sheet of paper. A typical paper line machine may have in excess of 20 rolls needing alignment. Anywhere between 20 and 40 meters in length, it may weigh more than 250 tons. The red line traces the paper path in the machine.

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Despite their massive weight and size, these cantilever beams at the base of the machine need to be brought into position with accuracies of 0.1mm.
this has meant frequently repositioning both. At times, the optimal theodolite position was not available due to the situation on the shop floor, so we needed to work around that, which used to cost valuable time while we waited for things or people to move away.”

Roller alignment using modern 3D metrology equipment

Migrating to the Leica TDA5005 Total Station has brought a slew of vast improvements. The most obvious one is in the ease of the instrument setup procedure itself. The Total Station no longer needs to be positioned on a specific location; rather, it merely needs a good line of sight to the roller whose alignment it is measuring. Just like a laser tracker, the Total Station collects true three-dimensional information of the points it is measuring in one go. In short, both parallelism and plumb are checked in one and the same way. And since the Total Station does not need to be meticulously positioned in front of a specific roller, several rollers can be inspected in one step without moving the Total Station to a new position, with the only prerequisite being a line of sight between the measurement point and the Total Station.

Measurement technician Jonas Hellqvist concludes: “Now, the Total Station can be located anywhere on the shop floor as long as you can see the reference point being inspected. Setting up the instrument takes a mere 2 minutes.

With the theodolite, it took more than 10 minutes just to set it up even if there was a line of sight to the measurement point. And I needed to repeat that procedure with each new roller. A Total Station does not have to be aligned, which saves a lot of time. Plus, we no longer need a level because the Total Station gives us three-dimensional information, which of course includes the height value.”

By using reflectors, all the measurements can be performed in one go. And one of the most important factors in the measurement process is automation. Using the Leica Geosystems Total Station incorporates Automatic Target Recognition (ATR), thus removing the human factor from the equation. The operator no longer has to develop a “gut feeling” for theodolite placement or for aiming the optics. The Total Station automatically tracks the reflectors as it is being moved from point to point, producing documentable information about each position measured with the onboard Local Resection and Tie Distance software. All this to a large extent minimizes the dependability on skilled labor, which is a limited resource.

The onboard software and its methodology allow the operator to use the angle component of the instrument to its highest accuracy possible, thus meeting and even exceeding the accuracy requirement of 0.1 mm in the roller alignment process. The reliability of the onboard software and its user-friendliness, coupled with the utility of the so-called roller alignment kit, which allows the operator to measure just 4 points on a roller to create two parallel lines to inspect the parallelism and perpendicularity (see illustration on opposite page), yield a quick, easy, highly reliable measurement system impervious to the influences by the operator. More simply put, it is a fail-proof system that creates repeatable measurement results of the highest integrity time after time.

Bengt Lennartzon concludes: “Using the Total Station is especially beneficial when I’m measuring points that are elevated high on the machine. If the roller was 5 meters up from the shop floor, with a theodolite I needed to be up there as well. With the Total Station, that requirement falls away. I can stay right here where am. Unlike with the old system, with which we always needed two operators to conduct the measurements, the Leica Geosystems Total Stations can in many situations be used by just one operator, freeing up skilled labor for other crucial tasks.

We are saving time by not performing multiple repositioning of the instrument, the quality and the reliability of the information gathered has been increased by leaps and bounds, and all operators can produce the same high-quality measurements because they are merely operating an instrument and not relying on their skill or perfect vision.”

from Neven Jeremic

www.metsopaper.com
Whether building the fastest car, the biggest plane, or the most precise tooling, you need exact measurements to improve quality and productivity. So when it has to be right, professionals trust Leica Geosystems Metrology to help collect, analyze, and present 3-dimensional (3D) data for industrial measurement.

Leica Geosystems Metrology is best known for its broad array of control and industrial measurement products including laser trackers, Local Positioning Technology (LPT) based systems, hand-held scanners, 3D software and high-precision total stations. Those who use Leica Metrology products every day trust them for their dependability, the value they deliver, and the world-class service & support that’s second to none.

Precision, reliability and service from Leica Geosystems Metrology.