

Critical level measurement of Hydraulic Oil in the Paper Industry - Keep those Rollers Rollin'

Before paper becomes paper there are a series of steps that involve taking the wet pulp, forming it into a long continuous sheet, drying it, pressing it flat and putting it onto a roll.

The entire process requires a reliable and uninterruptible supply of hydraulic oil for hydraulic motors and roller and carriage movement lubrication oil - or it's "Stop the Presses".

Conveying a long continuous sheet of wet and fragile paper requires a series of rollers that guide and support the paper through this process. As the wet paper is moved forward through the forming process and drying process, in a modern paper mill, it's speeds can reach over of 6,000 feet per minute (2100 m / min.).

As the wet pulp leaves the Head Box it is evenly distributed on a continuously moving loop of a fine wire mesh screen called a "Fourdrinier wire" (named after its inventor), which allows the wet, soupy, pulp to be de-watered by gravity. Rollers and vacuum also help in removing additional water and form the paper surface.

The wet sheet of paper is then lifted from the wire mesh screen to an endless "looped" belt of heavy woolen fabric that sends the paper through a series of presses where it is sandwiched between two woolen felts and compressed to remove additional water. Hydraulic oil is additionally used in this stage of the process to keep "just the right amount of pressure" on the rollers to delicately squeeze out any excess water prior to further drying.

The sheet is then pressed onto a huge steam-heated (hot oil heated, in tissue mills) drum, called a Yankee Dryer, and partially dried. A doctor blade then scrapes the sheet from the dryer drum.

The sheet then runs through a series of rollers called After Dryers, which are heated by steam or hot (thermic) oil, in some mills. These rollers remove any remaining moisture.

Finally the sheet is flattened between two heavy "calender" rolls and finally wound on a "parent roll" at the end.

Level Measurement is Critical:

Lube Oil level measurement for the many rollers, presses, and dryers are a critical necessity to keep this part of the paper manufacturing process in operation. If any of the rollers seize while driving a paper sheet at thousands of feet per minute, the whole mill must be shut down, repaired and restarted. This can take days, or longer, to accomplish and at the cost of hundreds of thousands of dollars in lost revenue, delayed shipments and possible loss of market share.

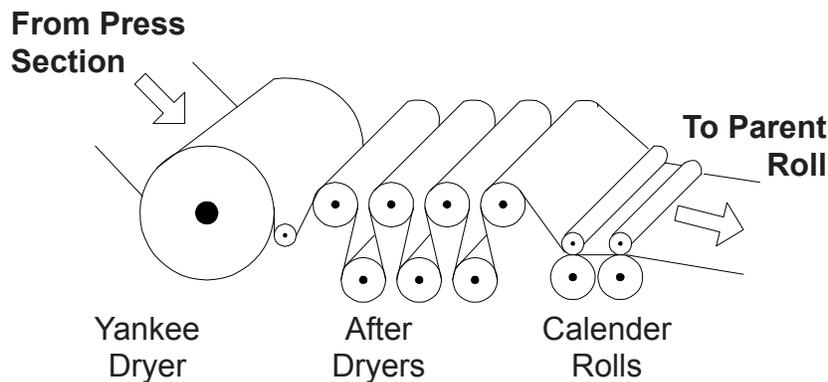
As the rollers speed the paper sheet on its way, the bearings and carriages get hot due to friction. The hydraulic oil keeps the bearings and carriages cooled to a working temperature and lubricated. The hydraulic oil also serves as a power transfer fluid to various hydraulic motors and is used to adjust the tension and pressure on the roller presses. The hydraulic oil is then re-circulated to the oil reservoir for its return trip to the rollers, motors, carriages, etc.

The level measurement of the hydraulic oil reservoir is critical to peak performance of the paper line. The output signal goes to a PLC where it is constantly monitored. Any gross variation in level can be an early warning of a pending mechanical problem.

Level Measurement Technology Challenges:

Typically lube and hydraulic oil measurement applications have short span requirements, with full measurement ranges of 24" to 36". Accuracy needs are generally within 1/4" to 1/2", so a +/- 1% of span accuracy is acceptable.

- **Pressure and Differential Pressure** - The traditional level measurement technology in this industry is pressure and differential pressure. And, this level measurement technology group will also include "Bubbler" systems. As the lubricating and hydraulic oils change temperature there will be wide variations in the specific gravity of the fluid being measured. The change in actual specific gravity of the fluid "in process" as compared to the specific gravity of the fluid when the pressure device was calibrated will be the proportional error that is generated. In some cases, plants have abandoned pressure technology devices as not being accurate enough and have gone back to plain old "stick" readings.
- **Manual readings** - When other technologies have been abandoned or found inadequate, the fall back is manual "stick" readings of many varieties. The drawback to this method is manpower. The readings are either not taken, not taken often enough to be of value or taken incorrectly, and can not be used in system automation or catastrophic shut-downs.
- **RF Technology** - RF technology has the ability to provide the best method of a "hands-off" solution for this group of applications. The Universal Lite with a bare, three-terminal Perm-a-Seal probe can provide the flexibility of having a system that has a probe that can be "field modified" by shortening to an exact length requirement. This system can provide the required accuracy, repeatability, and is not affected by the changes in oil temperature or pressure variations. A one-point (or two-point) calibration is all that is needed to commission the system, and no periodic maintenance is required.



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