TIP 0404-19

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Press section monitoring

Scope

The use of instrumentation and other techniques for monitoring and troubleshooting paper machine press sections is widely accepted. The need to produce at lower cost and high energy costs have emphasized the need for optimizing pressing efficiency. This TIP provides information on available instrumentation and procedures for monitoring wet press performance.

Trade names and manufacturers names may be found, without value judgments, in TIP 0404-62 "Index of Suppliers for Press Section Monitoring." in order to address the practical day-to-day aspects of press section monitoring. General descriptions of the various measurements are provided in TIP 0404-62 to assist in selecting a supplier.

Safety precautions

Paper machine press sections are complex machines that demand attention to personal safety. The following list contains only a part of the safety issues that should be addressed:

1. Mill safety procedures should be known before working on the machine.
2. Personal protective equipment, such as safety shoes and ear plugs, should be worn.
3. Make sure machine crews know what is being done and when.
4. Operators using instrumentation should be well trained.
5. Condition of the footwalks and ladders should be checked.
6. Make sure that any chemicals being applied to the press area are harmless before approaching or entering.
7. Measurements should not be taken ahead of in-going nips.
8. Do not hang over in-going nips or climb precariously around framework, drive shafts, etc.

Fabric thickness

Fabric thickness indicates degree of wear and fabric compaction which influences specific void volume and permeability of the fabric, and can be useful in predicting operational characteristics. Fabric thickness continually changes during press section operation and rate of change is strongly influenced by fabric design. Generally, fabric thickness decreases rapidly in the first few days after installation, tapers off, remains nearly uniform for a period of time, and finally reaches a point where the fabric is too thin to perform efficiently. Front side and back side measurements are taken while the fabric is in operation and an average value reported. Full cross-machine direction (CD) measurements may be made when the fabric is off the machine, before or after use. A history of thickness information on each fabric design is a useful indication of when to remove a fabric.

The various permeability tests can quantify the severity of a filling problem but cannot identify the cause. Some chemical and fabric suppliers can perform analyses on returned fabric samples to identify the chemical nature of the contaminants which are filling the fabric.

A database of these records can help track process changes and offer solutions to fabric filling problems.

Running fabric length

Press fabric running length must be within a specific size range to properly fit each press section. Woven fabrics were designed to run at a specific length for optimum performance relative to width, drainage, and tension. Modern fabrics are designed to operate in a specific tension range for best performance.

Running fabric length is usually determined with a fabric measuring wheel that consists of a rotating element (usually 1 foot [0.305 m] in circumference) connected mechanically with a footage meter. Buttons are incorporated to start, stop, and zero the counter. Some press sections have permanent position indicators mounted on the jack-roll take-up mechanism to allow for direct reading of running fabric length.

A less accurate method is to compare fabric revolutions per minute (rpm) to press speed.

Many mills use position of the stretch roll to chart running length versus time. This method can be used on fabrics running at constant tension and provide a good indication of fabric life.

Fabric tension

Uniform fabric tension is necessary for good drainage, optimum fabric life, and consistently good runnability. Every fabric is designed to operate in a specific tension range. Proper fabric tension generally will be obtained if the fabric is run to the desired length. Difference in fabric stiffness may require different operating tension targets for varying fabric designs.

Many machines now have pneumatic indicators or load cells to monitor and automatically control tension. Portable instruments capable of measuring paper machine fabric operating tension consist of a frame with two feet, a movable weighted arm and foot, a deflection gauge to measure position of the movable foot, and a handle to permit movement of the instrument on a fabric. The movable foot is positioned between stationary feet and it seeks a level depending on fabric tension. The deflection gauge is calibrated to convert the change in foot position to the change in fabric tension. Application is limited to press positions with an accessible, horizontal (±15°) fabric run. Gauges based on load cells and dial indicators are available from various instrument suppliers.

Tradeline distortion

Tradeline or weave distortion is a common phenomenon on paper machines. The tradelines are on the fabric to show the position of the filling (CD) yarn in relation to the warp (MD) yarn. Any distortion of the tradeline means a similar distortion in the weave which can cause the fabric to close up non-uniformly. A small amount of tradeline distortion is not significant if the distortion is uniform, but a tradeline that is off 1 foot (0.305 m) or more for each 100 inch (2.5 m) of fabric width changes permeability characteristics. Distortion of this magnitude may influence water removal, rate of filling with foreign material, fabric and sheet moisture profile, and fabric stability.

Fabric and roll speeds

Variation in drive speed on the press or between drive components on a single fabric can be a source of pressing problems. Comparing fabric surface speeds at different positions in the fabric loop can be beneficial in troubleshooting press sections. Portable electronic draw/speed indications are used for accurate monitoring of roll and fabric speeds. This type of unit consists of a transducer wheel which is held in contact with the moving surface and related electronics. The transducer generates a signal to the electronics relative to the surface speed of the roll or fabric. When two transducer wheels are used at different positions in the press section, the differential between the measurement points can be read instantaneously.

Fabric and roll surface speed measurement analysis should recognize that surface speeds can vary significantly across the machine due to speed differentials caused by crowned press rolls and concave fabric rolls. Roll surface speed measurements taken outside the nip can differ significantly from the speed in the nip due to rubber deformation. The softer the cover, the larger the error; in a hard roll/soft roll combination differences can be large, depending on which roll is measured. Strobes and optical tachometers are also used to determine roll

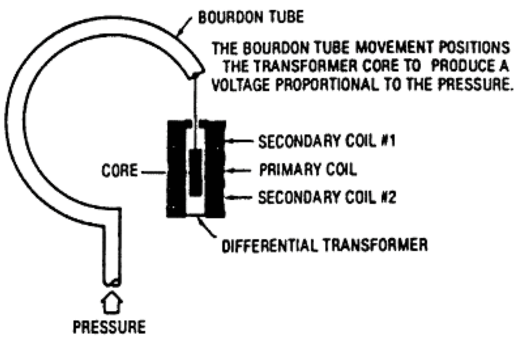

Fig. 5: Bourdon tube/LVDT pressure gauge(Courtesy Transamerica De Laval, Inc.)

Optical pressure sensors are configured as shown in Fig. 6. A source of light, usually a LED, is positioned across from the phototransistor. As pressure changes, the diaphragm deflects and the amount of light captured by the phototransistor changes.

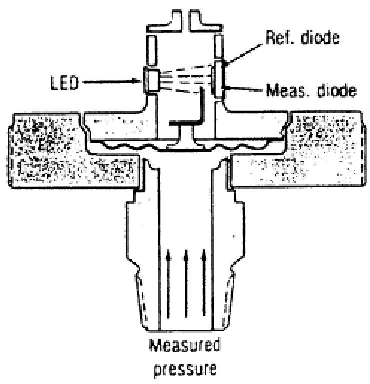

Fig. 6: Optical pressure sensor (Courtesy Dresser, Inc.)

A load cell is a pressure sensor where the deflecting disk is backed by a stiff spring. As a load is placed on the disk, the disk deflects an amount proportional to applied load. Thus, all of the methods for detecting disk movement for pressure transducers apply equally well to load cells. Instead of a load cell *per se*, press load is sometimes measured by mounting a strain gauge on the bearing pedestals.

Average fabric tension is measured as a load on a partially wrapped roll by any of the methods discussed above. Cross-direction profiles of local fabric tensions can be measured during operation with a hand-held portable device consisting of a spring-loaded movable shoe that is pressed into the fabric. The deflection of the shoe, read from a dial indicator, provides the tension measurement.

In many cases, the actual stretched length of the fabric is considered a measurement of fabric tension. Length is indicated by the position of the fabric stretch roll. This measurement can be obtained by attaching the wipe of the potentiometer to the stretcher roll to provide a variable electrical resistance proportional to stretch roll position. This measurement must be viewed with suspicion, particularly during the initial running of a new fabric when its length changes considerably. This also assumes the zero tension length is constant for all types of felts run on that position as well as their elastic modulus.

Other variables

There are many other variables which affect wet press water removal efficiency which also must be noted and considered in a press section evaluation. These include: