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Determination of water removal by wet presses

Scope

The objective of this procedure is to provide guidelines for press testing under production conditions. The following procedures are most appropriate for straight through presses. Other types of presses such as bi-nip or tri-nip are difficult to sample, particularly on wide machines. Each individual press can be evaluated by subtracting the exiting water from the entering water. The moisture profile across the machine is easily visualized by graphing data at each press position. Detailed analysis of press operation is possible when a history of test data is developed.

Significance

The measurement of water removal by a press section is conducted for many reasons, including:

1. To determine average sheet moisture content throughout a press section.
 2. To monitor the effect of changing pressing conditions such as press loading, felt design and age, roll crown, roll cover, sheet temperature, and furnish.
 3. To develop cross machine profile information.
 4. To compare data on pressing efficiency with other presses.
 5. Calibration and/or verification of on-line moisture sensing and measuring instruments.
- Standardized test procedures permit comparison of moisture data from different presses.

Safety precautions

For a detailed discussion of safety around the wet end of the paper machine, refer to chapter 15 of the Paper Machine Wet Press Manual (TAPPI PRESS, Fourth Edition, 1999).

Sample equipment needed

The equipment needed is a thermometer and a sufficient number of plastic bags or metal cans to hold samples from all measurement positions desired. If cans are used, they should be about 13 cm (5 in.) in diameter with tight fitting covers. The tare weight should be marked on each can to the nearest 0.1 g. If plastic bags are used, their capacity should be 0.5 to 1 L (.5 to 1 qt). Rubber bands or ties should be available to seal the plastic bags securely after the samples are obtained.

Preliminary organization and data gathering

Sheet moisture samples can only be obtained by briefly interrupting the papermaking process. Coordination between technicians and machine personnel has to be established in advance of sampling. A good testing team will not break down a two-press machine for more than about ten minutes.

Press test sampling with nondoctored press rolls

When press rolls are not doctored, samples must be obtained by simultaneous grab samples as described in item 4 in the previous section. Position machine personnel at each numbered sampling point on the machine and obtain samples off felts or rolls for each machine position.

Reel samples

1. Obtain reel samples by slabbing the outside 0.60 to 1.00 cm (0.25 to 0.40 in.) of the last reel.
2. Reel samples are obtained at cross machine positions which correspond to the sampling positions at the presses. Reference (1) describes a sampling procedure in detail.

Moisture measurement

Obtain moisture contents of all samples by TAPPI T 412¹ (ASTM D644-55). Report for each sample the moisture as grams water/gram oven-dry (o.d.) paper or lb water/lb o.d. paper. Calculation of water contents in percentages is both confusing and difficult to manipulate.

Calculations

1. *Production* -- Convert reel oven-dry basis weight and speed to g/m(s) of production:

$$\begin{aligned} \text{Oven-dry production} &= (\text{o.d. Basis weight}) \times (\text{Speed}) \\ &= (\text{g/m}^2) (\text{m/s}) = \text{g/m(s)} = B \end{aligned}$$

Table 1. Customary units for o.d. production.

$$\text{Oven-dry Production} = (\text{lb/in}^2) (\text{in./hr}) = \text{lb/in.hr}$$

$$\text{For conversion: } 1 \text{ lb/in. hr} = 4.961 \text{ g/m(s)}$$

2. *Water removal* -- The weight of water per unit of oven-dry paper production is calculated for each sampling point at couch, presses, and reel.

The moisture content at each sampling point is obtained as follows where (A) is the moisture content as grams water/gram oven-dry (o.d.) paper and (B) is the oven-dry production.

$$(A) \times (B) = \text{g moisture/m(s)}$$

Table 2. Customary units for water removal.

$$A \times B = (\text{lb water/lb oven-dry paper}) (\text{lb/in. hr.}) = \text{lb moisture/in. hr.}$$

The data are entered on a form similar to Table 2 with an adequate number of columns for sampling points. The rows correspond to moisture contents at the different locations; couch, first press, second press, and at the reel. Removal figures are obtained by subtracting between machine direction (MD) sample positions.

Analysis of results

The data may be presented as a series of cross machine profiles. This data along with the recorded machine data in Table 3 may identify operating conditions which are influencing final product quality and machine operation. This type of analysis is particularly important when intentional changes are made to compare results with other press data.

¹See T208 os-78, "Moisture in Wood, Pulp, and Paperboard by Toluene Distillation," Toluene distillation may be used. Specify which method is necessary. Also see TAPPI T 412 om-83, "Moisture in Paper and Paperboard."

