

T 221 cm-09

OFFICIAL TEST METHOD – 1981

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Drainage time of pulp

1. Scope

This method describes a procedure to determine numerically a measure of the slowness of stock, particularly groundwood or beaten pulps. Drainage time is not necessarily related to freeness of pulp, which is determined by TAPPI T 227 “Freeness of Pulp.”

2. Safety precautions

The tests are carried out with the same disintegrating and sheetmaking equipment as specified in TAPPI T 205 “Forming Handsheets for Physical Test of Pulp.” The drainage time may be obtained when preparing the test sheets according to the procedure there described. This is done by measuring the time required to form a standard sheet at 20°C weighing 60 g/m² (moisture-free).

3. Significance

This test gives an index of the slowness of stock on the paper machine (1, 2).

4. Apparatus

- 4.1 *Standard disintegrator* (for pulp not in slush form, see T 205).
- 4.2 *Standard sheet machine and stirrer*, see T 205.
- 4.3 *Stopwatch*, or clock to read to nearest 0.1 s.
- 4.4 *Container*, for pulp.
- 4.5 *Dipper*, 500 mL (17 fl oz), a polyethylene measuring cup with handle is suitable.

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- 4.6 Container, for diluted pulp; a 20-L (~5-gal) crock is recommended.
 4.7 Graduated cylinder, 1000 mL.

5. Calibration

5.1 Fill the container of the sheet machine to the mark 350 mm above the wire with deionized water at a temperature of $20 \pm 1^\circ\text{C}$. Simultaneously open the drain cock of the sheet machine and start the stopwatch. Stop the watch as soon as the water leaves the top of the wire.

NOTE 1: Due to the variation in the results obtained with “tap water” this procedure should be run with deionized water only (ASTM D 1193 – Type IV).

5.2 The drainage time of water alone through a clean grid plate in position in the sheet machine should be 3.8 ± 0.2 s. If it is over 4.0 s, and if the wire is clean, it is an indication that the drain cock is either dirty, or else through wear is has moved laterally so that its effective opening has been reduced, in which case the plug may be removed and the hole in it enlarged on the one side with a file.

5.3 The spare (new) grid plate supplied with the apparatus should be used to check the cleanliness of the grid plate being used, at least weekly, if the stock contains sizing and filler material. If the drainage time of a slow stock with the new plate is reduced, the grid plate in use should be cleaned by a steam jet or by washing with a weak alkali then scouring with a weak acid. If one of these treatments is not effective in restoring the plate to its new condition, the spare grid plate should be put into use and the old plate returned to the manufacturer for recovering.

6. Procedure

6.1 The drainage time may be obtained at the same time the sheets are formed with the standard apparatus. The procedure is the same as for sheetmaking except that the diluted stock mixture in the cylinder should have the temperature adjusted to be within $20 \pm 5^\circ\text{C}$ (effected by adding some hot or cold deionized water to the stock), and, after a preliminary stirring, the temperature of the stock is taken to the nearest 0.5°C .

NOTE 2: It is desirable to insert a temperature regulating valve in the water supply pipe to the sheet machine so as to maintain the water at the standard temperature of 20°C , provided that the temperature of the cold water supply is less than 20°C .

NOTE 3: For accurate results, especially with slow pulp ~~run~~, special care must be taken to avoid any air being trapped in the water leg. For this purpose, replace the needle valve in the drainage leg with a 3.12-mm (1/8-in.) plug or an inward opening poppet valve (obtainable from the manufacturer).

6.2 After the standard stirring and a pause of 5 s, open the drain valve and note the time taken in seconds for the level of the pulp suspension to fall from the 350-mm mark to the wire. Couch the sheet that has been formed. Mark the sheets on which the drainage times are determined (a minimum of three sheets) with an indelible pencil and determine their average weight per unit area (g/m^2) separately for special accuracy; otherwise it may be taken as that of the complete set of sheets. Entrained air from excessive agitation of the stock or from the water supply will give falsely higher drainage times.

7. Calculation

7.1 The drainage time in seconds, d_s , for the standard conditions of 20°C and 60 g/m^2 (dry basis) may be found by the empirical formula:

$$d_s = \left[\frac{d(60 - K)}{(r - K)} \right] + \left[\frac{1}{V_t} - 1 \right] (d - 4)$$

where