

APPENDIX XI.—METHODS OF DETERMINING STRENGTH OF PAPER.

For paper-testing, three sheets about 24 in. long, as nearly equal in thickness and weight as possible, are selected. They are prepared for testing by seasoning on the drying-rack in the humidity-room two hours, at a relative humidity of 65 per cent. and a temperature of 72° F., which are maintained during the testing. One of the sheets is used for thickness, basis weight, and bursting tests; one for the tensile, folding, and tearing tests; and the third cut to 8 in. by 10½ in. for the sample to be saved.

BASIS WEIGHT.

A sample is cut from the first sheet corresponding to the brass template, 6½ in. by 14½ in., and weighed on the scale. The basis weight per ream is obtained by applying the proper correction for 500 or 480 sheets to the ream of the size 24 in. by 36 in.

THICKNESS.

Ten thickness readings are taken on the weighed sheet with the Randall and Stickney micrometer estimating to the nearest 0.0001 in., five along each side of the sheet. The average of the ten readings is taken as the thickness of the sheet.

BURSTING-STRENGTH TEST.

The bursting tests are made on the weighed sheet, using the Mullen tester, turning the handle about two revolutions per second. The bursting-strength is obtained by dividing the average of ten tests by the ream-weight (24 in. × 36 in. × 500). The gauge on the Mullen tester should be checked frequently against a standardized gauge attached to the tester.

TENSILE-STRENGTH TEST.

From the second sheet, five strips are cut in the machine-direction and five across the machine. The strips are 15 mm. wide, and long enough for a space of 180 mm. between the clamping-jaws of the Schopper tester. The machine registers the number of kilograms required to break the strip, and the percentage of stretch at the point of failure.

The breaking-length, or length of a strip of paper that will be broken by its weight, is computed from the kilograms required to break the strip and the weight of the strip between the jaws of the tester as follows:—

$$\frac{\text{Av. tensile str. (grm.)} \times \text{No. of strips} \times \text{length of strips (metres)}}{\text{Weight of strips (grm.)}} = \text{breaking-length (metres)}.$$

TEARING-STRENGTH TEST.

The Elmendorf machine, which registers the grammes of force required to make the tear, is used for the tearing test. The sheets are cut according to the gauge, and the number of sheets necessary to give a scale reading above 15 (usually either two, four, or eight sheets) are clamped in the tester. Five tests across and five in the machine direction are made. The calculation is made as follows:—

$$\frac{\text{Sum of 10 tests} \times \text{Elmendorf factor}^*}{\text{No. of tests}} = \text{grammes of force}.$$

Dividing the grammes of force by the ream-weight gives grammes per pound per ream.

FOLDING-STRENGTH TEST.

The folding test is made on the Schopper machine, which registers the number of double folds required to break the strip, under a maximum tension of 1,000 grm. Five strips are cut across and five in the machine direction, 15 mm. wide and 100 mm. long. The results are reported in average double folds in and across the machine direction, and the average of the two.

* To reduce scale readings to force in grammes, when tearing one sheet multiply by 16, two sheets by 8, four sheets by 4, and eight by 2.

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