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Folding endurance of paper (Schopper type tester)

1. Scope

1.1 This method describes the use of the Schopper type of folding apparatus. It is suitable for papers having a thickness of 0.25 mm (0.010 in.) or less.

1.2 The procedure for the MIT type apparatus, which may be used for papers of any thickness, is described in TAPPI T 511 “Folding Endurance of Paper (MIT Tester).”

2. Significance

Folding endurance tests have been used for the estimation of the suitability of paper in use to withstand repeated bending, folding, and creasing.

3. Apparatus

3.1 *Folding tester* (Fig. 1 in the Appendix), consisting of the following:

3.1.1 Two horizontally opposed and movable *clamping jaws*, which hold a specimen 100 mm (4 in.) long under variable tension during the folding cycle, while a slotted folding blade, sliding back and forth between four creasing rollers, folds the paper at 105-125 double folds per minute. The clamps are supported from below on rollers and, while in motion, are freely suspended between tension springs. The folding blade is 0.50 ± 0.0125 mm (0.020 ± 0.0005 in.) thick, with a vertical folding slot 0.50 ± 0.0125 mm (0.020 ± 0.0005 in.) wide, the slot extending somewhat above and below the normal position of the test specimen. The vertical edges of the slot are cylindrical with radius equal to half the thickness of the blade. The four creasing rollers, each 6 mm (approximately $\frac{1}{4}$ in.) diameter and 18 mm (approximately $\frac{3}{4}$ in.) long, are arranged symmetrically about the midposition of the folding slot, and are provided with antifriction or jeweled bearings.

3.1.2 *Counter*, to register the number of double folds and to stop the instrument when the specimen breaks.

3.2 *Cutter*, to provide test strips, 15.0 ± 0.1 mm (0.590 ± 0.004 in.) wide, and with clean edges.

4. Adjustment and calibration

4.1 Test the clamps as follows: Insert a specimen in place and alternately apply and release the tension a number of times. Then, with tension released, note whether the specimen remains smooth and straight as originally inserted. Buckling or waviness indicates a faulty clamp which has allowed the specimen to slip.

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4.2 Inspect the supporting rollers for worn surfaces and for bearing friction, and correct if necessary. Adjust the rollers so that they do not bind against the clamps in any position. With a feeler gage, check the four creasing rollers for parallelism and clearance. Also make sure that the two edges of the folding slot are parallel with each other and with the creasing rollers. The distance between the folding blade and the two creasing rollers on each side of it is required to be 0.38 ± 0.05 mm (0.015 ± 0.002 in.), and the width between the rollers of the space occupied by the unbent specimen should be approximately 0.5 mm (0.02 in.). As a final test of alignment, fold a specimen somewhat short of failure and inspect it for uniformity of wear along the crease. If the specimen seems weaker at one end of the crease than at the other, and the ends of the strip are satisfactorily clamped, this indicates faulty alignment of the rollers or the folding slot and will lead to low folding results.

4.3 Adjust the tension springs attached to the clamps against dead-weight loads, so that the tension on the specimen during a test is 7.60 ± 0.1 N (780 ± 10 gf) when the clamps are farthest apart (when the specimen is straight and free), and 9.81 ± 0.1 N (1000 ± 10 gf) when they are nearest together. The adjustments are preferably made *in situ* with the aid of a calibrating device (1), as described (Fig. 1) in the Appendix.

NOTE 1: As stated in Section A.3.2, the minimum tension (7.60 ± 0.1 N) is the most important value. If the difference between the maximum and minimum tension is not equal to the desirable 2.21 n., then the minimum tension should be adjusted to the 7.60 N value and the maximum rechecked. If the maximum tension is not within 0.5 N of the specified 9.81 N then the springs should be replaced.

4.4 Adjust and calibrate the instrument at least once a month if it is in continual use or immediately before a test.

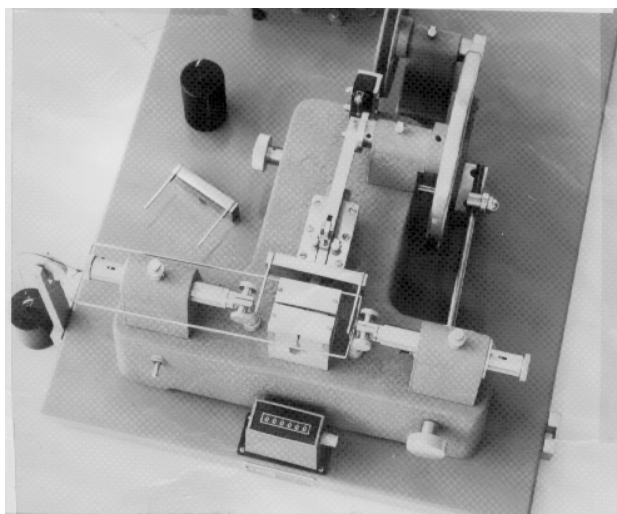


Fig. 1. Schopper-type tester.

5. Sampling and test specimens

5.1 Obtain a sample of the paper in accordance with TAPPI T 400 "Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, or Related Product." From each test unit obtain 10 specimens, cut in each principal direction of the paper, having a width of 15.0 ± 0.1 mm (0.590 ± 0.004 in.) and a length of 100 mm (4 in.). Select specimens that are free from wrinkles or blemishes not inherent in the paper and be sure that the area where the folding is to take place does not contain any portion of a watermark and appears to be of average opacity.

5.2 Handle each specimen by an end and do not touch it with the hands in the region in which it is to be folded.

6. Procedure

6.1 Precondition, condition, and test the paper in accordance with TAPPI T 402 "Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products."