

T 456 om-10

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Tensile breaking strength of water-saturated paper and paperboard (“wet tensile strength”)

1. Scope

1.1 This method describes the procedure for the determination of the tensile strength of paper and paperboard after saturation with water.

1.2 This procedure is applicable to papers and paperboard (excluding corrugated board) that will be subjected to stress while wet, either during processing or use. Such materials include but are not limited to tissue products, papers used in map-making, photography, and blue prints, bags and food wraps.

2. Summary

Specimens are selected in accordance with TAPPI T 400 “Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard or Related Product” and saturated with distilled water either by immersion or with the use of the Finch cup. After saturation, the wet tensile breaking strength is evaluated using a tensile tester complying with the requirements TAPPI T 494 “Tensile Breaking Properties of Paper and Paperboard (Using Constant Rate of Elongation Apparatus)”

NOTE 1: This method requires use of a one-inch-wide Finch cup. Versions of the Finch procedure for low wet strength paper using wider Finch cup devices are found in ISO/EN 12625-5 (two-inch Finch cup) or TAPPI 576 (three-inch Finch cup).

3. Significance

The wet tensile breaking strength is an important performance characteristic of papers that will be processed wet, or that will be subjected to wetting, whether accidentally or intentionally during use. Example of such products include, but are not limited to tissue products (including paper toweling), photographic paper, bags, moisture food wraps, saturating papers, and any other papers subjected to stress during processing or use, while wet.

Approved by the Standard Specific Interest Group for this Test Method



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4. Definitions

4.1 *Wet tensile breaking strength*; the tensile strength of a specimen after the specimen has been wetted with water under specified conditions. The conditions specified in this test method are those required to saturate the sample with water.

4.2 *Finch wet strength*; the tensile strength of a specimen after the specimen has been tested using a Finch cup under the conditions specified in this test method.

5. Apparatus

5.1 *Tensile tester*, as described in T 494.

5.2 *Blotting paper* (needed for permanent wet tensile strength only), the paper used should comply with the requirements in TAPPI T 205 "Forming Handsheets for Physical Tests of Pulp."

5.3 *Finch wet strength device*, a wet strength device (Fig. 1) consisting of an inverted stirrup about 38 mm (1.5 in.) in width and about 76 mm (3 in.) in length, made of metal straps by which a horizontal rod, about 28 mm (1.1 in.) in length and 5 ± 0.05 mm (0.188 ± 0.002 in.) in diameter, is supported. Between the straps and under the horizontal rod is a small, vertically movable container for holding water or other liquid. When the liquid container is locked in its uppermost position, the horizontal rod is immersed in the liquid to a depth of at least 19 mm (0.75 in.). A thin metal tang forming the lower part of the inverted stirrup permits it to be fastened in the lower clamp of a tension testing machine. This device is not required if the sample is saturated by immersion.

6. Conditioning

Condition the samples as required in TAPPI T 402 "Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets and Related Products."

7. Test specimens

7.1 Cut at least ten test specimens from each test unit of the sample in each principle direction of the sample (machine direction and cross direction) 25.4 mm (1.00 in) wide and optimally at least 230 mm (9 in.) long as described in T 494. To the highest degree possible, avoid areas of the sample containing folds, embossing, or printing.

7.2 For certain finished product items such as toilet tissue, a test specimen of the specified length is impossible to obtain because of the dimensions, either length, width or both, of the material being tested. In such cases, cut the sample of the longest length possible.

7.3 Additional test specimens should be cut to enable determination of the time necessary to achieve saturation of the specific material being testing (see section 8).

8. Procedure

8.1 Make all tests in the testing atmosphere specified in TAPPI T 402 "Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets and Related Products."

8.2 When testing materials which are designed to maintain wet strength either in processing or in use and can be handled without difficulty when wet, including, but not limited to papers such as photographic papers, map papers, blueprint papers, bag papers, proceed as follows:

8.2.1 Immerse the test specimens in distilled water maintained at $23.0 \pm 2^\circ\text{C}$ ($73.4 \pm 3.6^\circ\text{F}$) for the required period of time for saturation.

8.2.2 To determine the period of time required for saturation, make preliminary tests on each of five specimens cut in the machine direction and saturated by immersion for different known periods of time. In all preliminary tests the increase in time intervals should be sufficient to be determinative. In general, each succeeding interval should be about double that of the previous one. For paper or paperboard which is difficult to saturate, it may be necessary to make preliminary tests after immersion for 2, 4, 8, 16 and 24 h.

8.2.3 When less than a 10% loss in tensile strength occurs between two time intervals, consider the longer period as the minimum time of immersion for the final test.