Designation: D 6125 – 97 (Reapproved 2002)

An American National Standard

Standard Test Method for Bending Resistance of Paper and Paperboard (Gurley Type Tester)[1]

This standard is issued under the fixed designation D 6125; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method determines the bending resistance of paper, paperboard, and other flexible flat-sheet materials by measuring the force required to bend a specimen under controlled conditions. The instrument described allows for a wide variation in specimen length, width and applied force.

1.2 This test method is not recommended for soft, limp or creped materials. Materials such as tissue or toweling would not normally be tested by this procedure and materials with a pronounced degree of curl would give erroneous results. Products with a bending resistance below 1.39 Gurley Units (or products not able to give a deflection between 1 and 7 on the scale when using the lightest weight) should not be tested by this procedure.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

1.4 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.

2. Referenced Documents

2.1 *ASTM Standards:*

D 585 Practice for Sampling and Accepting a Single Lot of Paper, Paperboard, Fiberboard, and Related Product[2]

D 685 Practice for Conditioning Paper and Paper Products for Testing[2]

2.2 *TAPPI Standards:*[3]

T 543 Bending Resistance of Paper

T 1200 Interlaboratory Evaluation of Test Methods to Determine TAPPI Repeatability and Reproducibility

3. Terminology

3.1 *Definitions:*

3.1.1 *bending resistance*, *n*—a material attribute quantified by the magnitude of an applied force which produced deflection of a specimen having specified dimensions.

3.1.2 *stiffness, of paper and paperboard*, *n*—a synonym for bending resistance.

3.1.3 *machine direction bending resistance*, *n*—the bending resistance of a test specimen, clamped with the machine direction of the paper perpendicular to the specimen clamp.

3.1.4 *cross direction bending resistance*, *n*—the bending resistance of a test specimen, clamped with the cross direction of the paper perpendicular to the specimen clamp.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 *Gurley stiffness*, *n*—stiffness or bending resistance of paper and paperboard determined using measurements made with a specific instrument patented by W& L.E. Gurley Co.

3.2.2 *Gurley units*, *n*—the units assigned to represent the force required to bend the specimen. Traditionally the results have been reported in terms of milligrams of force (mgf) which are identical to the now preferred term of Gurley units. In terms of force units (milliNewtons) the following applies:

$$\text{Force, mN} = 9.807 \times 10^{-3} \text{ (Gurley units)} \quad (1)$$

3.2.3 *Taber stiffness*, *n*—stiffness of paper and paperboard determined using measurements made with a specific instrument patented by Taber Industries.

4. Significance and Use

4.1 The bending resistance of paper affects many converting operations and most end-users. The bending resistance of paperboard is basic to many of the uses into which this material is placed. It is necessary to have a convenient, reproducible test method to measure this fundamental characteristic.

5. Apparatus

5.1 *Bending Resistance Tester*:

5.1.1 The instrument, shown in Fig. 1, consists of a balanced pendulum or pointer, pivoted at its center of gravity, mounted in jewel bearings, and provided with holes for attaching weights at a distance of 25.4 mm (1 in.), 50.8 mm (2 in.), and 101.6 mm (4 in.) below the center pivot. In non-digital instruments, the lower end of the pendulum is pointed and moves parallel to a scale mounted on the base of the instrument. The scale is graduated, in both left and right directions,

[1] This test method is under the jurisdiction of ASTM Committee D06 on Paper and Paper Products and is the direct responsibility of Subcommittee D06.92 on Test Methods.

Current edition approved May 10, 1997. Published February 1998.

[2] *Annual Book of ASTM Standards*, Vol 15.09.

[3] Available from the Technical Association of the Pulp and Paper Industry, Technology Park, P.O. Box 105113, Atlanta, GA 30348.

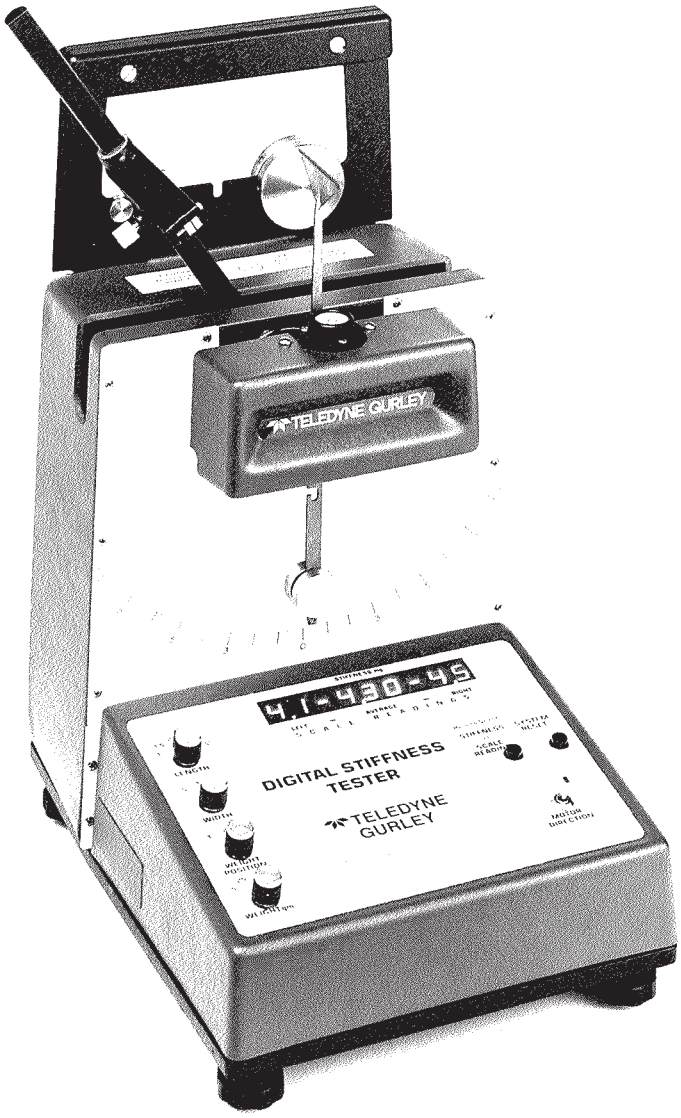

FIG. 1 Bending Resistance Tester

from zero to 8 units (corresponding to 10 times the sine of the angle produced by the pendulum) and is subdivided into five divisions, permitting readings to 0.1 unit. Newer versions employ optical encoders and microprocessors to measure the pendulum angle and compute the bending resistance automatically.

5.1.2 The upper end of the pendulum terminates in a triangular vane, 50.8 mm (2 in.) wide at the upper edge. The specimen presses against the vane causing the pendulum to deflect when the test is conducted. The upper edge of the vane is parallel to a specimen clamp, which is mounted upon an arm that rotates about the same geometrical center as the pendulum. The specimen clamp is movable upon the arm and may be positioned so that a gap (test length) of 12.7 mm (0.5 in.), 25.4 mm (1 in.), 50.8 mm (2 in.), 76.2 mm (3 in.), or 101.6 mm (4 in.) separates the clamp jaws from the top edge of the pendulum vane. The arm carrying the clamp is rotated left and right through approximately 20° by means of a reversible gear-motor at 2 rpm and contains recesses that automatically position the specimen clamp to the gaps referred to previously.

5.1.3 Weights of 5, 25, 50, and 200 g are provided. The tolerance on these weights is ±0.1 %. They are attachable to the lower end of the pendulum at distances of 25.4 mm (1.0 in.), 50.8 mm (2.0 in.), and 101.6 mm (4.0 in.) from the pivot.

5.1.4 The instrument is mounted upon a base that is provided with a spirit level (identical to those used with surveying instruments), leveling screws and a reversing switch for operating the motor.