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Tensile strength and elongation at break for fiber glass mats

1. Scope

This method covers the determination of the tensile strength and elongation at break of fiber glass mats.

2. Applicable documents

2.1 TAPPI T 494 "Tensile Breaking Properties of Paper and Paperboard (Using Constant Rate of Elongation Apparatus)."

2.2 TAPPI T 1007 "Sample Location."

3. Summary of method

The average tensile strength and elongation of fiber glass mat is determined by fixing the test specimen in place with a suitable clamping mechanism and then applying a smoothly increasing load until the specimen breaks.

4. Significance

Tensile strength and elongation are fundamental properties associated with fiber glass mats since both properties are influenced by the kind and treatment of the fiber, by the manner in which the sheet has been formed and by the binder and curing conditions employed in the mat production. Tensile strength and elongation measurements indicate the potential resistance to breaking when the fiber glass mat is subjected to stress during subsequent converting operations or in the finished product.

5. Apparatus

5.1 *Tensile testing machine*, having the following characteristics:

5.1.1 Two jaws, 3 in. (76 mm) wide with clamping surfaces in the same plane parallel to the direction of motion of the applied stress and so aligned that they hold the test specimen in that plane throughout the test without slippage and without damage to the sample. The four faces of the jaws should be padded with a thin strip of soft

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Documents

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gasket rubber to prevent slippage and damage to the test specimen. At the start of the test, the edges of the jaws are set apart at 6 ± 0.1 in. (152 ± 2 mm) for both the constant rate of strain tester and the pendulum-type tester.

5.1.2 Means for applying a smoothly increasing force to the test specimen until it breaks, the increase being such that the additional force applied each second is not different by more than 10% from the additional force applied in the previous second.

NOTE 1: This condition is fulfilled by most motor-driven tensile breaking testers, including the pendulum-type and constant rate of strain-type.

The recommended maximum rate of extension is 12 in./min (30 cm/min) for pendulum testers and 2 in./min (5 cm/min) for load cell test machines. For more accurate measurement of elongation, slower rates of extension are necessary for some materials.

5.1.3 Means of indicating elongation of the specimen at failure to within 1%.

5.1.4 Paper cutter, template or other specimen cutting device of suitable size to prepare specimens. The cutting edge of the device should produce specimens with clean, parallel edges without distorting the test specimens.

6. Calibration

Calibration of the instrument should be accomplished in accordance with the manufacturer's instructions in both procedure and frequency.

7. Test specimen

7.1 Obtain samples in accordance with TAPPI T 1007 "Sample Location." For each sheet direction to be tested, cut at least 10 specimens with clean, parallel edges to a width within $1/32$ in. (0.8 mm) of that specified. Avoid abnormalities, creases, and wrinkles.

7.2 Specimens tested on a constant rate of extension-type tester and pendulum-type tester shall be 3 in. $\times$ 12 in. (75 mm $\times$ 300 mm).

7.3 Alternate specimen sizes may be used, e.g. 3 $\times$ 9 in. (7.6 $\times$ 22.9 cm) or 2 $\times$ 10 in. (5.1 $\times$ 25.4 cm), provided that the gauge length (clamp separation) is not less than 6 in. (15.2 cm) and the specimen width is not less than 2 in. (5 cm).

8. Procedure

8.1 Condition all specimens prior to test at $77^\circ \pm 5^\circ\text{F}$ ($25^\circ \pm 3^\circ\text{C}$) and with $50 \pm 5\%$ relative humidity for at least one-half hour. Specimen should remain in conditioned atmosphere until test is run.

8.2 Clamp the specimen carefully in the top jaw, being certain that the specimen is aligned, and held securely enough so that the specimen will not slip, but not so tightly as to damage the specimen. When specimen is aligned, clamp securely in lower jaw.

8.3 Operate the constant rate of extension tester at 2 in./min (50 mm/min) crosshead speed, and pendulum-type tester at 12 in./min (300 mm/min) driven clamp speed.

8.4 Reject readings from individual specimens if the specimen slips or breaks in or at the edge of the jaw face.

8.5 Record the results of each individual breaking force to the number of significant figures recommended by the manufacturer of the testing instrument.

8.6 Directly read or calculate the percent elongation in accordance with the procedure recommended by the manufacturer of the testing instrument, using the instrument recorder.

8.7 Calculate the average breaking force and average percent elongation for each specimen set.

9. Report

9.1 Report the average value of the breaking force as the tensile strength for both the machine and cross machine direction of the fiber glass mat to the nearest 0.1 lbf/3 in. (0.006 kN/m) of width, or 0.1 lbf/in. (0.02 kN/m) of width.

9.2 Report the average value of elongation for both the machine and cross machine direction of the fiber glass mat to the nearest 0.1%.