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OFFICIAL TEST METHOD – 1981
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Smoothness of paper (Bekk method)

1. Scope

This method is for determining the smoothness of individual surfaces of paper when under a clamping pressure of approximately 100 kN/m² and using an anvil with an effective area of 10.00 ± 0.05 cm².

2. Summary

The specimen is clamped with a pressure of one atmosphere between a plain, circular anvil having a small hole in its center and a soft rubber pad. The time required to draw 10 mL of air radially between the anvil and the specimen is measured, when a decreasing suction averaging 49.3 kPa (370 mm of mercury) is applied to the hole.

3. Significance

This test is an indirect measure of smoothness when the paper is under moderate pressure. At other pressures, such as the higher pressure used in some printing presses, the ranking of papers may be changed, depending upon the relative compressibilities of the papers being compared (1). With some papers, radial air leakage may affect the result (2).

4. Apparatus

4.1 Testing instrument¹ having:

¹Names of suppliers of testing equipment and materials for this method may be found on the Test Equipment Suppliers list, available as part of the CD or printed set of Standards, or on the TAPPI website general Standards page.

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4.1.1 An anvil with a circular, plain, glass surface, with a small hole (1-2 mm diameter) in its center, the surface having an effective area of $10.00 \pm 0.05 \text{ cm}^2$. A capillary connected to a suction chamber having a volume such that the addition of 10 mL of air at 23°C and normal pressure causes its negative pressure to fall from 50.7 to 48.0 kPa (380 to 360 mm Hg).

4.1.2 A 4-mm-thick pad of soft butyl or EPDM rubber about 50 mm across with smooth surfaces and a Shore Durometer hardness of 39 ± 5 units (A scale).

4.1.3 A platen (pressure disk) with means of applying a load² of $100 \pm 5 \text{ N}$, including the disk and rubber pad, to the specimen on the anvil.

NOTE 1: Some instruments are supplied with a small chamber, one-tenth the volume that is specified, or with inserts that can be placed in the chamber to reduce its volume to one-half or one-quarter of the normal volume. The one-tenth volume chamber reduces the measurement to one-tenth, and the one-half or one-quarter inserts reduce the measurement to one-half and one-quarter, respectively. They are for use with very smooth papers when the time for test with the standard chamber exceed 300 s.

4.2 *Stopwatch or timer*

5. Calibration

5.1 Check the instrument frequently for leakage. By means of a vacuum pump, raise the mercury level, turn the stopcock to the closed or “0” position, and allow the instrument to remain in this state for at least 5 h. If the drop in the mercury column is found to be over 5 mm, tighten all gaskets. If air leakage continues, remove the stopcocks and the regulating valve pin, clean them, and apply a thin film of stopcock grease to the polished surfaces. Make certain that the nut holding the plain glass block in place is tight.

5.2 It is particularly important that the capillary be kept clean. A jerky movement of the mercury column or adherence to the glass is an indication that the capillary is dirty. In this case, carefully remove and clean the capillary by washing it alternatively with nitric acid and a solution of potassium dichromate in concentrated sulfuric acid. Remove all the cleaning solution by flushing with distilled water and rinsing with alcohol. (Do not use ether.) Dry the tube thoroughly by letting it stand in a warm room or by blowing filtered warm air through it. The mercury and reservoir should be cleaned at the same time. Before inserting the capillary, it is recommended that a layer, approximately 2 mm in height, of pure benzyl salicylate be poured onto the surface of the mercury in the reservoir to lubricate the capillary walls.

5.3 Whenever the instrument is not being used, protect the polished glass surface with a dust cap. Keep the surface of this block and the rubber pad clean at all times. Handle the rubber pad by the edges to prevent grease from fingertips from accumulating on the surface of the pad. When the pad hardens beyond the specified limits, discard it.

6. Sampling and test specimens

6.1 Obtain a sample of the paper in accordance with TAPPI T 400 “Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product,” being careful not to expose the sample to dampness.

6.2 From each test unit of the sample select 10 representative specimens (i.e., 5 for each side) at least 50 mm square.

7. Procedure

7.1 Condition the specimens and test them in an atmosphere in accordance with TAPPI T 402 “Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products.” Ensure that the apparatus is not subjected to any vibration during the test.

7.2 Set the stopcock of the tester to position “P”. With gentle strokes of the vacuum pump, raise the mercury column to slightly above 380 mm and turn the stopcock to position “0”.

² A 10-kgf is within the allowable tolerance shown of $100 \pm 5 \text{ N}$ force.