

T 547 om-02

PROVISIONAL METHOD – 1988
OFFICIAL METHOD – 1997
REVISED – 2002
©2002 TAPPI

The information and data contained in this document were prepared by a technical committee of the Association. The committee and the Association assume no liability or responsibility in connection with the use of such information or data, including but not limited to any liability under patent, copyright, or trade secret laws. The user is responsible for determining that this document is the most recent edition published.

CAUTION:

This Test Method may include safety precautions which are believed to be appropriate at the time of publication of the method. The intent of these is to alert the user of the method to safety issues related to such use. The user is responsible for determining that the safety precautions are complete and are appropriate to their use of the method, and for ensuring that suitable safety practices have not changed since publication of the method. This method may require the use, disposal, or both, of chemicals which may present serious health hazards to humans. Procedures for the handling of such substances are set forth on Material Safety Data Sheets which must be developed by all manufacturers and importers of potentially hazardous chemicals and maintained by all distributors of potentially hazardous chemicals. Prior to the use of this method, the user must determine whether any of the chemicals to be used or disposed of are potentially hazardous and, if so, must follow strictly the procedures specified by both the manufacturer, as well as local, state, and federal authorities for safe use and disposal of these chemicals.

Air permeance of paper and paperboard (Sheffield method)

1. Scope

1.1 This method is used to measure the air permeance of a circular area of paper using a pressure differential of approximately 10 kPa (1.5 psig). In order to accommodate a wide range of paper products, rubber clamping plates are available for five commonly used orifice diameters: 9.5 mm (0.375 in.), 19.1 mm (0.75 in.), 38.1 mm (1.50 in.), 57.2 mm (2.25 in.), and 76.2 mm (3.00 in.). The air flow range for this method is 0 to 3348 mL/min (0 to 400 Sheffield units). Instruments are available with either variable area flowmeters (glass tubes with internal tapers and floats) or electronic mass flowmeters.

1.2 This method measures the air that passes through the test specimen, along with any possible leakage of air across the surface; therefore it is unsuitable for papers with rough surfaces which cannot be securely clamped so as to avoid significant surface leakage.

1.3 For other methods of measuring the air resistance of paper using a 28.6 mm (1.125 in.) orifice diameter, refer to TAPPI T 460 "Air Resistance of Paper (Gurley Method)" or a test that operates at a pressure differential of 1.22 kPa, or TAPPI T 536 "Resistance of Paper to Passage of Air (High Pressure Method)" for 3 kPa.

2. Summary

This method measures the rate of air flow that is directed to the rubber clamping rings that hold the test specimen. Compressed air, regulated at a fixed pressure, passes through a flow measuring device just before it is directed to the paper specimen test area, which is defined by the diameter of the orifice in the rubber clamping rings. Air that passes through the paper specimen escapes to the atmosphere through holes in the downstream clamping plate.

3. Significance

The air permeance of paper may be used as an indirect indicator of variables such as: degree of beating, absorbency (penetration of oil, water, etc.), apparent specific gravity, and filtering efficiency for liquids or gases. Air permeance is influenced by the internal structure and also surface finish. Internal structure is controlled largely by the type and length of fibers, degree of hydration, orientation, and compaction of the fibers; as well as by the type and amount of fillers and sizing. The measurement of air permeance is a useful control test for machine production, but due

6. Calibration

6.1 The flow measuring device can be calibrated using electronic mass flowmeters that have “NIST”-traceable calibration curves. The relationship between the traditional “Sheffield unit” and engineering units (mL/min) is shown in Table 1 (2). When using calibration restrictors, follow the manufacturer’s instructions.

Table 1. Conversion of traditional Sheffield units to engineering units

| <i>Tube #3 (SU)</i> | <i>Flow (mL/min)</i> | <i>Tube #2 (SU)</i> | <i>Flow (mL/min)</i> | <i>Tube #1 (SU)</i> | <i>Flow (mL/min)</i> |
|-------------------------|--------------------------|-------------------------|--------------------------|-------------------------|--------------------------|
| 0 | 0 | 50 | 313 | 160 | 1342 |
| 5 | 35 | 60 | 404 | 180 | 1509 |
| 10 | 70 | 70 | 495 | 200 | 1676 |
| 15 | 104 | 80 | 585 | 220 | 1843 |
| 20 | 139 | 90 | 676 | 240 | 2010 |
| 25 | 174 | 100 | 767 | 260 | 2178 |
| 30 | 209 | 110 | 858 | 280 | 2345 |
| 35 | 244 | 120 | 949 | 300 | 2512 |
| 40 | 278 | 130 | 1039 | 320 | 2679 |
| 45 | 313 | 140 | 1130 | 340 | 2846 |
| 50 | 348 | 150 | 1221 | 360 | 3014 |
| 55 | 383 | 160 | 1312 | 380 | 3181 |
| 60 | 418 | 170 | 1403 | 400 | 3348 |
| | | 180 | 1493 | | |
| | | 190 | 1584 | | |

| Sheffield Tube # | Recommended range Sheffield units (SU) | Conversion to engineering units (mL/minute) |
|---------------------|---|--|
| 3 | 0 - 56 | mL/min = 6.96 (SU) |
| 2 | 56 - 170 | mL/min = 9.08 (SU) - 141 |
| 1 | 170 - 400 | mL/min = 8.36 (SU) + 4 |

mL/min = milliliters per minute referenced to 760 mm Hg and 21°C

6.2 Air pressure calibration can be performed with instruments traceable to the “NIST.” A pneumatic dead-weight tester is typically used.

7. Sampling

To determine conformance to product specifications, select a sample of paper in accordance with TAPPI T 400 “Sampling and Accepting a Single Lot of Paper, Paperboard, Containerboard, or Related Product.”

8. Test specimens

Cut 10 test specimens from each test unit of the sample. A 125-mm (5-in.) square, or larger size is adequate. Each measured area should be free of thin or thick areas atypical of the sheet sample formation, and free of watermarks.

9. Conditioning

Precondition, condition and test the specimens in an atmosphere in accordance with TAPPI T 402 “Standard Conditioning and Testing Atmospheres for Paper, Board, Pulp Handsheets, and Related Products.”

10. Procedure

- 10.1 Calibrate the air flowmeter system in accordance with the manufacturer’s instructions.
- 10.2 Select the appropriate size rubber orifice plates. If using the type where various size inserts fit a master