INTERNATIONAL STANDARD

ISO 5636-5

Second edition
2003-06-01

Paper and board — Determination of air permeance and air resistance (medium range) —

Part 5: Gurley method

Papier et carton — Détermination de la perméabilité à l'air et de la résistance à l'air (valeur moyenne) —
Partie 5: Méthode Gurley

Reference number
ISO 5636-5:2003(E)

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

Contents

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 5636-5 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*, Subcommittee SC 2, *Test methods and quality specifications for paper and board*.

This second edition cancels and replaces the first edition (ISO 5636-5:1986), which has been technically revised.

In this edition, the factor to be used for the calculation of air permeance (10.1) has been changed to 135,3 (from calculation factor 127 in the first edition). The new factor for calculation of air permeance will cause an increase in the level of the result of approximately 7 %. To avoid confusion in trade due to the fact that some laboratories are not aware of this new edition and thus will still use the factor 127, it is important to report the calculation factor used.

ISO 5636 consists of the following parts, under the general title *Paper and board — Determination of air permeance and air resistance (medium range)*:

— *Part 1: General method*

— *Part 2: Schopper method*

— *Part 3: Bendtsen method*

— *Part 4: Sheffield method*

— *Part 5: Gurley method*

Introduction

This part of ISO 5636 describes a method for measuring the air permeance or, if required, the air resistance of paper and board using the measurement principle known as “Gurley”. The air pressure within the cylinder varies slightly according to the displacement of the cylinder, but it has been shown that the variation is about 1,2 % of the mean pressure for 100 ml of displacement and about 4 % for a cylinder with a displacement of 400 ml. Because these variations are within the 5 % limit specified in ISO 5636-1, the apparatus complies with the general requirements detailed in ISO 5636-1 and the air-permeance results may be expressed in micrometres per pascal second [µm/(Pa·s)].

Paper and board — Determination of air permeance and air resistance (medium range) —

Part 5: Gurley method

1 Scope

This part of ISO 5636 specifies the Gurley method of determining the air permeance of paper and board. It is applicable to papers and boards which have air permeances between 0,1 µm/(Pa·s) and 100 µm/(Pa·s). It is unsuitable for rough-surfaced materials, which cannot be securely clamped to avoid leakage.

This method may also be used to determine the air resistance of paper and board.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 48, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD*

ISO 186, *Paper and board — Sampling to determine average quality*

ISO 187, *Paper, board and pulps — Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples*

ISO 385-1, *Laboratory glassware — Burettes — Part 1: General requirements*

ISO 3104, *Petroleum products — Transparent and opaque liquids — Determination of kinematic viscosity and calculation of dynamic viscosity*

ISO 5636-1, *Paper and board — Determination of air permeance (medium range) — Part 1: General method*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
air permeance
mean flow of air through unit area under unit pressure difference in unit time, under specified conditions

NOTE Air permeance is expressed in micrometres per pascal second [1 ml/(m^2·Pa·s) = 1 µm/(Pa·s)].

3.2
air resistance
time required for a specific volume of air under unit pressure to pass through unit area

NOTE Air resistance is expressed in seconds per 100 millilitres [s/(100 ml)].

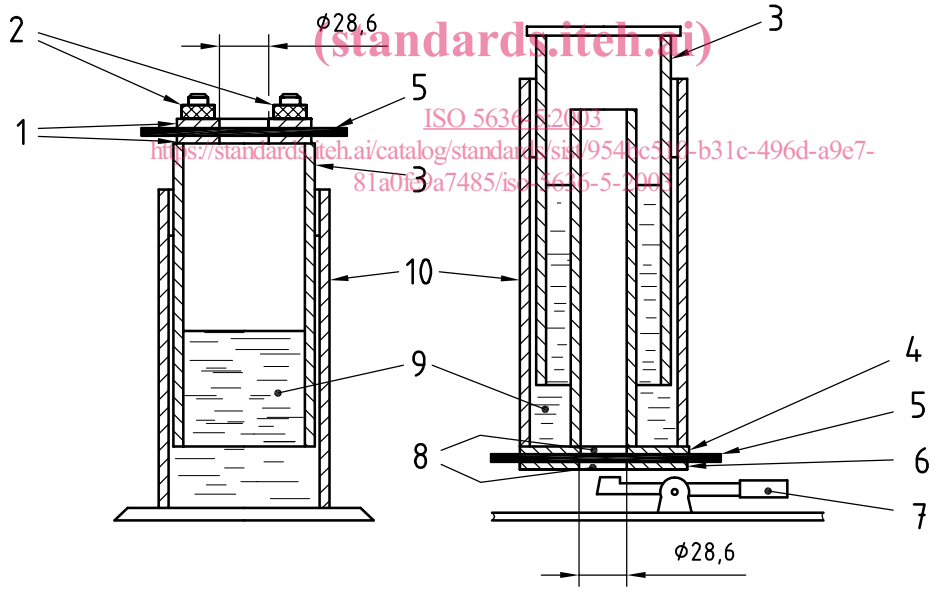
4 Principle

Air is compressed by the weight of a vertical cylinder floating in a liquid. A test piece is in contact with the compressed air and the cylinder falls steadily as air passes through the test piece. The time for a given volume of air to pass through the test piece is measured and from this the air permeance is calculated.

5 Apparatus and materials

5.1 Air-resistance apparatus (Gurley tester), a diagrammatic sketch of which is shown in Figure 1, consisting of an outer cylinder partly filled with sealing fluid, and an inner cylinder, having an open or closed top, sliding freely in the outer cylinder. Air pressure, provided by the weight of the inner cylinder, is applied to the test piece held between clamping plates in a circular orifice. The clamping plates are at the top if the inner cylinder is open, or at the base of the apparatus if the top of the cylinder is closed. The latter arrangement is preferred (see Annex A). An elastic gasket attached to the clamping plate on the side exposed to the air pressure prevents leakage of air between the surface of the paper and the clamping plate.

Dimensions in millimetres



Key

1 clamping plates and gasket
2 knurled nuts
3 inner cylinder mass 567 g
4 gasket
5 test piece
6 clamping plate
7 loading lever
8 holes for egress of air
9 oil
10 outer cylinder

Figure 1 — Diagrammatic sketch of air-resistance (Gurley) apparatus

The gasket consists of a thin, elastic, oil-resistant, non-oxidizing material, having a smooth surface, a thickness of 0,7 mm to 1,0 mm and a hardness of 50 IRHD to 60 IRHD (International Rubber Hardness Degrees) in accordance with ISO 48. The inside diameter of the gasket is about 28,6 mm and the outside diameter is about 34,9 mm. The aperture of the gasket is concentrically aligned with the aperture in the clamping plates. To align and protect the gasket in use, it is cemented to a groove machined in the inner clamping plate. The groove is concentric with the aperture in the opposing plate. Its internal diameter is 28,50 mm ± 0,15 mm and its depth 0,45 mm ± 0,05 mm. Its outside diameter is 35,2 mm ± 0,1 mm for convenience in inserting and attaching the gasket. The gasket when mounted inside the concentric groove defines the measurement area and shall have an inside diameter of 28,6 mm ± 0,1 mm (6,42 cm^2 area). The gasket should be changed at regular intervals.

The outer cylinder has a height of 254 mm and an internal diameter of 82,6 mm. The inner surface has three or four bars, not less than 190 mm and not greater than 245,5 mm in length, and 2,4 mm square or 2,4 mm diameter, spaced equidistantly to serve as guides for the inner cylinder.

The inner cylinder is made of aluminium alloy, is graduated in units of 50 ml and has a full-scale reading of at least 300 ml. Some cylinders may have 25 ml graduations between 0 ml and 100 ml markings. The scale markings represent true volumes enclosed within the inner cylinder and, in most instruments, are accurate to within 0,5 %. The exact volume of the inner cylinder may be checked by means of the procedure given in Annex B. The cylinder has a height of 254 mm ± 0,5 mm, an external diameter of 76,2 mm ± 0,5 mm and an internal diameter about 74 mm such that the mass of the cylinder assembly is 567 g ± 0,5 g.

The volumes referred to are nominal volumes and should, in principle, be increased by the volume of fluid displaced by the walls of the inner cylinder during the test; in practice, since this error is common to all instruments of this type, it is ignored. For one instrument, the actual volume delivered between the 100 ml and 200 ml marks was measured to be 106 ml.

5.2 Sealing fluid, oil having a density of 860 kg/m^3 ± 30 kg/m^3 (0,86 g/cm^3 ± 0,03 g/cm^3), a viscosity of 16 cP to 19 cP at 20 °C in accordance with ISO 3104, and a flash point of at least 135 °C. (The change in specification of the oil viscosity from that of a kinematic viscosity of 10 mm^2/s to 13 mm^2/s at 38 °C is based on the typical physical properties of lightweight paraffin oils.)

5.3 Ancillary equipment, stopwatch, or electric timer to be accurate to within 0,5 % at all levels and capable of being read to the nearest 0,2 s.

6 Sampling

Sampling is not included in this International Standard. If the mean quality of a lot is to be determined, sampling shall be in accordance with ISO 186. If the tests are made on another type of sample, make sure that the test pieces taken are representative of the sample received.

7 Conditioning

Condition the sample in accordance with ISO 187.

8 Preparation of test pieces

One test piece cut from each of ten specimens is normally sufficient (but see 10.3).

Where the clamping plates of the apparatus are at the top of the inner cylinder, a convenient test-piece size is 50 mm × 120 mm; for apparatus having the clamp in the base, a 50 mm square is adequate.