

Methods of test for

Filter papers

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Committees responsible for this British Standard

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- British Laboratory Ware Association
- British Paper and Board Industry Federation
- Ministry of Defence
- Motor Industry Research Association

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Foreword

This British Standard has been prepared under the direction of the Paper and Printing Standards Policy Committee. It revises clauses **3, 7, 8, 12, 14, 17, 20, 21, 23, 25, 29** and **32** and Appendix A and Table 1 of the 1984 edition and adds methods for the determination of acid solubility. Figure 2 and Figure 9 of the 1984 edition have also been revised and new Figure 5, Figure 13, Figure 14 and Figure 15 added. It supersedes BS 6410:1984, which is withdrawn.

The methods described in this standard do not cover all the desired fields and further methods may be added to future revisions of this standard.

Appropriate precautions are necessary to ensure the safety of personnel carrying out the tests in this standard. In particular, it is essential that suitable safety precautions are taken when curing resin-treated filter papers.

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations. In particular attention is drawn to the provisions of the Health and Safety at Work etc. Act 1974.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 32, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

Section 1. General

1 Scope

This British Standard describes methods of test for filter papers made by the papermaking process.

NOTE 1 Some of the test methods may also apply to filter media made by other processes.

NOTE 2 Appendix A gives further information on the types of filter paper to which these test methods are applicable.

NOTE 3 The titles of the publications referred to in this standard are listed on page 32.

2 Definitions

For the purposes of this British Standard, the following definitions apply.

2.1

filter paper

a paper, made by a papermaking process, of organic and/or inorganic fibrous composition intended to provide selective retention of solid particles or liquid droplets from a fluid suspension

2.2

corrugation depth

the difference between the thickness measured across the corrugations and that measured in the valleys of the corrugations

2.3

grammage

the mass of a unit area of paper (see clause 6)

2.4

total resin content

the difference, expressed in g/m^2 , between the oven dry grammages of an unimpregnated sample and an impregnated sample

2.5

extractable resin content

the quantity of resin, expressed in g/m^2 , that can be extracted from the treated paper by a solvent

2.6

equivalent pore diameter

the diameter of a capillary of constant circular cross section that requires the same air pressure to force a wetting liquid from it as from the paper pore

2.7

maximum equivalent pore diameter

the equivalent pore diameter at which air just starts to flow through the filter paper under the conditions defined in the method of test (see clause 14)

2.8

minimum equivalent pore diameter

the equivalent pore diameter at which all liquid has just been removed from the smallest pores

2.9

tensile strength

the maximum tensile force that a test piece will withstand before it breaks under the conditions defined in the method of test (see clause 18)

2.10

tearing resistance

the mean force required to continue the tearing of an initial cut in a single sheet of paper

2.11

bursting strength

the maximum uniformly distributed pressure, applied at right angles to its surface, that a test piece will withstand before it fails under the conditions defined in the method of test (see clause 20)

2.12

flexibility

the downward deflection under load, expressed in mm/g, of a test strip supported as described in the method of test (see 23.2)

2.13

brittleness

the percentage loss in tensile strength after creasing

2.14

air flow resistance

the resistance offered by a paper to the passage of air

2.15

media migration

the contamination of a filtrate by particles or fibres shed by the filter paper during use

2.16

water resistance

the hydrostatic head supported by a filter paper at which penetration of water first occurs

2.17

water filtration time

the time, in s, for 100 cm^3 of clean, prefiltered, de-aerated water to pass through the filter under a constant hydrostatic head

2.18

choking life

the time after which a filter fails to perform at an acceptable filtration rate and/or pressure differential

2.19**flammability**

the ability of a filter paper to retard the spread of flame when ignited and to be self-extinguishing when the source of ignition is removed

2.20**afterflame time (flaming time)**

the length of time for which the test piece continues to flame under specified test conditions after the burner flame has been removed

2.21**afterglow time (glowing time)**

the length of time for which the test piece continues to glow under specified test conditions after it has ceased to flame

2.22**retentivity to particles in liquids**

the particle size, in μm , at which a retention level of 98 % of the total number of particles challenging the filter paper is obtained

3 Sampling and pretreatment of test pieces**3.1 Sampling**

Sampling shall be in accordance with BS 3430, except where modified by individual testing methods.

3.2 Pretreatment of test pieces

WARNING. Some resin-treated filter papers will evolve toxic or inflammable fumes during curing. It is essential that suitable safety precautions are taken.

Unless otherwise specified in a particular test method, the resin in resin-treated filter papers shall be cured before commencing the test.

NOTE Curing may be carried out by exposure to high temperature for a period, e.g. 150 °C for 10 min, or to high humidity or to ultraviolet light. The curing method used depends on the resin involved.

4 Conditioning of test pieces

Where specified in the test method, test pieces shall be conditioned at 50 ± 2 % r.h. and a temperature of 23 ± 1 °C, in accordance with BS 3431.

5 Test report

In addition to the test reports required by individual methods, the following shall be reported:

- a) precise identification of the samples;
- b) pretreatment conditions used;
- c) conditioning atmosphere used;
- d) reference to the clauses of this British Standard detailing the test methods applied;
- e) the mean results of the applied tests;
- f) if required, the range or standard deviation of results of the applied tests;
- g) details of any departure from the method of test and any circumstances or influences that may have affected the results;
- h) details of any deviations from the sampling procedure of 3.1.

Section 2. Test methods for general and structural properties

6 Grammage

Use the method of test described in BS 3432, except that for test pieces taken from narrow coils, instead of using the nominal width, measure the width to an accuracy of $\pm 1\%$.

NOTE 1 The test piece may be in the "as taken", "after conditioning" (see clause 4) or "oven-dry" (see note 2) condition, and the condition should be reported.

NOTE 2 If the filter paper has been treated with a resin, it is recommended that the grammage (see 2.3) be measured in the oven-dry condition after curing the resin (see 3.2). Other times and temperatures may be agreed between the parties concerned.

7 Thickness

Use the method of test described in BS 3983 but, because filter papers are more compressible than other papers, reduce the applied load or increase the test area.

An applied load of 100 kPa or 50 kPa may cause excessive compression of the test piece. For low-density filter papers, especially those of types 3 and 4 (see Appendix A), it is recommended that an applied pressure of 10 ± 1 kPa over an area of 200 mm² is used. Other loads or test areas may be used, as agreed between the parties concerned.

NOTE 1 The use of grammage and thickness to calculate apparent density may not be reliable for filter papers because of their more compressible nature.

NOTE 2 The precision micrometer may be of the hand-operated mechanical type or the automatic digital readout type, but it may be difficult to obtain consistent loading conditions with the hand-operated type.

8 Corrugation depth

8.1 Principle

The thickness across the corrugations and that in the valleys of the corrugations is measured and the depth of the corrugations (see 2.2) is calculated.

8.2 Apparatus

8.2.1 *Precision micrometer*, in accordance with BS 907. The micrometer shall be fitted with a pressure foot as shown in Figure 1 or Figure 2 and shall have a maximum plunger load of 50 g.

8.3 Procedure

Cure resin-treated filter papers before commencing the test (see 3.2). Measure across the tops of the corrugations at a minimum of 10 positions wire side up and 10 positions wire side down. Repeat the measurements in the valleys of the corrugations at positions along a line parallel to the first set of measurements.

8.4 Calculation of results

Calculate the corrugation depth by taking the difference between the mean values of the two sets of measurements.

9 Moisture (volatile) content

Use the method of test described in BS 3433, but, for resin-treated filter papers, use a temperature of 105 ± 2 °C or 150 ± 5 °C.

NOTE This method does not distinguish between water and any other matter that may be volatile at the drying temperature.

10 Ash

WARNING. The combustion of some kinds of fibre and resins produces toxic fumes. It is essential that suitable safety precautions are taken.

Use the method of test described in BS 3631, but vary the ashing temperature from that given in that standard.

NOTE 1 An ashing temperature of 900 ± 25 °C is recommended, but another temperature may be used if appropriate and should be reported.

Condition each test piece in accordance with clause 4 of this standard. Cure resin-treated filter papers in accordance with 3.2 of this standard.

NOTE 2 The results obtained will include any residue from impregnants.

11 Ignition loss

WARNING. The combustion of some kinds of fibre and resins produces toxic fumes. It is essential that suitable safety precautions are taken.

Use the method of test described in BS 3631 to determine the ignition loss of filter papers containing a substantial proportion of inorganic fibres, but reduce the furnace temperature to 450 ± 25 °C. Report the ignition loss as a percentage of the mass of the test piece.

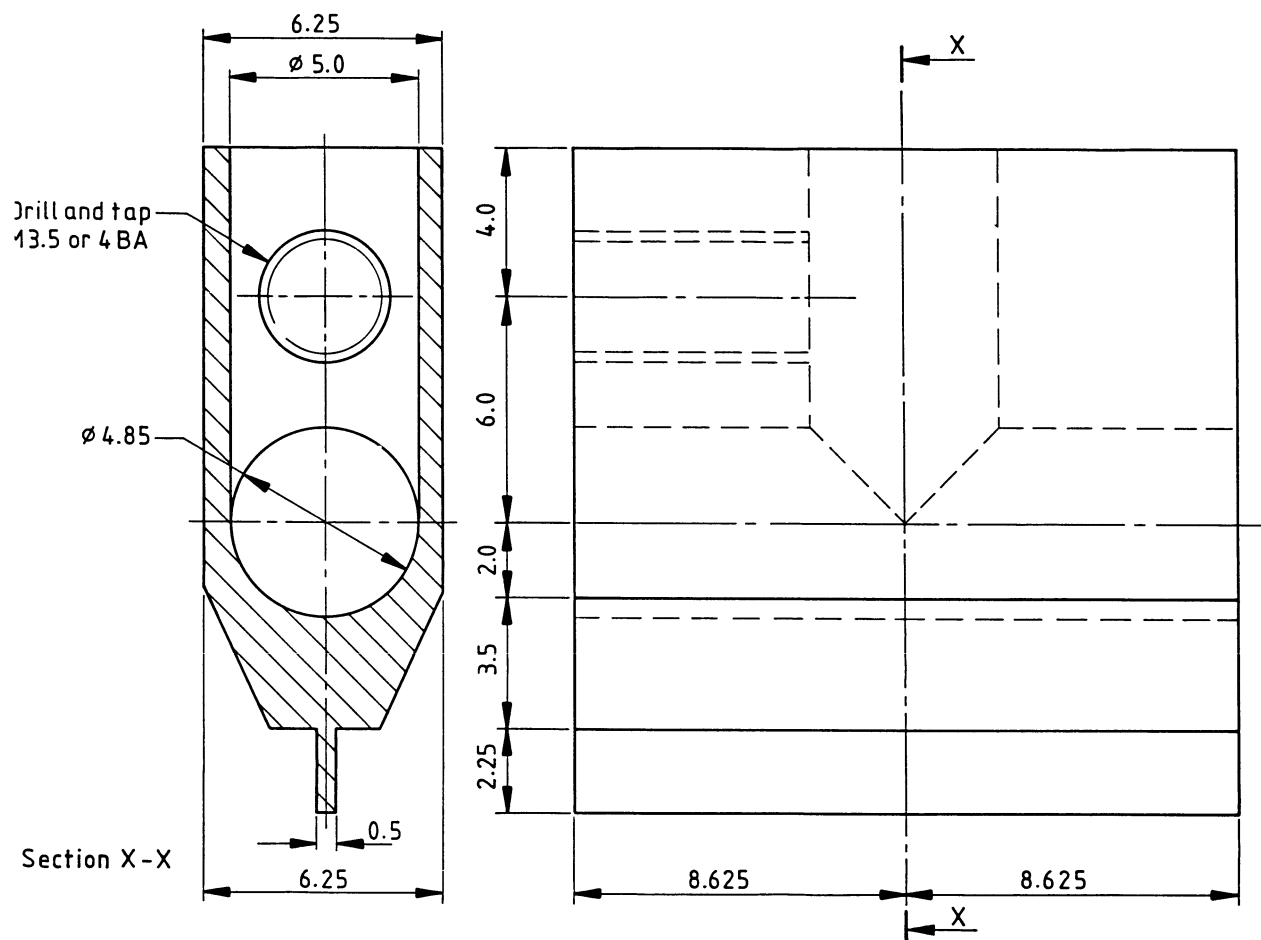
12 Resin content

WARNING. It is essential that suitable safety precautions are taken when working with solvents and resin systems. In particular, the following points should be observed:

- solvent extraction should be carried out in a fume cupboard;
- solvent trays should be covered;
- excess solvent should be blotted off test pieces before they are transferred to the oven;
- a flameproof oven should be used.

12.1 General

These methods apply to filter papers treated with substantial quantities of thermoplastic or thermosetting resins, e.g. a phenol formaldehyde resin.



All dimensions are in millimetres.

Figure 1 — Pressure foot for micrometer

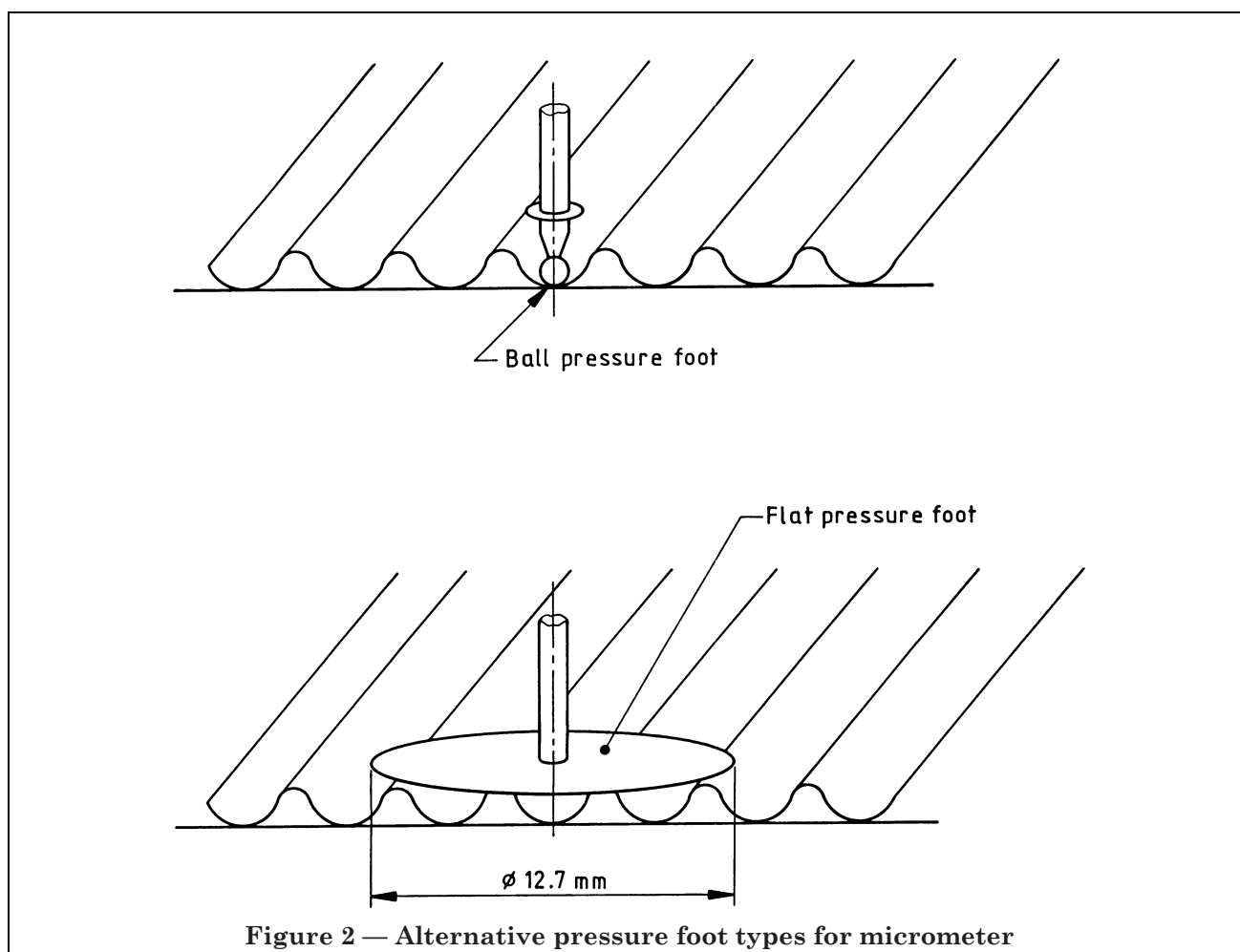


Figure 2 — Alternative pressure foot types for micrometer

NOTE Certain types of filter papers are treated during manufacture to increase their wet strength by the addition of a small quantity of a melamine formaldehyde resin, a polyamide resin or some similar material. If nitrogenous, these agents may be detected and estimated by the procedures given in BS 4497.

12.2 Total resin content

12.2.1 Principle

The oven-dry mass of test pieces of unimpregnated and impregnated filter paper is measured and the total resin content (see 2.4) is calculated.

NOTE The procedure may only be applied if representative samples of both the impregnated and unimpregnated filter paper are available.

12.2.2 Apparatus

12.2.2.1 Oven, flameproof and capable of maintaining a temperature of $150 \pm 5^\circ\text{C}$.

12.2.2.2 Weighing device, capable of weighing to an accuracy of $\pm 0.01\text{ g}$.

12.2.3 Procedure

Dry test pieces of impregnated and unimpregnated paper of known area at $150 \pm 5^\circ\text{C}$ in an oven until constant mass is achieved.

Repeat the procedure with a second set of test pieces of impregnated and unimpregnated paper.

12.2.4 Calculation of results

Take the total resin content (in g/m^2) as the difference between the grammage of the impregnated test pieces and the grammage of the unimpregnated test pieces. Calculate the mean of the results.

12.3 Extractable resin content

NOTE Two methods are given here for the determination of extractable resin content (see 2.5). Whilst the method using the Soxhlet apparatus will tend to give higher results, the rapid method may be more suitable for online quality assurance testing where results are required quickly.

12.3.1 Principle

The test piece is treated with a solvent and the quantity of resin that can be extracted is measured.

12.3.2 Apparatus and reagents

12.3.2.1 Soxhlet method

The apparatus shall comprise the following.

- Soxhlet apparatus*, in accordance with BS 2071.
- Acetone*.
- Air stream*.
- Oven*, flameproof and capable of maintaining a temperature of 150 ± 5 °C.
- Weighing device*, capable of weighing to an accuracy of ± 0.005 g.

12.3.2.2 Rapid method

The apparatus shall comprise the following.

- Weighing device*, capable of weighing to an accuracy of ± 0.005 g.
- Methanol*, or the solvent combinations used in the resin system.
- Trays*.
- Timing device*, capable of timing to an accuracy of ± 0.5 min.
- Oven*, flameproof and capable of maintaining a temperature of 150 ± 5 °C.
- Blotting paper*.

12.3.3 Procedure

12.3.3.1 Soxhlet method

Divide a number of test pieces of known area into two sets, A and B. Extract set A in a Soxhlet apparatus with acetone for 4 h at a rate of approximately 10 cycles/h. Expose the extracted test pieces to an air stream to remove the acetone left in the paper. Heat the two sets of test pieces for 10 min at 150 ± 5 °C and weigh each set to the nearest 0.01 g.

Repeat the procedure with two further sets of test pieces.

12.3.3.2 Rapid method

Divide a number of test pieces into two sets, A and B, each not less than 5 g in mass. Weigh both sets to the nearest 0.01 g. Wash set A in methanol or the solvent combinations used in the resin system, using three trays of solvent and for a total time of 10 min. Wash the test pieces in the first tray for 9 min, turning at intervals. Wash the test pieces in the second tray to remove excess solvent/resin and wash in clean solvent in the third tray. Blot the test pieces to remove excess solvent and dry at 150 ± 5 °C for 10 min. Dry set B at 150 ± 5 °C for 10 min. Weigh both sets of test pieces to the nearest 0.01 g.

Repeat the procedure with two further sets of test pieces.

12.3.4 Calculation of results

12.3.4.1 Soxhlet method

Take the extractable resin content (in g/m²) as the difference between the grammage of set A and the grammage of set B.

Calculate the mean of the results.

NOTE The extractable resin content determined by the Soxhlet method will usually be lower than the total resin content by an amount that depends upon the past history of the paper and the type of resin treatment used. However, in exceptional circumstances it may be higher.

12.3.4.2 Rapid method

Calculate the extractable resin content, *ER*, expressed as a percentage, from the following equation:

$$ER = \frac{A_1 B_2 - A_2 B_1}{A_1 B_2} \times 100 \quad (1)$$

where

- ER* is the extractable resin content;
- A*₁ is the mass of set A before extraction (in g);
- A*₂ is the mass of set A after extraction and drying (in g);
- B*₁ is the mass of set B before drying (in g);
- B*₂ is the mass of set B after drying (in g).

Calculate the mean of the results.

NOTE 1 The results may also be expressed in g/m² if the area of the test pieces is determined.

NOTE 2 The rapid method of determining extractable resin content will tend to give lower results than the Soxhlet method.

12.3.5 Test report

The test report shall include a statement giving the method used to measure the extractable resin content.

13 pH value, conductivity, chloride and sulphate contents of aqueous extracts

Use the methods of test described in BS 2924.

14 Pore size

14.1 General

The test determines the size of pores (mean, maximum and equivalent pore diameters, see 2.6, 2.7 and 2.8) that allow the passage of a fluid from one side of the filter paper to the other, designated "flow pores". Non-interconnecting pores are not determined by this method.