BRITISH STANDARD

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Methods of test for

Flexible cellular materials —

Part 4: Method 10. Determination of solvent swelling

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Committees responsible for this British Standard

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British Plastics Federation
British Railways Board
British Rigid Urethane Foam Manufacturers' Association
British Rubber Manufacturers Association
Department of the Environment (Building Research Establishment)
Furniture Industry Research Association
Furniture, Timber and Allied Trades Union
Ministry of Defence
National Bedding Federation
Phenolic Foam Manufacturers Association
RAPRA Technology Ltd.
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Foreword

This part of BS 4443 has been prepared under the direction of the Plastics Standards Committee and the Rubber Standards Committee as a revision of BS 4443-4:1976, which is withdrawn.

It comprises a method of test for the determination of solvent swelling.

Attention is drawn to method 1 of BS EN ISO 1923:1995, BS 4443-1, BS 4443-2 and BS 4443-3.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 3 and a back cover.

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Section 1. General

1 Scope

This Part of BS 4443 describes a method of test that applies to flexible cellular products of polymeric origin: determination of solvent swelling.

Section 2. Method 10. Determination of solvent swelling

2 General

This method measures the volume of swelling of flexible cellular materials when immersed in specified solvents for a given time at a controlled temperature.

Although in some respects swelling tests may simulate service conditions, no direct correlation with service behaviour is implied. The measurement of swelling can provide valuable information on the suitability of the cellular material for use with a given liquid; examples are the resistance of flexible polyurethane cellular material complying with BS 4021 to tetrachloroethylene, and the development of cellular rubbers for oil-resistant applications.

3 Solvent

The solvent shall be tetrachloroethylene or any solvent of analytical reagent quality (see **A.1**).

NOTE In the case of light mineral oils, where differences in aromatic content may arise, a supply of liquid of known composition should be reserved for the complete series of tests.

WARNING. Care should be taken to follow the correct recommended procedures when using toxic and flammable liquids.

4 Test specimen

The test specimen shall be a die-cut 100 mm diameter disc. The thickness T_1 of the test specimen shall be measured in accordance with BS EN ISO 1923 and shall not exceed 10 mm. The presence of skin on the test specimen shall be noted in the test report (see **A.2**) since it may affect the test result.

5 Conditioning and test conditions

Material shall not be tested less than 72 h after manufacture, unless, at either 16 h or 48 h after manufacture, it can be demonstrated that the solvent swelling values obtained do not differ by more than ± 10 % from those obtained after 72 h. Testing is permitted at either 16 h or 48 h if, at the selected time, the above criteria have been satisfied.

Unless otherwise specified the test shall be carried out at 23 ± 2 °C (see **A.3**).

Prior to the test the test specimens shall be stored for at least 16 h under the following standard conditions:

23 ± 2 °C, 50 ± 5 % relative humidity.

NOTE This storage period can form the latter part of the period following manufacture.

6 Procedure

Place the test specimen in a dish approximately 300 mm x 200 mm containing the solvent to a depth of 25 mm to 30 mm. After 5 min, submerge the test specimen by covering it with a 200 mm square of wire gauze with a nominal aperture of 0.25 mm (legs may be formed by bending a 12.5 mm strip on two opposite sides to 90°).

After the test specimen has been in contact with the solvent for a total of 30 min, remove the wire gauze and lift the test specimen from the solvent by means of a flat wire gauze scoop consisting of a 175 mm square of wire gauze with a nominal aperture of 0.25 mm and fitted with a wire frame and handle. Secure the scoop at an angle of 45° and allow the test specimen to drain for 5 min.

Cover the test specimen with a 150 mm square of 6 mm plate glass, the thickness T_4 of which has been measured in accordance with BS EN ISO 1923. Invert the glass, test specimen and scoop and, after removing the scoop, remeasure the diameter D_2 of the test specimen and the thickness T_2 of the test specimen with the glass plate in accordance with BS EN ISO 1923.

Allow the test specimen to stand at room temperature for 24 h or until it is completely free from solvent, whichever is the longer period. If possible, dry the test specimen in a fume cupboard without forced extraction.

Measure the diameter $D3$ and thickness $T3$ in accordance with BS EN ISO 1923.

7 Calculation of results

7.1 Temporary swelling

Calculate the percentage temporary swelling P_t from the following equation:

$$P_t = \left\{ \frac{D_2^2(T_2-T_4) - D_1^2 T_1}{D_1^2 T_1} \right\} \times 100$$

where

D_1 is the original diameter of test specimen (in mm);

D_2 is the diameter of test specimen soaked in solvent (in mm);

T_1 is the original thickness of test specimen (in mm);

T_2 is the thickness of test specimen soaked in solvent plus plate glass (in mm);

T_4 is the thickness of plate glass (in mm).

7.2 Permanent swelling

Calculate the percentage permanent swelling P_p from the following equation:

$$P_p = \left\{ \frac{D_3^2 T_3 - D_1^2 T_1}{D_1^2 T_1} \right\} \times 100$$

where

D_3 is the final diameter (in mm);

T_3 is the final thickness (in mm).

8 Test report

The report shall include the following information:

a) a description of the material including the test specimen thickness;

b) the solvent used for swelling if other than tetrachloroethylene;

c) the test conditions;

d) the location of skin if present;

e) the value of the percentage temporary swelling, expressed as a percentage;

f) the value of the percentage permanent swelling, expressed as a percentage;

g) the method used, i.e. method 10 of BS 4443-4:1989.

Section 3. Method 11. Humidity ageing at an elevated temperature

Section 3 superseded by BS EN ISO 2440:1998.

Section 4. Method 12. Heat ageing

Section 4 superseded by BS EN ISO 2440:1998.

Appendix A Details to be agreed between purchaser and supplier

A.1 The solvent to be used if not tetrachlorethylene (see clause **3**).

A.2 Whether or not the test specimen used in method 10 is to have the surface skin included (see clause **4**).

A.3 The temperature and humidity conditions for the determination of solvent swelling (see clause **5**).

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