BRITISH STANDARD

BS 7431:1991
ISO 9808:1990

Method for

Assessing solar water heaters — Elastomeric materials for absorbers, connecting pipes and fittings

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Refrigeration Heating and Air Conditioning Standards Policy Committee (RHE/-) to Technical Committee RHE/25, upon which the following bodies were represented:

Association for Consumer Research (ACRE)
Association of Consulting Engineers
British Gas plc
British Precast Concrete Federation Ltd
Chartered Institution of Building Services Engineers
Copper Development Association
Cranfield Institute of Technology
Department of the Environment
Department of the Environment (Building Research Establishment)
Design Council
Institution of Gas Engineers
International Solar Energy Society
National Centre for Alternative Technology
Royal Institute of British Architects
Solar Trade Association
Swimming Pool and Allied Trades Association Ltd
University College Cardiff
Water Byelaws Advisory Service

This British Standard, having been prepared under the direction of the Refrigeration Heating and Air Conditioning Standards Policy Committee, was published under the authority of the Standards Board and comes into effect on 29 March 1991

The following BSI references relate to the work on this standard:
Committee reference RHE/25
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Amendments issued since publication

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Contents

National foreword

This British Standard has been prepared under the direction of the Refrigeration Heating and Air Conditioning Standards Policy Committee and implements a corresponding International Standard in the development of which the UK has played an active part.

This British Standard is identical with ISO 9808:1990 "*Solar water heaters — Elastomeric materials for absorbers, connecting pipes and fittings — Method of assessment*", published by the International Organization for Standardization (ISO) and prepared by Technical Committee ISO/TC 180, Solar heating.

Cross-references

International Standard	Corresponding British Standard
	BS 903 *Methods of testing vulcanized rubber*
ISO 48:1979	Part A26:1969 *Determination of hardness* (Technically equivalent)
ISO 188:1982	Part A19:1986 *Heat resistance and accelerated ageing tests* (Identical)
ISO 471:1983	Part A35:1985 *Temperatures, humidities and times for conditioning and testing of test pieces* (Identical)
	BS 5173 *Methods of test for rubber and plastics hoses and hose assemblies*
ISO 1402:1984	Section 102.1:1985 *Hydrostatic tests* (Identical)
ISO 1431-1:1989	Part A43:1990 *Determination of resistance to ozone cracking (static strain test)* (Identical)
ISO 1653:1975	Part A39:1980 *Determination of compression set under constant deflection at low temperatures* (Identical)
ISO 1817:1985	Part A16:1987 *Determination of the effect of liquids* (Identical)
ISO 4661-1:1986	Part A36:1987 *Preparation of samples and test pieces* (Identical)
	BS 5173 *Methods of test for rubber and plastics hoses and hose assemblies*
ISO 7326:1984	Section 106.3:1986 *Determination of ozone resistance* (Identical)

The Technical Committee has reviewed the provisions of ISO 4632-1 to which reference is made in the text, and has decided that they are acceptable for use in conjunction with this standard. Related British Standards to ISO 34-1[1)] and ISO 4632-1 are BS 903-A3:1982 and BS 5176:1975 respectively.

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.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 4, 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.

[1)] In preparation.

1 Scope

This International Standard specifies a means of assessing elastomeric materials for use in the manufacture of absorbers, connecting piping and fittings for use in solar water heaters.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 34-1:—, *Rubber, vulcanized — Determination of tear strength — Part 1: Trouser, angle and crescent test pieces*[2)].

ISO 37:1977, *Rubber, vulcanized — Determination of tensile stress-strain properties.*

ISO 48:1979, *Vulcanized rubbers — Determination of hardness (Hardness between 30 and 85 IRHD).*

ISO 188:1982, *Rubber, vulcanized — Accelerated ageing or heat-resistance tests.*

ISO 471:1983, *Rubber — Standard temperatures, humidities and times for the conditioning and testing of test pieces.*

ISO 1402:1984, *Rubber and plastics hoses and hose assemblies — Hydrostatic testing.*

ISO 1431-1:1989, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static strain test.*

ISO 1653:1975, *Vulcanized rubbers — Determination of compression set under constant deflection at low temperatures.*

ISO 1817:1985, *Rubber, vulcanized — Determination of the effect of liquids.*

ISO 4661-1:1986, *Rubber, vulcanized — Preparation of samples and test pieces — Part 1: Physical tests.*

ISO 7326:1984, *Rubber and plastics hoses — Assessment of ozone resistance under static conditions.*

3 Test pieces

The test pieces shall be as specified in the relevant test method.

The test pieces required for the tests specified in **4.3** and **4.7** should preferably be cut from samples of the finished product. Where this is not practicable test pieces may be cut from sheet material.

If it is required to separate a section of fluid passage from a finished absorber, the test piece shall be prepared in accordance with ISO 4661-1.

4 Qualification tests

4.1 Hardness

Hardness shall preferably be tested using the normal test set out in ISO 48.

The test may also be performed using the micro-test set out in ISO 48, on a test piece of thickness not less than 2 mm, but it should be noted that the two methods may give a different result on a particular test piece. In case of doubt, the results of the normal test shall be considered as definitive.

4.2 Compression set at low temperature

Compression set shall be tested in accordance with ISO 1653, using a small-type test piece maintained under a compression of 25 % for 24 h at a temperature of – 40 °C.

4.3 Resistance to ozone

Resistance to ozone shall be tested in accordance with ISO 1431-1, procedure A, for test pieces other than hose or absorber fluid passages.

The test period shall be 7 days, and the ozone concentration shall be 200 pphm ± 20 pphm. The temperature of test shall be 40 °C ± 2 °C and the elongation of the test piece shall be 20 %.

For hose or absorber fluid passages, the test shall be carried out in accordance with ISO 7326.

4.4 Tear strength

Tear strength shall be tested in accordance with ISO 34-1, method C, using a crescent test piece.

4.5 Tensile strength

Tensile strength shall be tested in accordance with ISO 37, using a type 2 dumb-bell test piece.

[2)] To be published.

4.6 Elongation at break

Elongation at break shall be tested in accordance with ISO 37, using a type 2 dumb-bell test piece.

4.7 Burst pressure

Burst pressure of hose or absorber fluid passages shall be tested in accordance with the relevant requirements of ISO 1402. The test piece shall be at least 450 mm long for items of internal diameter 76 mm or smaller, and at least 600 mm long for larger items.

NOTE 1 Burst pressure tests carried out at ambient temperature cannot be taken as indicative of the burst pressure at elevated temperatures.

5 Ageing tests

5.1 Artificial ageing

The test pieces required for the tests specified in **5.2** shall be subjected to an ageing test in an air-oven in accordance with ISO 188, for a period of 14 days at a test temperature related to the maximum service temperature as listed in Table 1.

Upon being removed from the oven, the test pieces shall be conditioned for 24 h in a standard atmosphere at 23 °C and 50 % humidity, in accordance with ISO 471.

Table 1 — Test temperature for ageing tests

Type[a]	Test temperature[b] °C	Maximum service temperature °C
B	100	70
C	125	100
D	150	125
E	175	150
F	200	175
G	225	200
H	250	225

[a] Type (heat resistance) classification in accordance with ISO 4632-1:1982, *Rubber, vulcanized — Classification — Part 1: Description of the classification system*.

[b] The test temperatures are one step higher than the maximum service temperature to which the material may be subjected.

5.2 Properties after ageing

The following properties of the material shall be determined upon completion of the artificial ageing:

a) hardness, in accordance with **4.1**;

b) resistance to ozone, in accordance with **4.3**;

c) tensile strength, in accordance with **4.5**;

d) elongation at break, in accordance with **4.6**;

e) burst pressure, in accordance with **4.7**.

6 Immersion in heat-exchange fluids

6.1 Immersion in propylene glycol

If the material is to be used in conjunction with propylene glycol, the test pieces required for the tests specified in **6.3** shall be immersed in propylene glycol at the appropriate test temperature given in Table 1 for a period of 7 days in accordance with ISO 1817:1985, clause **11**.

6.2 Immersion in other heat-exchange fluids

If the material is to be used in conjunction with a heat-exchange fluid other than propylene glycol, the immersion shall be performed using the heat-exchange fluid proposed. The test pieces required for the tests specified in **6.3** shall be immersed in the heat-exchange fluid at the appropriate test temperature given in Table 1 for a period of 7 days in accordance with ISO 1817:1985, clause **11**.

6.3 Properties after immersion

The following properties of the material shall be determined upon completion of the immersion specified in **6.1** or, if appropriate, **6.2**:

a) hardness, in accordance with **4.1**;

b) tensile strength, in accordance with **4.5**;

c) elongation at break, in accordance with **4.6**;

d) burst pressure, in accordance with **4.7**.

7 Test report

The results of the tests described in clauses **4**, **5** and **6** shall be presented as shown in Table 2.

Table 2 — Test report

Property of material	Results[a]			
	Qualification test (clause **4**)	**After ageing** (clause **5**)	**After immersion in propylene glycol** (clause **6**)	**After immersion in other fluid (to be specified)** (clause **6**)
Hardness [IRHD[b]]				
Tensile strength (MPa)				
Elongation at break (%)				
Burst pressure of hose (MPa)				
Compression set at low temperature (%)		NR	NR	NR
Resistance to ozone (condition of test piece and any cracking)			NR	NR
Tear strength — crescent test piece (kN/m)		NR	NR	NR

[a] NR, not required.
[b] IRHD, International Rubber Hardness Degrees.

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Publication(s) referred to

See national foreword.

BSI — British Standards Institution

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Revisions

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