BRITISH STANDARD

BS 2751:2001
Incorporating Corrigendum No. 1

General purpose acrylonitrile-butadiene rubber compounds — Specification

ICS 83.060

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by the Materials and Chemicals Sector Policy and Strategy Committee (I/-) to Technical Committee PRI/54, Vulcanized Rubber Compounds, upon which the following bodies were represented:

British Rubber Manufacturers' Association
Chemical Industries' Association
RAPRA Technology Ltd.
Tun Abdul Razak Research Centre

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Contents

Foreword

This British Standard has been prepared under the direction of the Materials and Chemicals Sector Policy and Strategy Committee. It supersedes BS 2751:1990 which is withdrawn.

This new edition of BS 2751 incorporates technical changes only. It does not reflect a full review or revision of the standard, which will be undertaken in due course. Technically, new requirements for resistance to accelerated ageing, change in hardness degrees, maximum change in tensile strength and maximum change in elongation at break have been included. BS 903-A6 type 1 test piece has been replaced by type B test piece in the present standard.

Other British Standards in this group for rubber compounds are as follows.

BS 1154:1992, *Specification for natural rubber compounds*.

BS 1155:1992, *Specification for natural rubber compounds for extrusion*.

BS 2752:1990, *Specification for chloroprene rubber compounds*.

BS 3227:1990, *Specification for butyl rubber compounds (including halobutyl compounds)*.

BS 6014:1991, *Specification for ethylene propylene rubber compounds*.

BS 6996:1989, *Specification for mineral oil resistant acrylonitrile-butadiene rubber compounds*.

The following British Standards are also relevant to this standard.

BS 3558-1:1997, *Glossary of rubber terms — Part 1: International terms*.

BS 3558-2:2001, *Glossary of rubber terms — Part 2: Additional British terms*.

BS 3734-1:1997, *Rubber — Tolerances for products — Part 1: Dimensional tolerances*.

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Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 6, an inside back cover and a back cover.

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1 Scope

This British Standard specifies compositional and physical property requirements for general purpose acrylonitrile-butadiene rubber compounds of hardness range 40 IRHD to 90 IRHD, designated BA40, BA50, BA60, BA70, BA80, BA90, and for an electrical grade acrylonitrile-butadiene rubber compound, of hardness 60 IRHD, designated E.

These compounds are intended for the manufacture of items in the form of extrusions, mouldings, sheet and items cut or punched from sheet in which resistance to certain organic liquids is a necessary property, and where some stiffening of the harder grades at temperatures below −20 °C can be tolerated.

NOTE 1 Compounds in the BA series may not have good electrical insulating properties whereas the compound designated E is available with specific electrical properties.

NOTE 2 Ozone, which is naturally present in the atmosphere, can cause unprotected nitrile rubber to crack when it is strained, and this can often lead to failure of the part. The nitrile rubber compounds specified in this standard are not required to be compounded to be resistant to ozone attack and their resistance to ozone is not tested. Potential users should seek technical advice if they are unsure as to whether ozone resistance is required for their application. There is currently no British Standard for ozone resistant nitrile rubber compounds.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this British Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. For undated references, the latest edition of the publication referred to applies.

BS 903-A1:1996, *Physical testing of rubber — Part A1: Determination of density.*

BS 903-A2:1995, *Physical testing of rubber — Part A2: Method of determination of tensile stress-strain properties.*

BS 903-A6:1992, *Physical testing of rubber — Part A6: Method of determination of compression set at ambient, elevated or low temperatures.*

BS 903-A13:1990, *Physical testing of rubber — Part A13: Method of determination of stiffness at low temperature (Gehman test).*

BS 903-A16:1999, *Rubber, vulcanized — Determination of the effect of liquids.*

BS 903-A19:1998, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests.*

BS 903:A26:1995, *Physical testing of rubber — Part A26: Method for determination of hardness (hardness between 10 IRHD and 100 IRHD).*

BS 903:A37:1997, *Physical testing of rubber — Part A37: Determination of tendency to adhere to and to corrode metals.*

BS 903-C1:1991, *Methods of testing vulcanized rubber — Part C1: Determination of surface resistivity.*

BS 903-C2:1982, *Methods of testing vulcanized rubber — Part C2: Determination of volume resistivity.*

BS 3574, *Specification for controlled storage and packaging of vulcanized rubber and rubber products.*

BS EN 60243-2:2001, *Electric strength of insulating materials — Test methods — Part 2: Additional requirements for tests using direct voltage.*

3 Classification

Compounds shall be classified according to their vulcanized hardness, in international rubber hardness degrees (IRHD), and designated by grade as shown in Table 1.

Table 1 — Compound classification

Grade designation	Hardness after vulcanization (IRHD)
BA40	$40\ ^{+5}_{-4}$
BA50	$50\ ^{+5}_{-4}$
BA60	$60\ ^{+5}_{-4}$
BA70	$70\ ^{+5}_{-4}$
BA80	$80\ ^{+5}_{-4}$
BA90	$90\ ^{+5}_{-4}$
E (electrical)	$60\ ^{+5}_{-4}$

4 Composition

The compounds shall be based on acrylonitrile-butadiene copolymer reinforced only with carbon black, vulcanized with sulphur/organic accelerator, activated with not less than 4 parts per hundred of rubber by mass (p.h.r.) of zinc oxide. At least 2 p.h.r. of an antioxidant shall be incorporated in the mix.

No factice or other extender, or reclaimed or ground vulcanized rubber shall be used. Natural rubber may be used to produce a "building tack" if necessary but it shall not exceed 10 p.h.r.

All ingredients of the mix shall be free from grit and extraneous material.

NOTE Chemical analysis may be carried out on either two-thickness sample sheets or sample items, as practicable, to verify that the composition of the mix complies with this clause. The methods described in BS 7164 Parts 2.2, 3, 5, 7.1, 13 and 14; BS 4181 Part 1 and BS 5923 Part 2 should be used where relevant.

5 Preparation of test sheet

From each batch of rubber mix, a two-thickness test sheet of the following dimensions shall be prepared for testing.

The sheet shall be approximately 250 mm square with a thicker section along one side 35 mm to 50 mm wide and 6.30 ± 0.15 mm thick. The remainder of the sheet shall be 2.00 ± 0.15 mm thick. The thicker sections of the sheet shall not be additionally vulcanized.

If part of the 6.3 mm section is moulded in the form of cylindrical buttons complying with the type B test piece defined in BS 903-A6 for the purpose of compression set tests, the mould cavities shall be individually charged with pellets and not by the flow of the excess rubber from the remainder of the mould. The minimum number of buttons moulded shall be nine and they shall be in a group at one end of the 6.3 mm section.

6 Physical properties of the vulcanized test sheet

Test pieces cut from the test sheet (see clause **5**) shall comply with the relevant requirements given in Table 2 when tested by the methods specified in Table 2.

NOTE Guidance for the preparation and testing of rubber products is given in Annex A.

7 Marking

The compound, as sheet or items, shall be accompanied by the following information (see also BS 3574):

a) number and date of this British Standard, i.e. BS 2751:2001[1)], and grade designation;

b) quarter and year of cure;

c) manufacturer's identity or trade mark;

d) manufacturer's batch number or similar means of production identity.

[1)] Marking BS 2751:2001 on or in relation to a product represents a manufacturer's declaration of comformity, i.e. a claim by or on behalf of the manufacturer that the product meets the requirements of the standard. The accuracy of the claim is therefore solely the responsibility of the person making the claim. Such a declaration is not to be confused with third party certification, which may also be desirable.

Table 2 — Physical properties of two-thickness test sheets

Physical property	Grade designation							Test method in BS 903 and type of test piece where appropriate
	BA40	BA50	BA60	BA70	BA80	BA90	E	
Hardness after vulcanization (IRHD)	40 $^{+5}_{-4}$	50 $^{+5}_{-4}$	60 $^{+5}_{-4}$	70 $^{+5}_{-4}$	80 $^{+5}_{-4}$	90 $^{+5}_{-4}$	60 $^{+5}_{-4}$	Part A26, method N, two plies, 6.30 mm and 2.00 mm, with the thicker ply on top
Density (Mg/m^3)	Agreed value ± 0.02[a]							Part A1, method A
Minimum tensile strength (MPa) Minimum elongation at break (%)	7.0 600	7.5 450	8.5 400	12.5 250	12.5 150	12.5 100	8.5 400	Part A2, type 2 dumb-bells
Maximum compression set (%)	30	25	20	20	20	25	20	Part A6, type B test piece, lubricated, 24 $^{+0}_{-2}$ h at 70 ± 1 °C
Resistance to liquids Volume change (%) after immersion in liquid B	−0 +30	−0 +30	−0 +25	−0 +25	−0 +25	−0 +25	−0 +25	Part A16, 24 $^{+0}_{-2}$ h at 40 ± 1 °C
Resistance to low temperature Temperature in °C at which the stiffness shall not exceed 70 MPa	−30	−25	−25	−20	−15	−10	−25	Part A13, using ethyl alcohol/CO_2 cooling medium
Resistance to accelerated ageing Change in hardness degrees (IRHD) Maximum change in tensile strength (% of original value) Maximum change in elongation at break (% of original value)	 −0 +10 −10 −35	 −0 +10 −10 −35	 −0 +10 −10 −35	 −0 +10 −10 −35	 −0 +10 −10 −35			Part A19, air-oven method A, 168 ± 2 h, 70 ± 1 °C Part A26, method N, measurement before and after ageing on the same 2 plies each 2.00 mm thick Part A2, type 2 dumb-bells
Minimum surface resistivity (Ω) Minimum volume resistivity (Ω·cm)	No requirement						5×10^9 2×10^9	Part C1 Part C2
Minimum electric strength (kV per 2.5 mm)							5	BS EN 60243-2
Adhesion to and corrosion of metals	There shall be no corrosion or pitting of the metals, and the vulcanizates shall not adhere to the metal surfaces or show any sign of liquid exudation. Discolouration of the metal surfaces shall not be considered cause for rejection							Part A37, using carbon steel and copper, 168 ± 2 h, 70 ± 1 °C

[a] No values are specified for density, but it is recommended that a value be established for each composition. This may provide a useful check when a series of batches of the same composition has to be tested for compliance with this British Standard.

Annex A (informative)
Guidance for the preparation and testing of rubber products

This British Standard specifies requirements for the rubber compounds when tested using a press-cured sample sheet. Where manufactured articles are to be tested the shape and size may prevent the preparation of some or all test pieces. In this case agreement between manufacturer and purchaser should be sought on the procedure to verify compliance of the manufactured article. Where standard test pieces can be prepared from the articles they may be used for quality control tests.

Finished rubber items should be free from surface imperfections, voids, inclusions, flow marks, moulding faults and defects which would impair satisfactory performance and should show minimal accelerator bloom.

Finished rubber items should be stored in accordance with BS 3574.

Bibliography

Standards publications

BS 1154:1992, *Specification for natural rubber compounds.*

BS 1155:1992, *Specification for natural rubber compounds for extrusion.*

BS 2752:1990, *Specification for chloroprene rubber compounds.*

BS 3227:1990, *Specification for butyl rubber compounds (including halobutyl compounds).*

BS 3558-1:1997, *Glossary of rubber terms — Part 1: International terms.*

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BS 3574, *Specification for the controlled storage and packaging of vulcanized rubber and rubber products.*

BS 3734-1:1997, *Rubber — Tolerances for products — Part 1: Dimensional tolerances.*

BS 4181-1:1985, *Identification of rubbers by infra-red spectrometry — Part 1: Method for identification of hydrocarbon, chloroprene, nitrile and chlorosulphonated polyethylene rubbers.*

BS 5923-2:1980, *Methods for chemical analysis of rubber — Part 2: EDTA titrimetric method for determination of zinc content of rubber products.*

BS 6014:1991, *Specification for ethylene propylene rubber compounds.*

BS 6996:1989, *Specification for mineral oil resistant acrylonitrile-butadiene rubber compounds.*

BS 7164-2.2:1990, *Chemical tests for raw and vulcanized rubber — Part 2: Sample preparation — Section 2.2: Vulcanized rubber.*

BS 7164-3:1992, *Chemical tests for raw and vulcanized rubber — Part 3: Methods for determination of solvent extract.*

BS 7164-5:1991, *Chemical tests for raw and vulcanized rubber — Part 5: Methods for determination of ash content.*

BS 7164-7.1:1990, *Chemical tests for raw and vulcanized rubber — Part 7: Methods for determination of polymer content — Section 7.1: Polyisoprene content.*

BS 7164-13:1994, *Chemical tests for raw and vulcanized rubber — Part 13: Method for determination of total hydrocarbon content.*

BS 7164-14:1996, *Chemical tests for raw and vulcanized rubber — Part 14: Methods for determination of carbon black content.*

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