

Classification system for vulcanized rubbers — Specification

ICS 83.060

Confirmed November 2008

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to PRI/54, Rubber compounds, upon which the following bodies were represented:

- British Rubber Manufacturers Association Ltd.
- Chemical Industries Association
- Ministry of Defence
- RAPRA Technology Ltd
- Tun Abdul Razak Research Centre

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 October 2003

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The following BSI references relate to the work on this British Standard:
Committee reference PRI/54
Draft for comment 02/120948 DC

ISBN 0 580 42773 0

Amendments issued since publication

Amd. No.	Date	Comments

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Foreword

This British Standard has been prepared under the direction of PRI/54, Rubber compounds. It provides means of specifying the physical properties of vulcanized rubbers in a convenient notation, and in the interests of rationalization of test methods limits the times and temperatures available for selection in connection with certain tests. It supersedes BS 5176:1975, which is now withdrawn.

The classification system is based on the physical properties of the vulcanized rubber rather than on compositional requirements and follows closely the system published by the American Society for Testing and Materials (ASTM Designation: D2000 “*Standard classification system for rubber products in automotive applications*”).

This standard is intended for use in a wide range of industries and is not limited to automotive applications.

In the preparation of this British Standard, consideration has been given to the economic importance of restricting the number of vulcanized rubbers in general demand. To this end, rubbers of low technical quality have in general been omitted.

The tests employed in this standard have been chosen for their reproducibility and ability to assess the properties of a rubber material. They are not intended to be simulated service tests, which can be unsatisfactory for control purposes.

The properties listed in this standard are not to be regarded as design data, especially with respect to heat resistance. As service conditions vary considerably, it is recommended that the selection of a rubber material for a given application should be discussed between user and supplier, so that all relevant operating factors may be considered.

NOTE In order to assist in the adoption of this classification system the types of rubber normally used to prepare the various vulcanizates are given in Annex A. The annex does not, however, form part of the classification system.

The major changes in this revision compared with the 1975 edition and Amendment No 1 published in 1985 are as follows:

- a) the replacement in Table 4 of ASTM D1171 by BS ISO 4665 for outdoor weathering resistance;
- b) recognition in Table 4 that reference Oil No. 2 and 3 have been replaced by reference Oil IRM902 and IRM903 respectively, although in accordance with BS 903-A16 (also numbered as BS ISO 1817), the terms Oil No. 2 and Oil No.3 continue to be used;
- c) the replacement in Table 6 of all specified limits for tear strength by “Limits to be agreed”. The requirement in the first edition was based on a crescent tear test piece having a nick size of 0.5 mm. The nick size now specified in BS 903-A3 is 1.0 mm and it cannot assume similar results will be given;
- d) the deletion of Liquid 100 for fluid resistance (E4 in Table 4) and deletion of corresponding requirements for MCE, MDH and MEH materials, following the withdrawal of the test liquid from BS 903-A16;
- e) the addition in Table 6/29 and Table 6/30 of a new material designation, MEE for ethylene-acrylic rubbers;
- f) the extension of Annex A to other suitable types of rubber;
- g) clarification of the use of the Z suffix.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its 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 58, an inside back cover and a back cover.

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1 Scope

This British Standard specifies a system of classification of solid vulcanized rubbers based on the test values obtained in standard laboratory tests for physical properties. This classification does not imply that every combination of properties for which a code can be given is technically feasible.

In addition this British Standard seeks to limit the variety of vulcanized rubbers used in industry and Table 6 contains a range of vulcanized rubbers to meet the great majority of industrial needs. To do so, an attempt has been made to align several rubbers with the physical property requirements of other well-established British Standard Specifications (see Annex B).

This standard is not intended for use with thermoplastic elastomers, including those sometimes described as thermoplastic vulcanizates.

2 Normative references

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

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

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

BS 903-A3, *Physical testing of rubber — Part A3: Determination of tear strength (trouser, angle and crescent test pieces).*

BS 903-A4, *Physical testing of rubber — Part A4: Determination of compression stress-strain properties.*

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

BS 903-A8, *Physical testing of rubber — Part A8: Determination of rebound resilience.*

BS 903-A9, *Physical testing of rubber — Part A9: Determination of abrasion resistance.*

BS 903-A13, *Physical testing of rubber — Part A13: Determination of the stiffness at low temperatures (Gehman test).*

BS 903-A16, *Physical testing of rubber — Part A16: Determination of the effect of liquids.*

BS 903-A19, *Physical testing of rubber — Part A19: Accelerated ageing and heat resistance tests.*

BS 903-A25, *Physical testing of rubber — Part A25: Determination of low-temperature brittleness.*

BS 903-A26, *Physical testing of rubber — Part A26: Determination of hardness (hardness between 10 IRHD and 100 IRHD).*

BS 903-A33, *Physical testing of rubber — Part A33: Methods of test for staining in contact with organic material.*

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

BS 903-A42, *Physical testing of rubber — Part A42: Determination of stress relaxation in compression at ambient and at elevated temperatures.*

BS 903-A43, *Physical testing of rubber — Part A43: Determination of resistance to ozone cracking (static strain test).*

BS 1154, *Specification for natural rubber compounds.*

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

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

BS ISO 132, *Rubber, vulcanized or thermoplastic — Determination of resistance to flex cracking and crack growth (De Mattia).*

BS ISO 4665, *Rubber, vulcanized or thermoplastic — Resistance to weathering.*

3 Classification system

3.1 Basic requirements

3.1.1 General

The basic classification code for a vulcanized rubber shall be:

- a) the letter M to indicate that metric units are used;
- b) a letter indicating the Type assigned on its level of heat resistance (see 3.1.2);
- c) a letter indicating the Class assigned on its level of resistance to mineral oil (see 3.1.3);
- d) a single figure indicating the hardness range (see 3.1.4);
- e) a double figure indicating the tensile strength (see 3.1.4).

3.1.2 Type (heat resistance)

This shall be based on changes in tensile strength of not more than $\pm 30\%$, elongation at break of not more than -50% , and hardness, of not more than ± 15 IRHD, after heat ageing for 70 h at an appropriate temperature. The temperatures at which these materials shall be tested for determining Type shall be as listed in Table 1.

3.1.3 Class (oil resistance)

This shall be based on the resistance of the material to swelling in oil No. 3 of BS 903-A16. In the test, the immersion time shall be 70 h and the oil temperature shall be the Type temperature or 150°C , whichever is the lower. Limits of swelling for each Class shall be as shown in Table 2.

NOTE 150°C has been chosen as the highest temperature for Class, as representing the limit of oil stability.

Table 1 — Basic requirements for establishing Type by heat resistance

Type	Temperature $^\circ\text{C}$
A	70
B	100
C	125
D	150
E	175
F	200
G	225
H	250
J	275

Table 2 — Basic requirements for establishing Class by oil resistance

Class	Volume swell % max.
A	No requirement
a	—
C	120
D	100
E	80
F	60
G	40
H	30
J	20
K	10

NOTE 1 The selection of Type assessed by standard laboratory test methods is an indication of the inherent dry heat resistance that can normally be expected from commercial compositions. Similarly, choice of Class is based on volume increase (assessed by standard laboratory test methods) which can be expected from such commercial compositions as established by Type.

The fact that a Type and Class of material is listed in Table 6 under basic requirements indicates the commercial availability of materials, which meet these requirements for heat and oil resistance.

NOTE 2 Since laboratory heat resistance tests are of relatively short term a material is not necessarily suitable for use in any particular application at the relevant material Type temperature. The Class designation does not indicate the level of resistance, which can be expected when a material is exposed to oils other than mineral oils.

^a Class B has been omitted as of no practical value but the other class letters/volume swell values of ASTM D2000 have been retained in order to preserve correspondence with that standard.

3.1.4 Mechanical properties

The basic mechanical properties indicated in all cases shall be a single figure for the hardness, followed by a double figure for the tensile strength in megapascals (MPa).

EXAMPLE The code 507 indicates a hardness of 50^{+5}_{-4} IRHD and a tensile strength of 7 MPa minimum and the code 710 indicates a hardness of 70^{+5}_{-4} IRHD and a tensile strength of 10 MPa minimum.

3.2 Supplementary requirements

3.2.1 General

When properties are needed that either supersede or supplement the basic requirements, they shall be indicated by the use of Grade numbers and by means of suffix letters and numbers. The Grade number indicates the test limits, the suffix letter indicates the property to be tested, and the suffix number indicates the test method and test conditions.

The last column in Table 6 under “Basic requirements” for each material shall give the available Grade numbers for supplementary requirements.

Supplementary requirements shall be specified only as needed to define qualities necessary to meet service requirements; not all suffix values available for a material need be specified. However, if all the supplementary requirements for a given Grade number are required, this may be indicated by the word ALL to abbreviate the line call-out (see 3.2.2 and 3.4).

Basic requirements shall always be effect, unless superseded by specific supplementary requirements in the line call-out.

3.2.2 Grade numbers

To specify supplementary requirements, a system of prefix Grade numbers shall be used. Grade 1 shall indicate that only the basic requirements are compulsory, and no supplementary requirements are permitted. Grades other than Grade 1 are used for expressing supplementary requirements.

Grade numbers shall be written as material prefix numbers, e.g 2MBC510, 4MBK610 or 3MHK714.

3.2.3 Suffix letters

3.2.3.1 General

A suffix letter shall be used to identify the property being tested. Available suffix letters and their meaning are given in Table 3. Tests applying to each suffix letter are listed in Table 4.

3.2.3.2 Suffix Z

As stated in the Foreword, this classification system shall be based on properties and not composition. However, many existing rubber specifications include clauses relating to composition, and users may be reluctant to lose this facility. It is therefore permissible to employ suffix Z to demand or prohibit certain ingredients, e.g. to specify a particular type of polymer. The facility may be used with Grade 1 as well as with other grades.

Table 3 — Meaning of suffix letters

Suffix letter	Test required
A	Heat resistance
B	Compression set
C	Ozone or weather resistance
D	Compression stress/strain
E	Fluid resistance
F	Low-temperature resistance
G	Tear strength
H	Flex resistance
J	Abrasion resistance
L	Water resistance
M	Flammability
P	Discoloration of organic finishes
R	Resilience
S	Corrosion of metals
T	Stress relaxation
Z	Any special requirement, which shall be specified in detail

Each suffix Z requirement applying to a material shall be uniquely numbered, e.g. Z1, Z2, Z3..., and shall be given at the end of the line call-out (see 3.4). Where there is a requirement for a particular test not available in the relevant supplementary requirement table, the Z suffix should, wherever possible, be identified by the appropriate letter and numbers listed in Table 4 and Table 5. The letter and numbers should be put in brackets after the appropriate Z number, e.g. Z1(B23).

A key shall be available for each specified Z suffix requirement.

3.2.4 Suffix numbers

Each suffix letter shall be followed by two suffix numbers except in the case of suffix Z.

- The *first suffix number* indicates *method of test*.
- The *second suffix number* indicates the *temperature of test*.

The number indicating the method of test, which also includes the duration of test, is taken from Table 4. The number indicating the temperature of test is taken from Table 5.

EXAMPLES Examples of the use of suffix letters and numbers are A14 and E34. Suffix letter A (see Table 3) stands for heat resistance, first suffix number 1 (see Table 4) specifies that the test be run according to BS 903-A19, method A for 70 h, and second suffix number 4 (see Table 5) indicates the temperature of test as 100 °C. Similarly, suffix E34 indicates resistance in oil No. 3 in accordance with BS 903-A16 for 70 h at 100 °C.

Where three or more digits are required to specify the test conditions the test method and temperature elements are separated by a dash, e.g. A1-10; F1-11.

Table 4 — Methods of test (see Note 1)

Requirement or suffix letter	Basic requirement and first suffix number									
	Basic	1	2	3	4	5	6	7	8	9
Tensile strength elongation at break	BS 903:A2 ^a									
Hardness	BS 903:A26 ^b									
Density (if required, see 3.3)	BS 903:A1									
Suffix A, heat resistance		BS 903:A19 method A ^c 70 h		BS 903:A19 method A ^c 168 h	BS 903:A19 method A ^c 336 h	BS 903:A19 method A ^c 1 000 h				
Suffix B, compression set, Type B (small) test pieces moulded or cut		BS 903:A6 22 h	BS 903:A6 70 h		BS 903:A6 336 h					
Suffix C, ozone or weather resistance		BS 903:A43 50 pphm ozone 72 h 20 % extension	BS ISO 4665 (see Note 2) outdoor ageing	BS 903:A43 200 pphm ozone 72 h 20 % extension	BS 903:A43 25 pphm ozone 72 h 20 % extension					
Suffix D, compression stress/strain		BS 903:A4 stress at specified strain	BS 903:A4 strain at specified stress							
Suffix E, fluid resistance (see Note 3)		BS 903:A16 volumetric method	BS 903:A16 volumetric method	BS 903:A16 volumetric method		BS 903:A16 volumetric method	BS 903:A16 volumetric method	BS 903:A16 volumetric method	BS 903:A16 volumetric method	BS 903:A16 volumetric method
		Oil No. 1 70 h	Oil No. 2 70 h	Oil No. 3 70 h		Liquid A 70 h	Liquid B 70 h	Liquid C 70 h	Liquid 101 70 h	Other reference fluids and/or times
Suffix F, low-temperature resistance (liquid cooling medium)		BS 903:A25	BS 903:A13 torsional modulus 70 MPa maximum							
Suffix G, tear strength		BS 903:A3 Method C								
Suffix H, flex resistance		BS ISO 132 flex cracking								

Using Type 1 or Type 2 test pieces.

The precise hardness method within BS 903:A26 depends on the required nominal test piece hardness and shall be as follows:

40 to 80 IRHD, inclusive: Normal test, N.

30 IRHD: Low hardness test, L.

90 IRHD: High hardness test, H.

The change in hardness for heat resistance, fluid resistance and water resistance shall be determined by methods N, L or H on plied-up test pieces from 2.0 mm thickness or by the microhardness method, M on a single ply of 2.0 mm thickness.

The standard test piece shall be used for basic unaged hardness used in the basic classification code and line call-out.

Cell type oven method is preferred.

Table 4 — Methods of test (see Note 1) (continued)

Requirement or suffix letter	Basic requirement and first suffix number									
	Basic	1	2	3	4	5	6	7	8	9
Suffix J, abrasion resistance (see Note 4)		BS 903:A9								
Suffix L, water resistance		BS 903:A16 70 h (see Note 5)	BS 903:A16 168 h (see Note 5)							
Suffix M, flammability (see Note 4)										
Suffix P, discoloration of organic finishes		BS 903:A33 method A1	BS 903:A33 method A2							
Suffix R, resilience		BS 903:A8 method B								
Suffix S corrosion of metals		BS 903:A37								
Suffix T stress relaxation		BS 903:A42								
Suffix Z special requirement (see Note 6)										
^a Using Type 1 or Type 2 test pieces. ^b The precise hardness method within BS 903:A26 depends on the required nominal test piece hardness and shall be as follows: 40 to 80 IRHD, inclusive: Normal test, N. 30 IRHD: Low hardness test, L. 90 IRHD: High hardness test, H. The change in hardness for heat resistance, fluid resistance and water resistance shall be determined by methods N, L or H on plied-up test pieces from 2.0 mm thickness or by the microhardness method, M on a single ply of 2.0 mm thickness. The standard test piece shall be used for basic unaged hardness used in the basic classification code and line call-out. ^c Cell type oven method is preferred.										

Notes to Table 4

NOTE 1 The following test methods are referred to in this table.

BS ISO 132, *Rubber, vulcanized or thermoplastic — Determination of flex cracking and crack growth (De Mattia)*.

BS ISO 4665, *Rubber, vulcanized and thermoplastic — Resistance to weathering*.

BS 903, *Physical testing of rubber*:

- *Part A1 Determination of density;*
- *Part A2: Determination of tensile stress-strain properties;*
- *Part A3: Determination of tear strength (trouser, angle and crescent test pieces);*
- *Part A4: Determination of compression stress-strain;*
- *Part A6: Determination of compression set at ambient, elevated or low temperatures;*
- *Part A8: Determination of rebound resilience;*
- *Part A9: Determination of abrasion resistance;*
- *Part A13: Determination of the stiffness of vulcanized rubber at low temperatures (Gehman test);*
- *Part A16: Determination of the effect of liquids;*
- *Part A19: Accelerated ageing and heat resistance tests;*
- *Part A25: Determination of low temperature brittleness;*
- *Part A26: Determination of hardness (hardness between 10 IRHD and 100 IRHD);*
- *Part A33: Methods of test for staining in contact with organic material;*
- *Part A37: Determination of tendency to adhere to and to corrode metals;*
- *Part A42: Determination of stress relaxation in compression at ambient and at elevated temperatures;*
- *Part A43: Determination of resistance to ozone cracking (static strain test).*

NOTE 2 Test conditions and, where appropriate, assessment to be agreed between the purchaser and the manufacturer. In the first edition of BS 5176, ASTM D1171 was specified, requiring the exposure of a strained triangular test piece designed to assess resistance to ozone cracking. This is approximately equivalent to BS 903-A43 strip test pieces exposed at a tensile strain of 20 %. Note that the two test pieces might not give the same result because of the effect of sample thickness.

NOTE 3 In ASTM D2000, suffix letter E has been sub-divided into three specific categories which are “EO, oil resistance”, “EF, fluid resistance (fuels)”; and “EA, aqueous fluid resistance”. The ASTM equivalents of the requirements given in Table 4 are as follows:

BS 5176	ASTM D2000
E1	E01
E2	E02
E3	E03
E5	EF1
E6	EF2
E7	EF3
E8	EO7
E9	EO8
L1	EA1
L2	No equivalent

Oils No. 2 and 3 as currently specified are also known as IRM902 and IRM903 respectively.

NOTE 4 Test method and conditions to be agreed between the purchaser and the manufacturer.

NOTE 5 Distilled or deionized (demineralized) water should be used.

NOTE 6 Requirement to be specified (see 3.2.3.2).

Table 5 — Suffix numbers to indicate temperature of test

Applicable supplementary requirements (see Table 3)	Second suffix number	Test temperature °C
A, B, C, D, E, G, H, J, L, P, R, T	11	275
	10	250
	9	225
	8	200
	7	175
	6	150
	5	125
	4	100
	3	70
	2	40
	1	23
	0	... ^a
F	1	20
	2	0
	3	−10
	4	−18
	5	−25
	6	−35
	7	−40
	8	−50
	9	−55
	10	−65
	11	−75
	12	−80

^a The preferred temperature specified in the test methods or ambient in the case of outdoor testing.

3.3 Available materials

The materials listed throughout Table 6 are considered to cover the majority of applications. Special requirements not listed may be specified by the use of suffix Z but in this case prior consultation between the purchaser and the supplier is recommended.

Materials meeting the same physical requirements can differ in density. Nominal values for density may therefore be agreed between the manufacturer and the user for control purposes.

With the exception of MFC, MFE, MFK and MGE materials and certain basic requirements of MAA materials, the values in the material tables are based on carbon black-containing compounds and comparable values may not be available in colour.

Supplementary requirements in Table 6 listed as “limits to be agreed” remain in force but the test limits shall be agreed between the purchaser and supplier.

3.4 Line call-outs

A line call-out, which is a specification, shall contain the Grade number, the material designation (Type and Class), and the hardness and tensile strength, followed by the appropriate supplementary requirements. Examples of line call-outs or specifications are 1MBC514, 2MBC514A14E14 and 2MBC514 ALL and Figure 1 illustrates the requirements they cover.

The meaning of the codes and the source of the information shall be as given under the relevant letters or numbers in Figure 1.

In all cases, the line call-out shall be preceded by the number of this British Standard, i.e. BS 5176.

NOTE 1 In the second line call-out specification example in 3.4, the basic requirement for heat resistance is superseded by a supplementary requirement (A14) and an additional oil resistance requirement is introduced (E14). However, the basic requirement of 80 % for compression set, which is not included as a supplementary requirement, is not superseded and therefore should be met as specified in Table 6/9. On the other hand in the third line call-out specification example the basic requirement of 80 % for compression set is superseded by a supplementary requirement (B14) which is implicit in the word ALL.

NOTE 2 In ASTM D2000, the prefix letter M is added before the Grade number, e.g. M2BC514.

3.5 Methods of test

The methods of test to be used in this classification are listed in Table 4.

Line call-out IMBC514												
Example 1												
1	M	B	C	5	14		Elongation at break		Heat resistance	Oil resistance	Compression set	
Basic grade	Metric	Material type (see Table 1)	Material class (see Table 2)	Hardness 50 ⁺⁵ ₋₄ IRHD (3.1.4) BS 903:A26 (see Table 4)	Tensile strength 14 MPa minimum (3.1.4) BS 903:A26 (see Table 4)	Also including:	400 % minimum (see Table 6/9) BS 903:A2 (see Table 4)	BS 903:A19 70 h at 100 °C (see Table 6/9)	BS 903:A16 Oil No. 3 70 hat 100 °C see (Table 6/9)	BS 903:A6 22 h at 100 °C (see Table 6/9)		
Line call-out 2MBC514A14E14												
Example 2												
2	M	B	C	5	14		A	1	4	E	1	4
Grade No. (see Table 6/10)	As Example 1	As Example 1	As Example 1	As Example 1	As Example 1		Heat resistance BS 903:A19	Test conditions method A 70 h (see Table 4)	Test temperature 100 °C (see Table 5)	Fluid resistance BS 903:A16	Test conditions oil No. 1 70 h (see Table 4)	Test temperature 100 °C (see Table 5)
Line call-out 2MBC514A ALL												
Example 3												
This is an abbreviation of 2MBC514A14B14C12C20E14F27G11P20												
2	M	B	C	514	A14	B14	C12	C20	E14	F27	G11	P20
As Example 2	As Example 2	As Example 2	As Example 2	As Example 2	Ax Example 2	Compression set BS 903:A6 22 h at 100 °C (see Table 4 and Table 5)	Resistance to ozone BS 903:A43 50 pphm 72 h at 40 °C (see Table 4 and Table 5)	Resistance to outdoor ageing BS ISO 4665 at ambient temperature (see Table 4 and Table 5)	As Example 2	Low- temperature resistance BS 903:A13 at –40 °C (see Table 4 and Table 5)	Tear strength BS 903:A3 method C at 23 °C (see Table 4 and Table 5)	Discoloration of organic finishes BS 903:A33 method A2 (see Table 4 and Table 5)
See Table 6/10 for test requirements												
Figure 1 — Examples of line call-outs												

Table 6 — Basic and supplementary requirements

Table 6/1 — MAA materials: basic requirements (Grade 1)

Hardness, IRHD +5 -4	Tensile strength, MPa, min.	Elongation at break, %, min.	Heat resistance, BS 903:A19, 70 h at 70 °C	Oil resistance, BS 903:A16, oil no. 3, 70 h at 70 °C	Compression set, BS 903:A6, 22 h at 70 °C, %, max.	Additional Grade numbers available
30	7	400	Change in tensile strength, ±30 % max.	No requirement	50	2, 3, 4
30	10	400			50	2, 3, 4
30	14	400			50	2, 3, 4
40	7	400	Change in elongation at break, -50 % max.		50	2, 3, 4
40	10	400			50	2, 3, 4, 6
40	14	400			50	2, 3, 4, 6, 8
40	17	500	Change in hardness, ±15 IRHD max.		50	2, 3, 4, 6, 7
40	17	600			50	8
40	19	600			50	7
40	21	600			50	2, 3, 4, 6
50	5	250			50	2, 3
50	7	400			50	2, 3
50	10	400			50	2, 3, 4, 5, 6
50	14	400			50	2, 3, 4, 5, 6, 8
50	17	400			50	2, 3, 4, 5, 6, 7
50	17	500			50	7, 8
50	21	500			50	2, 3, 4, 5, 6
60	5	250			50	2, 3
60	7	300			50	2, 3
60	10	350			50	2, 3, 4, 5, 6, 8
60	14	400			50	2, 3, 4, 5, 6, 7, 8
60	17	400			50	2, 3, 4, 5, 6, 7
60	21	400			50	2, 3, 4, 5, 6
70	5	150			50	2, 3
70	7	200			50	2, 3
70	9	200			50	8
70	10	250			50	2, 3, 4, 5, 6, 7
70	11	300			50	8
70	14	300			50	2, 3, 4, 5, 6, 7
70	17	300			50	2, 3, 4, 5, 6
70	21	350			50	2, 3, 4, 5, 6
80	7	100			50	2, 3
80	9	200			50	8
80	10	150			50	2, 3
80	10	200			50	8
80	14	200			50	2, 3
80	17	200			50	2, 3
90	7	100			50	2, 3
90	10	125			50	2, 3
90	14	125			50	2, 3
90					50	2, 3

Table 6/2 — MAA materials: supplementary requirements

Supplementary requirements		Grade 1 ^a	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A33	Heat resistance, BS 903:A19, 168 h at 70 °C: Change in hardness, IRHD, max. Change in tensile strength, %, max. Change in elongation at break, %, max.		±10 ±20 −30	±10 ±20 −30	±10 −25 −25	±10 −25 −25	±5 −20 −20	−10 −15	−10 −15
B13	Compression set, BS 903:A6, 22 h at 70 °C, %, max.				25	25	20	30	40
C12	Resistance to ozone, BS 903:A43		no cracks		no cracks				
C42	Resistance to ozone, BS 903:A43			no cracks					
C32	Resistance to ozone, BS 903:A43					no cracks			
C20	Resistance to outdoor ageing, BS ISO 4665			limits to be agreed					
F27	Low-temperature stiffness, BS 903:A13, at −40 °C, torsional modulus max. 70 MPa		pass	pass	pass	pass	pass		
G11	Tear strength, BS 903:A3, Method C, kN/m, min		limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed		
P20	Discoloration of organic finishes, BS 903:A33, method A2		limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed		
Z	(Special requirements)	Any special requirements should be specified in detail, including colour.							
^a Basic properties only; no supplementary requirements for Grade 1.									

Table 6/3 — MAJ materials: basic requirements (Grade 1)

Hardness, IRHD +5 -4	Tensile, strength, MPa, min.	Elongation at break, %, min.	Heat resistance, BS 903:A19, 70 h at 70 °C	Oil resistance, BS 903:A16, oil No. 3, 70 h at 70 °C	Compression set, BS 903:A6, 22 h at 70 °C, %, max.	Additional Grade numbers available
50	14	300	Change in tensile strength, ± 30 % max.	Change in volume, +20 % max.	50	—
50	20	400			50	—
60	14	300	Change in elongation at break, -50 % max.		50	3, 6
60	20	350			50	3, 6
60	27	400			50	3, 6
70	14	300	Change in hardness, ± 15 IRHD max.		50	3, 6
70	20	350			50	3, 6
70	27	400			50	3, 6
80	20	300			50	2, 3, 4, 5, 6, 7
80	27	350			50	2, 3, 4, 5, 6, 7
90	20	250			50	2, 3, 4, 5, 6, 7
90	27	350			50	2, 3, 4, 5, 6, 7

Table 6/4 — MAJ materials: supplementary requirements

Supplementary requirements	Grade 1 ^a	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A14 Heat resistance, BS 903:A19, 70 h at 100 °C: Change in hardness, IRHD, max. Change in tensile strength, %, max. Change in elongation at break, %, max.		±5 -25 -20	±5 -25 -20	±5 -15 -20	±5 -25 -20	±5 -25 -20	±5 -25 -20	-25
B13 Compression set, BS 903:A6, 22 h at 70 °C, %, max.		45	30	45	30	45		
C12 Resistance to ozone, BS 903:A43		no cracks	no cracks	no cracks	no cracks	no cracks	no cracks	
C20 Resistance to outdoor ageing, BS ISO 4665		limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed	limits to be agreed	
E34 Fluid resistance, BS 903:A16, oil No. 3, 70 h at 100 °C: Change in hardness, IRHD, max. Change in tensile strength, %, max. Change in elongation at break, %, max. Change in volume, %, max.		-12 to +3 -25 -20 -2 to +12	-12 to +3 -25 -20 -2 to +12	-12 to +3 -15 -20 -2 to +12	-12 to +3 -25 -20 -2 to +12	-12 to +3 -25 -20 -2 to +12	-12 to +3 -25 -20 -2 to +12	
E51 Fluid resistance, BS 903:A16, liquid A, 70 h at 23 °C: Change in hardness, IRHD, max. Change in tensile strength, %, max. Change in elongation at break, %, max. Change in volume, %, max.		±5 -15 -15 ±5	±5 -15 -15 ±5	±5 -15 -15 ±5	±5 -15 -15 ±5	±6 -35 -15 -5 to +10	±5 -15 -15 ±5	
E61 Fluid resistance, BS 903:A16, liquid B, 70 h at 23 °C: Change in hardness, IRHD, max. Change in tensile strength, %, max. Change in elongation at break, %, max. Change in volume, %, max.		0 to -15 -40 -40 0 to +30	0 to -15 -40 -40 0 to +30	0 to -15 -40 -40 0 to +30	0 to -15 -40 -40 0 to +30	0 to -20 -70 -40 0 to +40	0 to -20 -70 -40 0 to +40	
F26 Low-temperature stiffness, BS 903:A13, at -35 °C, torsional modulus max. 70 MPa						pass		
^a Basic properties only; no supplementary requirements for Grade 1.								