

Specification for

Classification system for vulcanized rubbers

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- British Rubber Manufacturers' Association Ltd.*
- Department of Trade and Industry
- Malaysian Rubber Producers' Research Association*
- Rubber and Plastics Research Association of Great Britain*
- Rubber Growers' Association
- Society of Motor Manufacturers and Traders Ltd.*
- Ministry of Defence*

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the committee entrusted with the preparation of this British Standard:

- Society of British Aerospace Companies Ltd.

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Foreword

This British Standard has been prepared under the direction of the Rubber Standards Committee as a reference classification system for vulcanized rubbers. 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.

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 should not be regarded as 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 may be unsatisfactory for control purposes.

The properties listed in this standard should therefore not 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 1 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 Appendix A. The appendix does not, however, form part of the classification system.

NOTE 2 This British Standard is not technically equivalent to the international classification system described in ISO 4632-1. The main differences are the inclusion in ISO 4632-1 of low temperature resistance as a classification criterion in addition to heat and oil resistance and of elongation at break and compression set at type temperature in the basic property code in addition to hardness and tensile strength. The coding system for the basic properties also differs between the two standards, one digit for tensile strength being used in ISO 4632-1, whereas two digit numerically related to tensile strength in SI units is specified in BS 5176.

Amendment No. 1 to this standard introduced several changes and additions, the principal ones being as follows.

- a) The addition in Table 4 of new or revised test methods for the determination of compression stress/strain, tear resistance, discoloration of organic finishes, corrosion of metals and stress relaxation.

NOTE It should be noted that tear strength is now expressed in force per unit thickness of test piece instead of being expressed as force required to tear a test piece of standard thickness. The numerical values specified for G11 in materials MBC, MFC, MFE, MFK, MGE, MHK and MJK should be halved for conversion from N to kN/m. These values are based on crescent test pieces having a nick size of 0.5 mm. In the revised test method the standard nick size is 1.0 mm, and it should not be assumed similar results will be given.

- b) The deletion of the “no lubricant” requirement for the compression set test.

- c) The addition in Table 6/1 and Table 6/2 for MAA materials of further basic tensile strength and elongation at break requirements and two new grades (7 and 8) in order to match the requirements of BS 1154 (*Natural rubber compounds [high quality]*) and BS 1155 (*Natural rubber compounds [high quality] for extrusion*). Appendix B lists line call-outs for these two material specifications and for BS 6014 (*Ethylene propylene rubber compounds*).

- d) The amendment of Table 6/9 for MBC materials to enable Grade number 5 to apply to a rubber of hardness 60^{+5}_{-4} IRHD and a tensile strength of 14 MPa min.

e) The addition in Table 6/41 and Table 6/42 of a new material designated MDA.

f) To note recent changes in ASTM D2000.

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 to iv, pages 1 to 46, 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 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 Appendix B).

2 References

The titles of the British Standards referred to in this standard are listed on the inside back cover.

3 Classification system

3.1 Basic requirements

3.1.1 General. The basic classification code for a vulcanized rubber is:

- The letter M to indicate that metric units are used.
- A letter indicating the Type assigned on its level of heat resistance.
- A letter indicating the Class assigned on its level of resistance to mineral oil.
- A single figure indicating the hardness range.
- A double figure indicating the tensile strength.

3.1.2 Type (heat resistance). This is 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 are listed in Table 1.

3.1.3 Class (oil resistance). This is 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 are shown in Table 2.

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

Table 1 — Basic requirements for establishing Type by heat resistance

Type	Temperature °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 ageing 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 D 2000^b have been retained in order to preserve correspondence with that standard.

^b ASTM D 2000 "Classification system for elastomeric materials for automotive applications".

3.1.4 Mechanical properties. The basic mechanical properties indicated in all cases are a single figure for the hardness, followed by a double figure for the tensile strength in megapascals (MPa). Thus 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 gives 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 gives the available Grade numbers.

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 are always in 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 indicates 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 are written as material prefix numbers, for example:

2MBC510, 3MBK610 or 5MHK614.

3.2.3 Suffix letters. The suffix letters that may be used together with their meaning appear in Table 3.

3.2.3.1 Suffix Z. As stated in the Foreword this classification system is 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.

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 resistance
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

Where there is a requirement for a particular test not available in the relevant supplementary requirement table the necessary suffix Z to be shown at the end of the line call-out (see 3.4) should, wherever possible, be identified by the appropriate suffix letter and numbers listed in Table 4 and Table 5.

3.2.4 Suffix numbers. Each suffix letter should be followed by two suffix numbers.

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 of the use of suffix letters and numbers would be A14 and E34. Suffix A (see Table 3) stands for heat resistance, suffix 1 (see Table 4) specifies that the test be run according to BS 903-A19, method A or B for 70 h, and suffix 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, method A 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, for example A1-10; F1-11.

Table 4 — Methods of test (see note 1)

Requirement or suffix letter	Basic requirements 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 or B ^c 70 h		BS 903:A19 method A or B ^c 168 h	BS 903:A19 method A or B ^c 336 h	BS 903:A19 method A or B ^c 1 000 h				
Suffix B, compression set, Type 1 (small) test pieces moulded or cut		BS 903:A6 22 h	BS 903:A6 70 h		BS 903:A6 336 h					
Suffix C, resistance to ozone or outdoor ageing		BS 903:A43 50 pphm ozone 72 h 20 % extension	ASTM D 1171 (see note 2) weather	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	BS 903:A16 volumetric method
		Oil No. 1 70 h	Oil No. 2 70 h	Oil No. 3 70 h	Liquid 100 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 modulus 70 Mpa maximum							
Suffix G, tear resistance		BS 903:A3 Method C								
Suffix H, flex resistance		BS 903:A10								
Suffix J, abrasion resistance (see note 2)		BS 903:A9								

Table 4 — Methods of test (see note 1)

Requirement or suffix letter	Basic requirements and first suffix number									
	Basic	1	2	3	4	5	6	7	8	9
Suffix L, water resistance		BS 903:A16 70 h (see note 4)	BS 903:A16 168 h (see note 4)							
Suffix M, flammability (see note 5)										
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 method A								
Suffix T, stress relaxation		BS 903:A42								
Suffix Z, special requirement (see note 6)										

^a Using 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:

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

Specimen 30 IRHD: Low hardness test, L

Specimen 90 IRHD: High hardness test, H

The standard test piece shall be used.

^c Method A (cell type oven method) is preferred.

Notes to Table 4

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

ASTM (A corresponding BS method of test is being prepared.)

D1171, *Rubber deterioration — Surface ozone cracking outdoors or in chamber (triangular specimens).*

BS 903

- 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 after constant strain;*
- Part A8: *Determination of rebound resilience;*
- Part A9: *Determination of abrasion resistance;*
- Part A10: *Determination of resistance to flex cracking (De Mattia-type machine);*
- Part A13: *Determination of the stiffness of vulcanized rubbers at low temperatures (Gehman test);*
- Part A16: *The resistance of vulcanized rubber to liquids;*
- Part A19: *Heat resistance and accelerated air ageing tests;*
- Part A25: *Determination of impact brittleness temperature;*
- Part A26: *Determination of hardness;*
- Part A33: *Methods of test for staining in contact with organic materials;*
- Part A37: *Assessment of adhesion to and corrosion of metals;*
- Part A42: *Determination of stress relaxation;*
- 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.

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
E4	E08
E5	EF1
E6	EF2
E7	EF3
E8	EO7
E9	EO8
L1	EA1
L2	No equivalent

NOTE 4 Demineralized water should be used. Determine the volume increase by the water displacement method, except that the alcohol dip should be omitted. When determining changes in tensile strength, elongation at break and hardness, the test tube should be $\frac{3}{4}$ full after the test pieces have been immersed. The determination should be made after 30 min. Cool in distilled water and omit the methanol dip.

NOTE 5 A method of test is to be established.

NOTE 6 Requirement to be specified.

Table 5 — Suffix numbers to indicate temperature of test

Applicable supplementary requirements	Second suffix number	Test temperature
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
	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 method or ambient in the case of outdoor testing.

3.3 Available materials. The materials listed in the appropriate material section of 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 may 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 black compounds and comparable values may not be available in colour.

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 is 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. 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 1MBC514*Example 1*

1	M	B	C	5	14						
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 Also including: 14 MPa minimum (3.1.4) BS 903:A2 (see Table 4)	Elongation at break 400 % minimum (see Table 6/9) BS 903:A2 (see Table 4)	Heat resistance BS 903:A19 70 h at 100 °C (see Table 6/9)	Oil resistance BS 903:A16 Oil No. 3 70 h at 100 °C (see Table 6/9)	Compression set 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 method A or B 70 h (see Table 4)	Test conditions	Test temperature 100 °C (see Table 5)	Fluid resistance BS 903:A16 oil No. 1 70 h (see Table 4)	Test conditions	Test temperature 100 °C (see Table 5)

Line call-out 2MBC514 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	As 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 ASTM D 1171 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 resistance 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

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, method B. 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, ASTM D 1171			limits to be agreed					
F27 Low-temperature stiffness, BS 903:A13, at – 40 °C, modulus max. 70 MPa		pass	pass	pass	pass	pass		
G11 Tear resistance, BS 903:A3		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			50	3, 6
60	20	350	Change in elongation at break, – 50 % max.		50	3, 6
60	27	400			50	3, 6
70	14	300			50	3, 6
70	20	350	Change in hardness, ± 15 IRHD max.		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	
B13 Compression set, BS 903:A6, method A, 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, ASTM D 1171		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 tensile strength, %, max. Change in elongation at break, %, max. Change in hardness, IRHD, max. Change in volume, %		– 25 – 20 – 12 to + 3 – 2 to + 12	– 25 – 20 – 12 to + 3 – 2 to + 12	– 15 – 20 – 12 to + 3 – 2 to + 12	– 25 – 20 – 12 to + 3 – 2 to + 12	– 25 – 20 – 12 to + 3 – 2 to + 25	– 25 – 20 – 12 to + 3 – 2 to + 12	
E51 Fluid resistance, BS 903:A16, liquid A, 70 h at room temperature: Change in tensile strength, %, max. Change in elongation at break, %, max. Change in hardness, IRHD, max. Change in volume, %		– 15 – 15 ± 5 ± 5	– 15 – 15 ± 5 ± 5	– 15 – 15 ± 5 ± 5	– 15 – 15 ± 5 ± 5	– 35 – 15 ± 6 – 5 to + 10	– 15 – 15 ± 5 ± 5	
E61 Fluid resistance, BS 903:A16, liquid B, 70 h at room temperature: Change in tensile strength, %, max. Change in elongation at break, %, max. Change in hardness, IRHD, max. Change in volume, %		– 40 – 40 0 to – 15 0 to + 30	– 40 – 40 0 to – 15 0 to + 30	– 40 – 40 0 to – 15 0 to + 30	– 40 – 40 0 to – 15 0 to + 30	– 70 – 40 0 to – 20 0 to + 40	– 70 – 40 0 to – 20 0 to + 40	
F26 Low-temperature stiffness, BS 903:A13, at – 35 °C, modulus max. 70 MPa						pass		
L13 Water resistance, BS 903:A16, 70 h at 70 °C: Change in tensile strength, %, max.		– 35		– 15	– 30	– 40	– 40	
L14 Water resistance, BS 903:A16, 70 h at 100 °C: Change in tensile strength, %, max.				– 45				
Z (Special requirements)	Any special requirements should be specified in detail including colour.							

^a Basic properties only; no supplementary requirements for Grade 1.

Table 6/5 — MAK 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
40	3	400	Change in tensile strength, ± 30 % max.	Volume change, + 10 % max.	50	2
50	3	400			50	2
60	5	300	Change in elongation at break, – 50 % max.		50	2
70	7	250	Change in hardness, ± 15 IRHD max.		50	2
80	8	150			50	2
90	7	100			50	2

Table 6/6 — MAK 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, method B, 70 h at 100 °C: Change in hardness, IRHD, max. Change in tensile strength, %, max. Change in elongation at break, %, max.		+ 15 – 15 – 40						
E14	Fluid resistance, BS 903:A16, oil No. 1, 70 h at 100 °C: Change in tensile strength, %, max. Change in elongation at break, %, max. Change in hardness, IRHD, max. Change in volume, %, max.		b b b – 3 to + 5						
E34	Fluid resistance, BS 903:A16, oil No. 3, 70 h at 100 °C: Change in tensile strength, %, max. Change in elongation at break, %, max. Change in hardness IRHD, max. Change in volume, %, max.		 – 30 – 50 – 5 to + 10 b						
F27	Low-temperature stiffness, BS 903:A13, at – 40 °C, modulus max. 70 MPa		pass						
Z	(Special requirements)	Any special requirements should be specified in detail including colour.							

^a Basic properties only; no supplementary requirements for Grade 1.
^b The requirement is applicable and materials are available to satisfy specified limits for these characteristics but a standard classification has not yet been established.