



SURFACE VEHICLE RECOMMENDED PRACTICE

J200™

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Classification System for Rubber Materials

RATIONALE

Update reference oil name "SF-105" to "SL-107" and "SAE Fluid 2, Stauffer 7700" to "Hatco 7700."

FOREWORD

The original version of this SAE Recommended Practice was prepared jointly by the Society of Automotive Engineers (SAE) and the American Society for Testing and Materials (ASTM) and bore the designation SAE J200/ANSI/ASTM D2000. This document superseded and replaced SAE J14/ASTM D735 and was intended to be used as a source of material quality "line call-out" specifications on procurement documents and drawings.

This SAE Recommended Practice is now under the sole jurisdiction of the SAE Committee on Automotive Rubber Specifications and bears the designation SAE J200.

This document is based on basic physical properties of rubber materials obtained directly from standard compression molded test specimens. Test specimens may be fashioned from finished products or by alternate methods. However, test specimens so prepared may be affected by forming of the product or sample and/or by shaping them for testing. Therefore, test results prepared from finished products or by alternate methods may not duplicate values obtained from standard test specimens.

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Documents

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1. SCOPE

This classification system tabulates the properties of vulcanized rubber materials (natural rubber, reclaimed rubber, synthetic rubbers, alone or in combination) that are intended for, but not limited to, use in rubber products for automotive applications.

NOTE 1: The SAE Committee on Automotive Rubber Specifications (CARS) has the sole responsibility for SAE J200. CARS Works closely with and receives input from ASTM Subcommittee D11.30 on Classification of Rubber Compounds with the goal to keep SAE J200 and ASTM D2000 technically equivalent. Candidate materials presented for development of new tables or for inclusion in Tables A1 or A2 of SAE J200 or Table X1.1 of ASTM D2000 shall be initiated with the SAE CARS Committee. The procedure to be followed is detailed in Appendix C of SAE J200.

NOTE 2: This document may serve many of the needs of other industries in much the same manner as SAE numbered steels. It must be remembered, however, that this system is subject to revision when required by automotive needs. It is recommended that the latest revision always be used. This document is based on the premise that all rubber materials intended for use in rubber products can be arranged into characteristic designations. These designations are determined by types, based on resistance to heat aging, and classes, based on resistance to swelling by oil. Basic levels are thus established which, together with values describing additional requirements, permit complete description of the quality of all rubber materials. In all cases where provisions of this document would conflict with those of the detailed specifications for a particular product, the latter shall take precedence.

NOTE 3: When the rubber product is to be used for purposes where the requirements are too specific to be completely prescribed by this classification system, it is necessary for the purchaser to consult the supplier in advance to establish the appropriate properties, test methods, and specification test limits.

1.1 Purpose

1.1.1 The purpose of this document is to provide guidance to the engineer in the selection of practical, commercially available rubber materials, and further to provide a method for specifying these materials by the use of a simple line call-out designation.

1.1.2 This document was developed to permit the addition of descriptive values for future rubber materials without complete reorganization of the classification system and to facilitate the incorporation of future new methods of test to keep pace with changing industry requirements.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or +1 724-776-4970 (outside USA), www.sae.org.

SAE J2979 Test Method for Vulcanized Rubber and Thermoplastic Elastomer Determination of Compressive Stress Relaxation (CSR) Response

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D395	Test Methods for Rubber Property - Compression Test
ASTM D412	Test Methods for Rubber Properties in Tension
ASTM D429	Test Methods for Rubber Property - Adhesion to Rigid Substrates
ASTM D430	Test Methods for Rubber Deterioration - Dynamic Fatigue
ASTM D471	Test Methods for Rubber Property - Effect of Liquids
ASTM D573	Test Methods for Rubber Deterioration in an Air Oven
ASTM D575	Test Methods for Rubber Properties in Compression
ASTM D624	Test Methods for Rubber Property - Tear Resistance
ASTM D865	Test Methods for Rubber Deterioration by Heating in Air (Test Tube Enclosure)
ASTM D925	Test Methods for Rubber Property - Staining of Surfaces (Contact, Migration, and Diffusion)
ASTM D945	Test Methods for Rubber Properties in Compression or Shear (Mechanical Oscillograph)
ASTM D1053	Test Method for Rubber Property - Stiffening at Low Temperature; Flexible Polymers and Coated Fabrics
ASTM D1149	Standard Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber
ASTM D1171	Test Method for Rubber Deterioration - Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
ASTM D1329	Test Method for Evaluating Rubber Property - Retraction at Low Temperatures (TR Test)
ASTM D1349	Practice for Rubber - Standard Temperatures for Testing
ASTM D1418	Practice for Rubber and Rubber Lattices - Nomenclature
ASTM D2137	Test Methods for Rubber Property - Brittleness Point of Flexible Polymers and Coated Fabrics
ASTM D2240	Test Method for Rubber Property - Durometer Hardness
ASTM D3183	Practice for Rubber - Preparation of Pieces for Test Purposes from Products

2.1.3 ISO Publications

Copies of these documents are available online at <http://webstore.ansi.org/>.

ISO 162	Rubber and Latices - Nomenclature
ISO 17025	General Requirements for the Competence of Testing and Calibration Laboratories

3. TYPE AND CLASS

3.1 The prefix letter M shall be used to indicate that this classification system is based on SI units.

NOTE 4: Call-outs not prefixed by the letter M refer to an earlier classification system based on U.S. customary units. This was published in editions prior to 1979.

3.2 Rubber materials shall be designated on the basis of type (heat aging resistance) and class (oil swelling resistance). Type and class are each indicated by letter designations as shown in Tables 1 and 2 and illustrated in 8.1. Type is the first letter after the grade number and class is the second letter. See Appendix A for the types of polymers most often used to meet the specification.

Table 1 - Basic requirements for establishing type by temperature

Type	Test Temperature, °C
A	70
B	100
C	125
D	150
E	175
F	200
G	225
H	250
J	275
K	300

Table 2 - Basic requirements for establishing class by volume swell

Class	Volume Swell, max, %
A	no requirement
B	140
C	120
D	100
E	80
F	60
G	40
H	30
J	20
K	10

3.3 Type is based on changes in tensile strength of not more than $\pm 30\%$, elongation of not more than -50% , and hardness of not more than ± 15 points after heat aging for 70 hours at an appropriate temperature. The temperatures at which these materials shall be tested for determining type are listed in Table 1.

3.4 Class is based on the resistance of the material to swelling in IRM 903 oil after 70 hours immersion at a temperature determined from Table 1, except that a maximum temperature of 150 °C (the upper limit of oil stability) shall be used. Limits of swelling for each class are shown in Table 2.

NOTE 5: The selection of type based on heat aging resistance is understood to be indicative of the inherent heat aging resistance that can be normally expected from commercial compositions. Differences in severity of two approved heat aging test methods (ASTM D865 and D573) may invalidate direct comparison between those classes of rubber material not tested by the same method. Likewise, choice of class is based on the range of volume swell normally expected from such commercial compositions as established by type. The fact that a type and class of material is listed under basic requirements, indicates that materials that meet these requirements for heat aging and oil swelling resistance are commercially available.

NOTE 6: ASTM Oils No. 1, 2, and 3 have been replaced by IRM 901¹, IRM 902¹, and IRM 903¹ (last number for each IRM denotes the ASTM oil replaced). Comparison of the effects of each new IRM oil on most elastomers produces a close correlation, but may not necessarily produce the same property change as the oil replaced. Questions regarding IRM oils should be directed to ASTM D11.15.

NOTE 7: Most oil aged data in the SAE J200 tables were developed with ASTM Oil #3 and are to be used as a guideline for material selection. Continued conformance will be based on testing in IRM 903 oil. Modified requirements may be agreed upon between the customer and the material supplier and be specified by use of a "Z" suffix.

3.5 The letter designations shall always be followed by a three-digit number to specify the hardness and the tensile strength—for example, 505. The first digit indicates durometer hardness, for example, 5 for 50 ± 5 , 6 for 60 ± 5 . The next two digits indicate the minimum tensile strength—for example, 05 for 5 MPa, 14 for 14 MPa. Correlation of available materials for desired hardness and tensile strength is obtained through the elongation values (see 6.2).

4. GRADE NUMBERS, SUFFIX LETTERS, AND NUMBERS

4.1 Grade Numbers

Since the basic requirements do not always sufficiently describe all the necessary qualities, provision is made for deviation or adding requirements through a system of prefix grade numbers, suffix letters, and suffix numbers. Grade No. 1 indicates that only the basic requirements are compulsory and no suffix requirements are permitted. Grades other than No. 1 are used for expressing deviations or additional requirements. A grade number is written as a material prefix number preceding the letters for type and class (see 8.1). Grade No. 1 is always an available suffix grade number, and thus is not referenced in the last column of each basic requirement table.

4.2 Suffix Letters

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

4.3 Suffix Numbers

Each suffix letter should preferably be followed by two suffix numbers (see Note 9 in 7.1). The first suffix number always indicates the method of test; time of test is part of the method and is taken from the listings in Table 4. The second suffix number, if used, always indicates the temperature of test and is taken from Table 5. Where three-digit numbers are required, a dash (-) is used for separation, for example: A1-10; B4-10; F1-11.

¹ Available from R.E. Carroll, P.O. Box 139, Trenton, NJ 08801.

Table 3 - Meaning of suffix letters

Suffix Letter	Test Required
A	Heat Aging Resistance
B	Compression Set
C	Ozone or Weather Resistance
D	Compression-Deflection Resistance
EA	Fluid Resistance (Aqueous)
EF	Fluid Resistance (Fuels)
EO	Fluid Resistance (Oils and Lubricants)
F	Low-Temperature Resistance
G	Tear Resistance
H	Flex Resistance
J	Abrasion Resistance
K	Adhesion
M	Flammability Resistance
N	Impact Resistance
P	Staining Resistance
R	Resilience
SR	Compression Stress Relaxation
Z	Any special rubber material requirement which shall be specified in detail

Table 4 - SAE and ASTM methods of test⁽¹⁾

Requirement or Suffix Letter	Basic	1	2	3	4	5	6	7	8
Durometer Hardness (Type A)	D2240	—	—	—	—	—	—	—	—
Tensile Strength, Elongation	D412 die C	—	—	—	—	—	—	—	—
Suffix A, Heat Aging Resistance	—	D573, 70 hours	D865, 70 hours	D865, 168 hours	573, 168 hours	D573, 1000 hours	D865, 1000 hours	—	—
Suffix B, Compression Set	—	D395, 22 hours, Method B, solid	D395, 70 hours, Method B, solid	D395, 22 hours, Method B, plied	D395, 70 hours, Method B, plied	D395, 1000 hours, Method B, solid	D395, 1000 hours, Method B, plied	—	—
Suffix C, Ozone or Weather Resistance	—	D1171, ⁽²⁾ ozone exposure	D1171, ⁽³⁾ weather exposure	D1171, ⁽⁴⁾ ozone exposure	—	—	—	—	—
Suffix D, Compression-Deflection Resistance	—	D575, Method A	D575, Method B	—	—	—	—	—	—
Suffix EA, Fluid Resistance (Aqueous)	—	D471, water 70 hours ⁽⁵⁾	D471, water-ethylene glycol, 70 hours ⁽⁶⁾	—	—	—	—	—	—

Table 4 - SAE and ASTM methods of test⁽¹⁾ (continued)

Requirement or Suffix Letter	Basic	1	2	3	4	5	6	7	8
Suffix EF, Fluid Resistance (Fuels)	—	D471, Reference Fuel A, 70 hours	D471, Reference Fuel B, 70 hours	D471, Reference Fuel C, 70 hours	D471, Reference Fuel D, 70 hours	D471, 85 volume percent Reference Fuel D plus 15 volume percent denatured anhydrous ethanol, ⁽⁷⁾ 70 hours	D471, 85 volume percent Reference Fuel C plus 15 volume percent anhydrous ethanol, ⁽⁷⁾ 70 hours	D471, 85 volume percent Reference Fuel C plus 15 volume percent anhydrous methanol	—
Suffix EO, Fluid Resistance (Oils and Lubricants)	—	D471, IRM 901 Oil, ⁽⁸⁾ 70 hours	D471, IRM 902 Oil, ⁽⁸⁾ 70 hours	D471, IRM 903 Oil, ⁽⁸⁾ 70 hours	D471, IRM 901 Oil, ⁽⁸⁾ 168 hours	D471, IRM 902 Oil, ⁽⁸⁾ 168 hours	D471, IRM 903 Oil, ⁽⁸⁾ 168 hours	D471, Service Fluid No. 101, ⁽⁸⁾ 70 hours	D471, Fluid as designated in Table 6, ⁽⁸⁾ 70 hours
Suffix F, Low-Temperature Resistance	—	D2137, Method A, paragraph 9.3.2 3 minutes	D1053, 5 minutes T ₂ or T ₅ or T ₁₀ or T ₅₀ or T ₁₀₀	D2137, Method A, Paragraph 9.3.2, 22 hours	D1329, 38 mm die, 50% elongation, retraction 10% min	D1329, 38 mm die 50% elongation, retraction 50% min	D1053, 5 min T ₅ , T ₁₀ , and T ₁₀ - T ₅ degree of separation max ⁽⁹⁾	D1329, 38 mm die 50% elongation, Retraction 70% min	—
Suffix G, Tear Resistance	—	D624, die B	D624, die C	—	—	—	—	—	—
Suffix H, Flex Resistance	—	D430, Method A	D430, Method B	D430, Method C	—	—	—	—	—
Suffix J, Abrasion Resistance ⁽¹⁰⁾	—	—	—	—	—	—	—	—	—
Suffix K, Adhesion	—	D429, Method A	D429, Method B	⁽¹⁰⁾	—	—	—	—	—
Suffix M, Flammability Resistance ⁽¹⁰⁾	—	—	—	—	—	—	—	—	—
Suffix N, Impact Resistance ⁽¹⁰⁾	—	—	—	—	—	—	—	—	—
Suffix P, Staining Resistance	—	D925, Method A	D925, Method B, Control Panel	—	—	—	—	—	—
Suffix R, Resilience	—	D945	—	—	—	—	—	—	—
Suffix SR, CSR	---	SAE J2979 (see SAE J200, section 7.1.1)	—	—	—	—	—	—	—
Suffix Z, Special Requirement ⁽¹⁰⁾	—	—	—	—	—	—	—	—	—

- (1) The designations refer to the following methods of the American Society for Testing and Materials.
- ASTM D395—Test Methods for Rubber Property—Compression Test
 - ASTM D412—Test Methods for Rubber Properties in Tension
 - ASTM D429—Test Methods for Rubber Property—Adhesion to Rigid Substrates
 - ASTM D430—Test Methods for Rubber Deterioration—Dynamic Fatigue
 - ASTM D471—Test Methods for Rubber Property—Effect of Liquids
 - ASTM D573—Test Methods for Rubber Deterioration in an Air Oven
 - ASTM D575—Test Methods for Rubber Properties in Compression
 - ASTM D624—Test Methods for Rubber Property—Tear Resistance
 - ASTM D865—Test Methods for Rubber Deterioration by Heating in Air (Test Tube Enclosure)
 - ASTM D925—Test Methods for Rubber Property—Staining of Surfaces (Contact, Migration, and Diffusion)
 - ASTM D945—Test Methods for Rubber Properties in Compression or Shear (Mechanical Oscillograph)
 - ASTM D1053—Test Method for Rubber Property—Stiffening at Low Temperature; Flexible Polymers and Coated Fabrics
 - ASTM D1171—Test Method for Rubber Deterioration—Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens)
 - ASTM D1329—Test Method for Evaluating Rubber Property—Retraction at Low Temperatures (TR Test)
 - ASTM D1349—Practice for Rubber—Standard Temperatures for Testing
 - ASTM D1418—Practice for Rubber and Rubber Lattices—Nomenclature
 - ASTM D2137—Test Methods for Rubber Property—Brittleness Point of Flexible Polymers and Coated Fabrics
 - ASTM D2240—Test Method for Rubber Property—Durometer Hardness
 - ASTM D3183—Practice for Rubber—Preparation of Pieces for Test Purposes from Products
 - SAE J2979—Test Method for Vulcanized Rubber and Thermoplastic Elastomer Determination of Compressive Stress Relaxation (CSR) Response
- (2) Use ozone chamber exposure method of ASTM Method D1149, Method B, Procedure B4.
- (3) ASTM Method D1171, Weather Test, is 6 weeks duration. Test area and time of year to be agreed upon by the purchaser and the manufacturer.
- (4) Use ozone chamber exposure method of ASTM Method D1149, Method B, Procedure B2.
- (5) Distilled water shall be used. Volume increase by water displacement method, except alcohol dip omitted. When determining changes in tensile strength, elongation, and hardness, test tube to be 3/4 full after specimens are immersed. Determination to be made after 30 minutes. Cool in distilled water; acetone dip to be omitted.
- (6) Equal parts by volume of distilled water and reagent grade ethylene glycol. Volume increase by displacement method, except alcohol dip omitted. When determining changes in tensile strength, elongation, and hardness, test tube to be 3/4 full after specimens are immersed. Determination to be made after 30 minutes. Cool in distilled water; acetone dip to be omitted.
- (7) Anhydrous ethanol denatured with unleaded gasoline according to CDA formula #20. Sources are Archer-Daniels-Midland, P.O. Box 1445, Cedar Rapids, Iowa 52406 and Ralph Shrader Inc., 2450 Lovette Avenue, Detroit, Michigan 48210.
- (8) IRM Oils are available from: R.E. Carroll Inc., 1570 N. Olden Ave., Trenton, NJ 08638. ASTM No. 1, 2, and 3 oils are no longer commercially available.
- ASTM Service Fluid 101 is available as Anderol 774 from Hüls AG Division, P.O. Box 2, Turner Place, Piscataway, NJ 08854.
- ASTM Service Fluid 102 consists of 95 mass percent ASTM IRM901 Oil + 5 mass percent Anglamol 99. Anglamol 99 is available from Lubrizol Corp., P.O. Box 17100, Cleveland, OH 44117.
- The above fluids are intended for comparative testing purposes. Commercial fluids may produce different results.
- (9) maximum T-values used for defining a curve for dynamic seal materials. See example in 8.3.
- (10) Test method to be specified.

Table 5 - Suffix numbers to indicate temperature of test

Applicable Suffix Requirements	Second Suffix No.	Test Temperature °C ⁽¹⁾
A, B, C, EA, EF, EO, G, K,	11	275
	10	250
	9	225
	8	200
	7	175
	6	150
	5	125
	4	100
	3	70
	2	38
	1	23
	0	(2)
F	1	23
	2	0
	3	-10
	4	-18
	5	-25
	6	-35
	7	-40
	8	-50
	9	-55
	10	-65
	11	-75
	12	-80

⁽¹⁾ These test temperatures are based on the ASTM Recommended Practice D1349. Annual Book of ASTM Standards, Parts 37 and 38.

⁽²⁾ Ambient temperature in the case of outdoor testing.

5. COMPOSITION AND MANUFACTURE

5.1 This classification is predicated upon materials, furnished under a specification based thereon, being manufactured from natural rubber, reclaimed rubber, synthetic rubber, alone or in combination, together with added compounding materials of such nature and quantity as to produce vulcanizates that comply with the specified requirements. All materials and workmanship shall be in accordance with good commercial practice, and the resulting product shall be free of porous areas, weak sections, bubbles, foreign matter, or other defects affecting serviceability.

5.2 Color

With the exception of FC, FE, FK, and GE materials, the values in the material tables are based on black compounds and comparable values may not be available in color.

6. BASIC REQUIREMENTS

- 6.1 The basic requirements for physical properties of available rubber materials are listed in Tables 6.AA to 6.KK² are based on test results obtained on test specimens having the highest and lowest tensile strength specified for each grade and durometer range.

Test results from specimens prepared from finished products may not duplicate values obtained from standard test specimens.

NOTE 8: When standard test specimens can be cut from finished parts in accordance with ASTM D3183³ a deviation to the extent of 10% (on tensile strength and elongation values only) is permissible when agreed upon by the purchaser and the supplier. This deviation is permissible only because of the recognized effects of knitting, grain, and buffing on the material when test specimens are prepared from finished parts and tested for tensile strength and elongation. This deviation is intended to apply to goods purchased by the government. For all other uses, when differences due to the method of processing or to the difficulty in obtaining suitable test specimens from the finished part arise, the purchaser and the supplier may agree on acceptable deviations. This can be done by comparing results of standard test specimens with those obtained on actual parts.

- 6.2 The available materials are listed in the appropriate material section of the table, giving each hardness and tensile strength grade with its appropriate elongation value. Also, there is a repetition of the values for the basic heat and oil aging requirements for the material resulting from the assignment of type and class. Compression set values are basic requirements to ensure proper vulcanization.
- 6.3 Available suffix numbers for each available rubber material are shown in the last column under Basic Requirements.
- 6.4 Unless a suffix requirement is used to override an existing basic requirement, the basic requirement applies.

7. SUFFIX REQUIREMENTS

7.1 Supplementary (Suffix) Requirements

Supplementary (suffix) requirements for available grades are listed in 6.AA to 6.HK.

Suffix requirements shall be specified only as needed to define qualities necessary to meet service requirements. These suffix requirements are set forth for the various grade numbers. Suffix letters and suffix numbers describing these suffix requirements may be used singly or in combination, but not all suffix values available for a given material need be specified.

7.1.1 Suffix Letters "F" and "SR"

Additions have been made to Tables 3 and 4 for Suffix "F" and "SR." SAE J200 convention requires available suffixes to be designated in the Table 6 "SUPPLEMENTARY (SUFFIX) REQUIREMENTS" section for each type and class of materials. SAE J200 also requires round robin testing to verify requirements. Recent additions to "F" in Table 4, or the addition of "SR" to Tables 3 and 4 will not undergo round robin testing, and thus will not be added to the suffix tables for each of the table grades AA through KK. The additions are available for use, but should not be added to a line call-out without conferring with the user's material group and agreement of the materials manufacturer. Use of "F" or "SR" callouts that do not exist in the AA thru KK suffix tables must be specified with a "Z":

$Z_1 = SR1x$ - Which specifies Compression Stress Relaxation Test (x = test temperature from Table 5)

7.1.2 Use of F2 or F6 (ASTM D1053) as a Suffix Requirement

When specifying an F2 or F6 requirement, the line specification must define which T-values are required, along with the maximum allowed temperature. ASTM D1053 properties must then be less than or equal to the specified temperature for the corresponding T-value.

² Tensile strength values (psi) shown in Tables 6.AA to 6.KK are for information purposes only.

³ Annual Book of ASTM Standards, Section 9, Volume 09.01.

Table 6.AA - Basic and supplementary (suffix) requirements for classification of rubber materials - AA materials

Durometer Hardness, ±5 points	Tensile Strength, min (MPa)	Tensile Strength, min (psi)	Ultimate Elongation, Min, %	Heat Aged, ASTM D573, 70 h at 70 °C	Oil Immersion, ASTM D471, IRM 903 Oil ⁽¹⁾ 70 hours at 70 °C	Compression Set, ASTM D395, Method B, Solid, Max, %, 22 hours at 70 °C	Available Suffix Grade Numbers
30	7	1015	400				2, 4
30	10	1450	400				2, 4
30	14	2031	400				2, 4
40	7	1015	400				2, 4
40	10	1450	400				2, 4
40	14	2031	400				2, 4
40	17	2466	500				2, 4
40	21	3046	600				2, 4
50	3	435	250				2
50	6	870	250				2
50	7	1015	400				2, 3
50	8	1160	400				2, 3
50	10	1450	400				2, 3, 4, 5
50	14	2031	400				2, 3, 4, 5
50	17	2466	400				2, 3, 4, 5
50	21	3046	500				2, 3, 4, 5
60	3	435	250				2
60	6	870	250				2
60	7	1015	300	Change in durometer hardness, ±15 points			2, 3
60	8	1160	300	Change in tensile strength, ±30%	No requirement	Compression set, 50% max	2, 3
60	10	1450	350	Change in ultimate elongation, -50% max			2, 3, 4, 5
60	14	2031	400				2, 3, 4, 5
60	17	2466	400				2, 3, 4, 5
60	21	3046	400				2, 3, 4, 5
60	24	3481	500				2, 3, 4, 5
70	3	435	150				2
70	6	870	150				2
70	7	1015	200				2, 3
70	8	1160	200				2, 3
70	10	1450	250				2, 3, 4, 5
70	14	2031	300				2, 3, 4, 5
70	17	2466	300				2, 3, 4, 5
70	21	3046	350				2, 3, 4, 5
80	3	435	100				2
80	7	1015	100				2
80	10	1450	150				2
80	14	2031	200				2
80	17	2466	200				2
90	3	435	75				2
90	7	1015	100				2
90	10	1450	125				2

⁽¹⁾ See Note 6 in 3.4.

Table 6.AA - Supplementary (suffix) requirements for classification of rubber materials - AA materials (continued)

Suffix Requirements		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A13	Heat aging resistance, ASTM D573, 70 hours at 70 °C:								
	Change in hardness, max, points	Basic requirements only	±15		+10	+10			
	Change in tensile strength, max, %	Basic requirements only	±30		-25	-25			
	Change in ultimate elongation, max, %	Basic requirements only	-50		-25	-25			
B13	Compression set, ASTM D395, Method B, 22 hours at 70 °C, max, %	Basic requirements only		25	25	25			
B33	Compression set, ASTM D395, Method B, 22 hours at 70 °C, max, %	Basic requirements only		35	35	35			
C12	Resistance to ozone, ASTM D1171, quality retention rating, min, %	Basic requirements only	85		85				
C20	Resistance to outdoor aging, ASTM D1171, quality retention rating, min, %	Basic requirements only	85	85	85	85			
EA14	Fluid resistance, ASTM D471, water, 70 hours at 100 °C, volume change, max, %	Basic requirements only	10	10	10	10			
F17	Low-temperature resistance, ASTM D2137, Method A, paragraph 9.3.2, nonbrittle after 3 minutes at -40 °C	Basic requirements only	pass	pass	pass	pass			
G21	Tear resistance, ASTM D624, Die C:								
	Under 7.0 MPa tensile strength, min, kN/m	Basic requirements only		22	22	22			
	7.0 MPa tensile strength and over, min, kN/m	Basic requirements only		26	26	26			
K11	Adhesion, ASTM D429, Method A, min, MPa	Basic requirements only	1.4	2.8	1.4	2.8			
K21	Adhesion, ASTM D429, Method B, min, kN/m	Basic requirements only	7	7	7	7			
P2	Staining resistance, ASTM D925, Method B, Control Panel, Nonstaining	Basic requirements only	pass	pass	pass	pass			
Z	(Special requirements) Shall cover only special rubber material requirements specified in detail, including test methods and aging parameters., or additional requirements per Tables 3, 4, and 5 specified as in 8.2								

Table 6.AK - Basic requirements for classification of rubber materials - AK materials

Durometer Hardness, ±5 points	Tensile Strength, min (MPa)	Tensile Strength, min (psi)	Ultimate Elongation, Min, %	Heat Aged, ASTM D573, 70 hours at 70 °C	Oil Immersion, ASTM D471, IRM 903 Oil ⁽¹⁾ , 70 hours at 70 °C	Compression Set, ASTM D395, Method B, Solid, Max, %, 22 hours at 70 °C	Available Suffix Grade Numbers
40	3	435	400				2
50	3	435	400				2
60	5	725	300	Change in durometer hardness, ±15 points	Volume change, +10% max	Compression set, 50% max	2
70	7	1015	250	Change in tensile strength, ±30% Change in ultimate elongation, -50% max			2
80	7	1015	150				3
90	7	1015	100				3

⁽¹⁾ See Note 6 in 3.4.

Table 6.AK - Supplementary (suffix) requirements for classification of rubber materials - AK materials (continued)

Suffix Requirements		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A14	Heat aging resistance, ASTM D573, 70 hours at 100 °C:								
	Change in durometer hardness, max, points	Basic requirements only	+15	+15					
	Change in tensile strength, max, %	Basic requirements only	-15	-15					
	Change in ultimate elongation, max, %	Basic requirements only	-40	-40					
B33	Compression set, ASTM D395, Method B, 22 hours at 70 °C max, %	Basic requirements only	50	50					
EO14	Fluid resistance, ASTM D471, IRM 901 Oil, 70 hours at 100 °C:								
	Change in volume, %	Basic requirements only	-3 to +5	-3 to +5					
EO34	Fluid resistance, ASTM D471, IRM 903 Oil ⁽¹⁾ , 70 hours at 100 °C:								
	Change in durometer hardness, points	Basic requirements only	-5 to +10	-5 to +10					
	Change in tensile strength, max, %	Basic requirements only	-30	-30					
	Change in ultimate elongation, max, %	Basic requirements only	-50	-50					
F17	Low-temperature resistance, ASTM D2137, Method A, 9.3.2, nonbrittle, 3 minutes at -40 °C	Basic requirements only	pass						
Z	(Special requirements) Shall cover only, special rubber material requirements specified in detail, including test methods and aging parameters, or additional requirements per Tables 3, 4, and 5 per 8.2.								

⁽¹⁾ See Note 6 in 3.4.

**Table 6.BA - Basic requirements for the classification
of rubber materials - BA materials**

Durometer Hardness, ±5 points	Tensile Strength, min (MPa)	Tensile Strength, min (psi)	Ultimate Elongation, Min, %	Heat Aged, ASTM D573, 70 hours at 100 °C	Oil Immersion, ASTM D471, IRM 903 Oil ⁽¹⁾ 70 hours at 100 °C	Compression Set, ASTM D395, Method B, Solid, Max, %, 22 hours at 70 °C	Available Suffix Grade Numbers
20 ⁽²⁾	6	870	400				3
30	7	1015	400				2
30	10	1450	400				2,3,4,5
30	14	2031	400				2,3,4,5
40	3	435	300				2,8
40	7	1015	300				2,8
40	10	1450	400				2,3,4,5,6
40	14	2031	400				2,3,4,5
50	7	1015	300				2,8
50	10	1450	400				2,3,4,5,6
50	14	2031	400				2,3,4,5
50	17	2466	400				2,3,4,5
60	3	435	250				8
60	6	870	250	Change in durometer hardness, ±15 points			8
60	7	1015	300				2,8
60	10	1450	350	Change in tensile strength, ±30%	No requirement	Compression set, 50% max	2,3,4,5,6
60	14	2031	400	Change in ultimate elongation, -50% max			2,3,4,5,6
60	17	2466	400				2,3,4,5,6
70	3	435	150				8
70	6	870	150				8
70	7	1015	200				2,8
70	8	1160	200				8
70	10	1450	250				2,3,4,5,6
70	14	2031	300				2,3,4,5
70	17	2466	300				2,3,4,5
80	7	1015	100				2,7
80	10	1450	150				2,4
80	14	2031	200				2,4
90	3	435	75				7
90	7	1015	100				2,7
90	10	1450	125				2,4

⁽¹⁾ See Note 6 in 3.4.

⁽²⁾ Materials would typically be 20 to 25 durometer based upon current capability.

Table 6.BA - Supplementary (suffix) requirements for the classification of rubber materials - BA materials (continued)

	Suffix Requirements	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A14	Heat aging resistance ASTM D573, 70 hours at 100 °C:								
	Change in hardness, max, points	Basic requirements only		+10	+10				
	Change in tensile strength, max, %	Basic requirements only		-25	-25				
	Change in ultimate elongation, max, %	Basic requirements only		-25	-25				
B13	Compression set, ASTM D395, Method B, 22 hours at 70 °C, max, %	Basic requirements only		25			25		25
C12	Resistance to ozone, ASTM D1171, quality retention rating, min, %	Basic requirements only	100	100	100	100	100	100	100
F17	Low-temperature resistance, ASTM D2137, Method A, 9.3.2, nonbrittle after 3 minutes at -40 °C	Basic requirements only	pass	pass	pass	pass			
F19	Low-temperature resistance, ASTM D2137, Method A, 9.3.2, nonbrittle after 3 minutes at -55 °C	Basic requirements only		pass		pass			
K11	Adhesion, ASTM D429, Method A, min, MPa	Basic requirements only		1.4	1.4	1.4	1.4		
K21	Adhesion, ASTM D429, Method B, min, kN/m	Basic requirements only		7.0	7.0	7.0			
K31	Adhesion, bond made after vulcanization	Basic requirements only		(1)	(1)	(1)			
Z	(Special requirements) Shall cover only, special rubber material requirements specified in detail, including test methods and aging parameters, or additional requirements per Tables 3, 4, and 5 per 8.2								

(1) Method of evaluation and requirement shall be based on agreement between fabricator and end user.

**Table 6.BC - Basic requirements for the classification
of rubber materials - BC materials**

Durometer Hardness, ±5 points	Tensile Strength, min (MPa)	Tensile Strength, min (psi)	Ultimate Elongation, Min, %	Heat Aged, ASTM D573, 70 hours at 100 °C	Oil immersion, ASTM D471, IRM 903 Oil ⁽¹⁾ 70 hours at 100 °C	Compression Set, ASTM D395, Method B, Solid, Max, %, 22 hours at 100 °C	Available Suffix Grade Numbers
30	3	435	300				2, 5
30	7	1015	400				2, 5
30	10	1450	500				2, 5
30	14	2031	500				2
40	3	435	300				2
40	7	1015	400				2, 5
40	10	1450	500				2, 5
40	14	2031	500				2, 5
40	17	2466	500				2
50	3	435	300				2, 5
50	7	1015	300				2, 5
50	10	1450	350				2, 5, 6
50	14	2031	400				2, 5, 6
50	17	2466	450				2, 6
50	21	3046	500				2, 6
50	24	3481	500				2, 6
60	3	435	300				3, 5
60	7	1015	300	Change in durometer hardness, ±15 points			3, 5
60	10	1450	350		Volume change, +120% max	Compression set, 80% max	3, 5, 6
60	14	2031	350	Change in tensile strength, ±30%			3, 6
60	17	2466	400	Change in ultimate elongation, -50% max			3, 6
60	21	3046	400				3, 6
60	24	3481	400				3, 6
70	3	435	200				3, 5
70	7	1015	200				3, 5
70	10	1450	250				3, 5, 6
70	14	2031	300				3, 5, 6
70	17	2466	300				3, 6
70	21	3046	300				3, 6
80	3	435	100				4
80	7	1015	100				4
80	10	1450	100				4
80	14	2031	150				4
90	3	435	50				4
90	7	1015	100				4
90	10	1450	150				4
90	14	2031	150				4

⁽¹⁾ See Note 6 in 3.4.

Table 6.BC - Supplementary (suffix) requirements for the classification of rubber materials - BC materials (continued)

	Suffix Requirements	Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A14	Heat aging resistance, ASTM D573, 70 hours at 100 °C:								
	Change in hardness, max, points	Basic requirements only	+15	+15	+15	+15	+15		
	Change in tensile strength, max, %	Basic requirements only	-15	-15	-15	-15	-15		
	Change in ultimate elongation, max, %	Basic requirements only	-40	-40	-40	-40	-40		
B14	Compression set, ASTM D395, Method B, 22 hours at 100 °C, max, %	Basic requirements only	35	35	35	35	35		
C12	Resistance to ozone, ASTM D1171, quality retention rating, min, %	Basic requirements only	100	100	100	100	100		
EO14	Fluid resistance, ASTM D471, IRM 901 Oil, 70 hours at 100 °C:								
	Change in hardness, points	Basic requirements only	±10	±10	±10	±10	±10		
	Change in tensile strength, max, %	Basic requirements only	-30	-30	-30	-30	-30		
	Change in ultimate elongation, max, %	Basic requirements only	-30	-30	-30	-30	-30		
	Change in volume, %	Basic requirements only	-10 to +15	-10 to +15	-10 to +15	-10 to +15	-10 to +15		
EO34	Fluid resistance, ASTM D471, IRM 903 Oil ⁽¹⁾ , 70 hours at 100 °C:								
	Change in tensile strength, max, %	Basic requirements only	-70	-60	-45	-60	-60		
	Change in ultimate elongation, max, %	Basic requirements only	-55	-50	-30	-60	-50		
	Change in volume, max, %	Basic requirements only	+120	+100	+80	+100	+100		
F17	Low-temperature resistance, ASTM D2137, Method A, 9.3.2, nonbrittle after 3 minutes at -40 °C	Basic requirements only	pass	pass	pass			pass	
F19	Low-temperature resistance, ASTM D2137, Method A, 9.3.2, nonbrittle after 3 minutes at -55 °C					pass			
G21	Tear resistance, ASTM D624, Die C:								
	Under 7.0 MPa tensile strength, min, kN/m	Basic requirements only	22	22	22				
	7.0 to 10 MPa tensile strength, min, kN/m	Basic requirements only	26	26	26				
	10 MPa tensile strength and over, min, kN/m	Basic requirements only	26	26	26	26	26		
K11	Adhesion, ASTM D429, Method A, min, MPa	Basic requirements only	1.4	1.4	1.4	1.4	2.8		
P2	Staining resistance, ASTM D925, Method B, Control Panel, Nonstaining	Basic requirements only	pass	pass	pass				
Z	(Special requirements) Shall cover only, special rubber material requirements specified in detail, including test methods and aging parameters, or additional requirements per Tables 3, 4, and 5 per 8.2								

⁽¹⁾ See Note 6 in 3.4.

**Table 6.BE - Basic requirements for the classification
of rubber materials - BE materials**

Durometer Hardness, ±5 points	Tensile Strength, min (MPa)	Tensile Strength, min (psi)	Ultimate Elongation, Min, %	Heat Aged, ASTM D573, 70 hours at 100 °C	Oil Immersion, ASTM D471, IRM 903 Oil ⁽¹⁾ 70 hours at 100 °C	Compression Set, ASTM D395, Method B, Solid, Max, %, 22 hours at 100 °C	Available Suffix Grade Numbers
40	3	435	500			40	2
40	7	1015	500			40	2
50	3	435	350			40	2
50	6	870	350			40	2
50	7	1015	400			40	2
50	10	1450	400			40	2,3
50	14	2031	400			40	2
60	3	435	300			40	2
60	6	870	300			40	2
60	7	1015	350	Change in durometer hardness, ±15 points	Volume change, +80% max	40	2
60	10	1450	350	Change in tensile strength, ±30%		40	2,3
60	14	2031	350	Change in ultimate elongation, -50% max		40	2
70	3	435	200			50	2
70	6	870	200			50	2
70	7	1015	200			50	2
70	10	1450	250			50	2,3
70	14	2031	250			50	2
70	17	2466	250			50	2
80	7	1015	100			50	2
80	10	1450	100			50	2
80	14	2031	150			50	2
80	17	2466	150			50	2
90	7	1015	100			50	2
90	10	1450	100			50	2
90	14	2031	150			50	2

⁽¹⁾ See Note 6 in 3.4.