

Standard Classification System for Nonmetallic Automotive Gasket Materials

1. Scope

- 1.1 The classification system provides a means for specifying or describing pertinent properties of commercial nonmetallic gasket materials. Materials composed of asbestos, cork, cellulose, and other organic or inorganic materials in combination with various binders or impregnants are included. Materials normally classified as rubber compounds are not included, since they are covered in SAE J200—ASTM D 2000. Gasket coatings are not covered, since details thereof are intended to be given on engineering drawings or in separate specifications.
- 1.2 Since all of the properties that contribute to gasket performance are not included, use of the classification system as a basis for selecting materials is limited.
- 1.3 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.
- 1.4 This SAE Recommended Practice may involve hazardous materials, operations, and equipment. This document does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of this document to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.
- 1.5 **Rationale**—The Powertrain Systems Group has been unable to convene a group of subject matter experts to perform the 5 year content review of this document. Under these circumstances, it is recommended that this Recommended Practice be cancelled.

2. References

- 2.1 **Applicable Publications**—The following publications form a part of this specification to the extent specified herein. The latest issue of SAE publications shall apply.

- 2.1.1 SAE PUBLICATIONS—Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

SAE J90—Standard Classification System for Nonmetallic Automotive Gasket Materials

SAE J200—Classification System for Rubber Products in Automotive Applications

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2.1.2 ASTM PUBLICATIONS—Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

ASTM D 2000—Classification System for Rubber Products in Automotive Applications
ASTM E 11—Specification for Wire-Cloth Sieves for Testing Purposes
ASTM F 36—Test Method for Compressibility and Recovery of Gasket Materials
ASTM F 37—Test Methods for Sealability of Gasket Materials
ASTM F 38—Test Methods for Creep Relaxation of a Gasket Material
ASTM F 146—Test Methods for Fluid Resistance of Gasket Materials
ASTM F 147—Test Method for Flexibility of Non-Metallic Gasket Materials
ASTM F 148—Test Method for Binder Durability of Cork Composition Gasket Materials
ASTM F 152—Test Methods for Tension Testing of Nonmetallic Gasket Materials
ASTM F 433—Practice for Evaluating Thermal Conductivity of Gasket Materials
ASTM F 607—Test Method for Adhesion of Gasket Materials to Metal Surfaces

3. *Significance and Use*

- 3.1 This classification is intended to encourage uniformity in reporting properties; to provide a common language for communications between suppliers and consumers; to guide engineers and designers in the test methods commonly used for commercially available materials; and to be versatile enough to cover new materials and test methods as they are introduced.
- 3.2 It is based on the principle that nonmetallic gasket materials should be described, insofar as is possible, in terms of specific physical and mechanical characteristics, and that an infinite number of such descriptions can be formulated by use of one or more standard statements based on standard tests. Therefore, users of gasket materials can, by selecting different combinations of statements, specify different combinations of properties desired in various parts. Suppliers, likewise, can report properties available in their respective products.

4. *Basis of Classification*

- 4.1 To permit "line call-out" of the descriptions mentioned in 3.2, this classification system establishes letter or number symbols or both for various performance levels of each property or characteristic (see Table 1).
- 4.2 In specifying or describing gasket materials, each "line call-out" shall include the number of this system (minus date symbol) followed by the letter "F" and six numerals, for example: SAE J90 (F125400). Since each numeral of the call-out represents a characteristic (as shown in Table 1), six numerals are always required. The numeral "0" is used when the description of any characteristic is not desired. The numeral "9" is used when the description of any characteristic (or test related thereto) is specified by some supplement to this classification system, such as notes on engineering drawings.
- 4.3 To further specify or describe gasket materials, each "line call-out" may include one or more suffix letter-numeral symbols, as listed in Table 2, for example: SAE J90 (F125400-B2M4). Various levels of definition may be established by increasing or decreasing the number of letter-numeral symbols used in the "line call-out."

TABLE 1—BASIC PHYSICAL AND MECHANICAL CHARACTERISTICS

Basic Six-Digit Number	Basic Characteristic
First Numeral	"Type" of material (the principal fibrous or particulate reinforcement material from which the gasket is made) shall conform to the first numeral of the basic six-digit number, as follows: 0 = not specified 1 = asbestos 2 = cork 3 = cellulose 4 = fluorocarbon polymer 5 = flexible graphite 7 = nonasbestos, tested as Type 1 9 = as specified⁽¹⁾
Second Numeral	Class of material (method of manufacture or common trade designation) shall conform to the second numeral of the basic six-digit number, as follows: When first numeral is "0" or "9," second numeral: 0 = not specified 9 = as specified⁽¹⁾ When first numeral is "1" or "7," second numeral: 0 = not specified 1 = compressed sheet process 2 = beater process 3 = paper and millboard 9 = as specified¹ When first numeral is "2," second numeral: 0 = not specified 1 = cork composition (Class 1) 2 = cork and elastomeric (Class 2) 3 = cork and cellular rubber (Class 3) 9 = as specified⁽¹⁾ When first numeral is "3," second numeral: 0 = not specified 1 = untreated fiber—tag, chipboard, vulcanized fiber, etc. (Class 1) 2 = protein treated (Class 2) 3 = elastomeric treated (Class 3) 4 = thermosetting resin treated (Class 4) 9 = as specified⁽¹⁾ When first numeral is "4," second numeral: 0 = not specified 1 = sheet PTFE 2 = PTFE of expanded structure 3 = PTFE filaments, braided, or woven 4 = PTFE felts 5 = filled PTFE 9 = as specified When first numeral is "5," second numeral: 0 = not specified 1 = homogeneous sheet 2 = laminated sheet 9 = as specified⁽¹⁾

TABLE 1—BASIC PHYSICAL AND MECHANICAL CHARACTERISTICS

Basic Six-Digit Number	Basic Characteristic	
Third Numeral	Compressibility characteristics, determined in accordance with 9.2, shall conform to the percent indicated by the third numeral of the basic six-digit number. (Example: 4 = 15 to 25%)	
	0 = not specified	5 = 20 to 30%
	1 = 0 to 10%	6 = 25 to 40%
	2 = 5 to 15%*	7 = 30 to 50%
	3 = 10 to 20%	8 = 40 to 60%
	4 = 15 to 25%	9 = as specified ⁽¹⁾
	*7 to 17% for compressed sheeter process	
Fourth Numeral	Thickness increase when immersed in ASTM No. 3 Oil: determined in accordance with 9.3, shall conform to the percent indicated by the fourth numeral of the basic six-digit number. (Example: 4 = 15 to 30%)	
	0 = not specified	5 = 20 to 40%
	1 = 0 to 15%	6 = 30 to 50%
	2 = 5 to 20%	7 = 40 to 60%
	3 = 10 to 25%	8 = 50 to 70%
	4 = 15 to 30%	9 = as specified ⁽¹⁾
Fifth Numeral	Weight increase when immersed in ASTM No. 3 Oil: determined in accordance with 9.3, shall conform to the percent indicated by the fifth numeral of the basic six-digit number. (Example: 4 = 30% max)	
	0 = not specified	5 = 40%, max
	1 = 10%, max	6 = 60%, max
	2 = 15%, max	7 = 80%, max
	3 = 20%, max	8 = 100%, max
	4 = 30%, max	9 = as specified ⁽¹⁾
Sixth Numeral	Weight increase when immersed in water: determined in accordance with 9.3, shall conform to the percent indicated by the sixth numeral of the basic six-digit number. (Example: 4 = 30%, max)	
	0 = not specified	5 = 40%, max
	1 = 10%, max	6 = 60%, max
	2 = 15%, max	7 = 80%, max
	3 = 20%, max	8 = 100%, max
	4 = 30%, max	9 = as specified ⁽¹⁾

1. On engineering drawings or other supplement to this classification system.

TABLE 2—SUPPLEMENTARY PHYSICAL AND MECHANICAL CHARACTERISTICS

Suffix Symbol	Supplementary Characteristics																						
A9	Sealability characteristics shall be determined in accordance with 9.4. External load, internal pressure, other details of test, and results shall be as specified on engineering drawing or other supplement to this classification.																						
B1 through B9	Creep relaxation characteristics shall be determined in accordance with 9.5. Loss of stress at end of 24 h shall not exceed the amount indicated by the numeral of the B-symbol. <table> <tr> <td>B1 = 10%</td><td>B5 = 30%</td></tr> <tr> <td>B2 = 15%</td><td>B6 = 40%</td></tr> <tr> <td>B3 = 20%</td><td>B7 = 50%</td></tr> <tr> <td>B4 = 25%</td><td>B8 = 60%</td></tr> <tr> <td></td><td>B9 = as specified⁽¹⁾</td></tr> </table>	B1 = 10%	B5 = 30%	B2 = 15%	B6 = 40%	B3 = 20%	B7 = 50%	B4 = 25%	B8 = 60%		B9 = as specified ⁽¹⁾												
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	B9 = as specified ⁽¹⁾																						
D00 through D99	The former ASTM standard F 64, Test Method for Corrosive and Adhesive Effects of Gasket Materials on Metal Surfaces, was discontinued in 1980. The recently established test for adhesion has become Test Method ASTM F 607.																						
E00 through E99	Weight and thickness change after immersion in ASTM Fuel B shall be determined in accordance with 9.3. Weight increase shall not exceed the standard rating number indicated by the first numeral of the two-digit number of the E-symbol. Thickness increase shall not exceed the standard rating number indicated by the second numeral of the E-symbol. <table> <tr> <td>Weight Increase, % (first numeral)</td><td>Thickness Increase, % (second numeral)</td></tr> <tr> <td>E0_ = not specified</td><td>E_0 = not specified</td></tr> <tr> <td>E1_ = 10</td><td>E_1 = 0 to 5</td></tr> <tr> <td>E2_ = 15</td><td>E_2 = 0 to 10</td></tr> <tr> <td>E3_ = 20</td><td>E_3 = 0 to 15</td></tr> <tr> <td>E4_ = 30</td><td>E_4 = 5 to 20</td></tr> <tr> <td>E5_ = 40</td><td>E_5 = 10 to 25</td></tr> <tr> <td>E6_ = 60</td><td>E_6 = 15 to 35</td></tr> <tr> <td>E7_ = 80</td><td>E_7 = 25 to 45</td></tr> <tr> <td>E8_ = 100</td><td>E_8 = 30 to 60</td></tr> <tr> <td>E9_ = as specified⁽¹⁾</td><td>E_9 = as specified⁽¹⁾</td></tr> </table>	Weight Increase, % (first numeral)	Thickness Increase, % (second numeral)	E0_ = not specified	E_0 = not specified	E1_ = 10	E_1 = 0 to 5	E2_ = 15	E_2 = 0 to 10	E3_ = 20	E_3 = 0 to 15	E4_ = 30	E_4 = 5 to 20	E5_ = 40	E_5 = 10 to 25	E6_ = 60	E_6 = 15 to 35	E7_ = 80	E_7 = 25 to 45	E8_ = 100	E_8 = 30 to 60	E9_ = as specified ⁽¹⁾	E_9 = as specified ⁽¹⁾
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E9_ = as specified ⁽¹⁾	E_9 = as specified ⁽¹⁾																						
H	Adhesion characteristics shall be determined in accordance with 9.6. Results shall be as specified on engineering drawing or other supplement to this classification.																						
K1 through K9	Thermal conductivity characteristics shall be determined in accordance with 9.10. The K-factor obtained in $W/(m \cdot K)(Btu \cdot in/h \cdot ft^2 \cdot ^\circ F)$ shall fall within the ranges indicated by the numeral of a K symbol. <table> <tr> <td>K1 = 0.00 to 0.09 (0.00 to 0.65)</td><td>K5 = 0.29 to 0.38 (2.00 to 2.65)</td></tr> <tr> <td>K2 = 0.07 to 0.17 (0.50 to 1.15)</td><td>K6 = 0.36 to 0.45 (2.50 to 3.15)</td></tr> <tr> <td>K3 = 0.14 to 0.24 (1.00 to 1.65)</td><td>K7 = 0.43 to 0.53 (3.00 to 3.65)</td></tr> <tr> <td>K4 = 0.22 to 0.31 (1.50 to 2.15)</td><td>K8 = 0.50 to 0.60 (3.50 to 4.15)</td></tr> <tr> <td></td><td>K9 = as specified⁽¹⁾</td></tr> </table>	K1 = 0.00 to 0.09 (0.00 to 0.65)	K5 = 0.29 to 0.38 (2.00 to 2.65)	K2 = 0.07 to 0.17 (0.50 to 1.15)	K6 = 0.36 to 0.45 (2.50 to 3.15)	K3 = 0.14 to 0.24 (1.00 to 1.65)	K7 = 0.43 to 0.53 (3.00 to 3.65)	K4 = 0.22 to 0.31 (1.50 to 2.15)	K8 = 0.50 to 0.60 (3.50 to 4.15)		K9 = as specified ⁽¹⁾												
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M1 through M9	Tensile strength characteristics shall be determined in accordance with 9.7. Results in MPa (psi) shall be no less than the value indicated by the numeral of the M-symbol.																						