

## Understanding the ASTM D2000 (SAE Recommended Practice J200)

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"Standard Classification System for Rubber Products in Automotive Applications"

ASTM D2000 was introduced to provide engineers with a classification system for commercially available rubber materials and to provide a simple designation method, called the "Line call-out." Although the title specifies automotive application it is no longer limited to only the automotive industry. In fact several industries now benefit from this standard.

ASTM D2000 standard follows the Society of Automotive Engineer's (SAE) standard J200. As revisions are made to the J200 standard, the corresponding changes are made to the D2000 standard. ASTM D2000 was originally intended for elastomer compounds containing carbon black. However, it has become a standard for almost all elastomer compounds.

### ASTM D2000-12 2BG710 B14 B34 EF11 EF21 EO14 EO34 F17 K11

Lets breakdown the "Line call-out" above.

"ASTM D2000" is the reference number for this standard.

"-90" is the revision year of the document. The latest revision year should always be used.

Now we get to the nitty gritty of the line call-out.

"M" states that the units of measure are SI (International Standard of Units). If the line call-out doesn't have the "M" them the "Inch-Pound Units" are to be used.

Lets Jump ahead one step and skip "2" for now.

"BG" - The first letter, "B", is the designation for *Type* (resistance to heat aging) as shown in table 1. The second letter, "G", is the designation for *Class* (resistance to swelling in oil) as shown in Table 2. Put these two designation together and you can use table X1.1 in the ASTM D2000 specification to see what basic elastomers are used. According to Table X1.1, BG is "NBR polymers, urethanes."

<i>Type</i>	Test Temperature
A	70°C (158°F)
B	100°C (212°F)
C	125°C (257°F)
D	150°C (302°F)
E	175°C (347°F)
F	200°C (392°F)

G	225°C (437°F)
H	250°C (482°F)
J	275°C (527°F)

**Table 1**

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%

**Table 2, Tested for 70 hrs @ temperature from table 1 in ASTM Oil No 3.**

Lets go back to "2" now.

"2" represents the grade of rubber. The grades available are shown on table 6 of the ASTM D2000 specification. The grades available are dependent on the hardness and tensile strength for the particular *Type* and *Class* material. Table 6 also shows the basic requirements of the rubber like hardness, tensile strength, elongation, heat ages properties and oil immersion, compression set (Does heat aged & oil immersion sound familiar?--*Type and Class "BG"*). Grade 1 indicates that only the basic requirements are required and no suffix requirements are permitted. But well get to suffix requirements in a minute.

"7" represents the hardness. In this case 7 = 70 Durometer Shore "A"

"10" represents the tensile strength. Remember the "M" from before? Here's were it comes in.

M2BG710 = 10 MPa tensile strength minimum -- SI Units

2BG710 = 1015 psi tensile strength minimum -- Inch-Pound Units

Starting to get the picture? Lets continue with the next step, the suffix requirements.

Grades other than 1 are used to show deviations or additional requirements other than the basic requirements and are listed as "Suffix Requirements." Example: **"B14 B34 EF11 EF21 EO14 EO34 F17 K11"** are suffix requirements.

Each suffix requirement has a *suffix letter(s)* and a *suffix number*. The suffix letter represents the test required. The meaning of each *suffix letter* is shown in table 3.

The *suffix number* is a two digit number. The first number indicates the test method and the second number indicates the temperature of the test. table 4 in the ASTM D2000 manual shows each suffix requirement.

Suffix Letter	Test Required
A	Heat 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
Z	Any Special Requirements

**Table 3, Suffix letter meanings**

So lets recap the Suffix Requirements.

For each *Type* and *Class* of material there are a set of basic requirements: heat ages properties, tensile strength, elongation, oil immersion in ASTM Oil No 3 and compression set. For grades of material other than 1 there are additional requirements or deviations from the basic requirements that are shown as *Suffix Requirements*. Each suffix requirements is a group of letters and numbers that tell what test, the test method and temperature of the test to be performed.

Please note that you do not need to meet ALL the suffix requirements for a particular material . The suffix requirements are picked based on the qualities needed to meet the service requirements of the

material. For example, you may not be particularly interested in the fluid resistance tests if the material you are picking is going to be used in an application where it will only see compressed air. If there is a special requirement that you need to meet the suffix letter "Z" is used to note them. These requirements need to be specified in detail.

I hope this helps you to understand the ASTM D2000 Manual. I highly recommend that you have this manual on hand. This manual can be purchased from <http://www.sae.org>.