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HOW TO READ AN ASTM D 2000 SPECIFICATION

The overwhelming majority of specifications for rubber compounds are based on ASTM D 2000, “Standard Classification for Rubber Products in Automotive Applications” A second standard, SAE J200, “Classification System for Rubber Products”, is for all intents and purposes, identical to ASTM D 2000, so for the purpose of this discussion we will address the ASTM D 2000.

While somewhat daunting to newcomers to the world of rubber specs, ASTM D 2000 is actually very easy to understand, once the fundamentals are understood. In the example below, we have taken the specification for our standard 70 durometer nitrile, N-7002, and broken it down to its individual elements.

ASTM D 2000-03 M2BG714 B14 EA14 EF11 EF31 EO14 EO34 F17

This is the year that the standard was last revised; in this case 2003.

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The “ M ” signifies that all units of measure used in reporting test results will be in **International System of Units** , or SI for short. In other words, they will be in metric units, such as degrees Centigrade instead of Fahrenheit, mega Pascals instead of psi, etc. If no M is present, then English units of measure are to be assumed, although this is becoming increasingly rare, as the change to SI units occurred in 1980.

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This is the Grade number of the material. Grade numbers are commonly specified when the basic requirements (Grade 1) do not sufficiently cover the desired properties of a given material. Designating a grade other than 1 allows for the addition of suffix requirements. (more on these later).

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This is the type of material. Type is used to classify materials by **temperature**

resistance. ASTM D2000 requires that rubber materials must meet the following requirements after 70 hours of heat aging at various temperatures, according to type.

- 1 Change in tensile strength: $\pm 30\%$
- 2 Change in hardness: -50% max.
- 3 Change in hardness: ± 15 points

The test temperature by type are as follows:

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

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This is the class material. Class is used to differentiate materials on the basis of resistance to swelling in IRM No. 903 Oil, after 70 hours at the temperatures per the immediately preceding table. However, a maximum of 150° C has been established, which is the limit of stability of the test oil. The maximum allowable volume swell by class is set forth in the table below:

Class	Max. Swell, %
A	No Requirement
B	140
C	120
D	100
E	80
F	60
G	40
H	30
J	20
K	10

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After type and class have been determined, durometer hardness and tensile strength are defined by a three-digit number, in our example, 714, the “7” denotes a material of with a durometer hardness, in A units, of 70 ± 5 . The “14” means that the tensile strength must be at least 14 mega Pascals, or 2031psi.

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The rest of our specification consists of suffix requirements. Suffix requirements are specified when the basic requirements as set forth in ASTM D 2000 for a particular type and class of material are not sufficient to achieve the desired properties in the finished product. Suffix requirements always consist of one or two of both alpha and numeric characters. The meaning of the alpha characters is explained in the following table:

Suffix	Required Test
A	Heat Resistance
B	Compression Set
C	Ozone or Weather Resistance
D	Compression-Deflection Resistance
EA	Water Resistance
EF	Fuel Resistance
EO	Oil and Lubricant Resistance
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

In those cases where the end user has a special requirement, not covered by the tests in the table above, these may be designated as “Z” requirements. They are user defined, should always be clearly specified, and agreed upon by the customer and compounder and/or molder in advance.

The numeric characters in suffix requirements serve two purposes. The first number specifies the duration of the test, and the test method to be employed. The second number indicates the temperature at which the test is to be run. In our example, “B14” means that the compression set test must be run using Test Method D 395 for a period of 22 hours. The test temperature is 100°C. For a complete listing of the meaning of numeric characters in ASTM specifications, please consult Tables 4 and 5 in ASTM D 2000.

It should be noted that with the exception of FC, FE, FK, and GE materials, the color of all materials is assumed to be black. In fact, changing the color of a rubber material almost always has an effect (frequently adverse) on its physical properties, and equivalent performance cannot always be achieved. It is also important that suffix requirements be

specified only as needed to achieve the desired properties in the end product. It is not necessary, or even desirable, to specify all available suffix requirements for a given grade number.

The combination of the document number (in our example D 2000), the prefix letter “M”, the grade number, type and class designation, the hardness and tensile strength, and the suffix requirements, if any, constitute what is known as a **line call-out**, which is another name for **material specification**
