TECHNICAL BULLETIN

Low Temperature Compounds

Low temperature performance can be a very important characteristic of an elastomeric compound. Reducing the temperature of the environment surrounding the rubber article will have a negative impact on the rubber properties. With decreasing temperatures, the movements of the molecular chains are reduced. At a certain temperature the molecular chains will no longer be able to move and the rubber looses all it rubber characteristics. The rubber will embrittle and become plastic like, reducing or eliminating the ability of the material to act as a seal.

Some elastomers possess inherently good low temperature properties, while others do not. Silicones and Fluorosilicones generally have very good low temperature characteristics, with low range operating temperatures being as low as –100°F and below. EDPM materials are also pretty good with lower range temperatures being in the –50°F to –75°F range. On the other hand, most Fluoroelastomers and Perfluoroelastomers become stiff at temperatures above 0°F with some even above 32°F. Most of the other elastomers range somewhere between these two extremes. A couple of them - including Neoprenes, require extended time to become completely stiff at lower temperatures.

Many materials can be modified chemically to dramatically improve the low temperature performance of a given compound. Formulating a compound to improve its low temperature performance may result in sacrificing some of its other properties, however. For example improving the low temperature properties of NBR compounds will result in less oil and fuel resistance.

Twenty-five Precision Associates compounds specifically formulated to improve low temperature performance are listed on the back of this page.

For general low temperature properties for elastomer families, please refer to the Polymer Comparison page in Precision Associates' Compound Selection Guide. For individual compound test results, you may request a Product Data Sheet from your PAI Customer Service representative.

There are several different ways to measure the low temperature properties of a rubber compound. The three most common methods used in the rubber industry are:

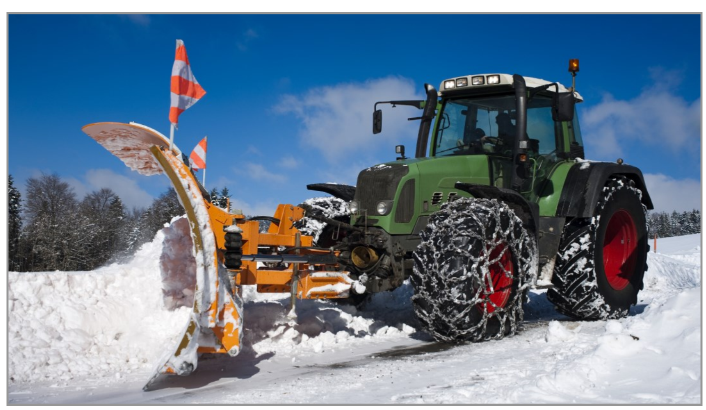
The **Glass Transition** temperature is the point at which a particular rubber compound becomes crystalline and is stiff and brittle. At this point many molecules will be aligned and the compound will cease to be liquid or elastic. Time at a given temperature may also be required as some polymers need time to develop this crystallization. Testing is performed per ASTM E 1640

The **Brittle Point** of a compound is the temperature at which the material breaks upon impact. Testing is performed per ASTM D 1329.

Temperature Retraction is the temperature at which frozen rubber returns to an elastic state. Testing is performed per ASTM D2137.

Precision Associates typically tests our seal compounds for Brittle Point and for Temperature Retraction, specifically TR-10. We can also provide other retraction results if desired.

Precision Associates considers the TR-10 test to be the best indicator for the performance of seals at low temperatures.



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B-Lo°™
Lo-Temp
Rubber Compounds

Precision Associates' B-Lo° Compounds Formulated Specifically for Improved Low Temperature Properties

Compound	Polymer	Duro	Color	Brittle Point		TR-10	
3314	NBR	30	Black	-74° F	-52° C	-45° F	-43° C
7501	NBR	50	Black	-67° F	-55° C	-46° F	-43° C
7601	NBR	60	Black	-74° F	-59° C	-61° F	-52° C
5716	NBR	70	Black	-53° F	-47° C	-44° F	-42° C
3716	NBR	70	Black	-81° F	-63° C	-50° F	-46° C
603721	NBR	70	Black	-90° F	-68° C	-58° F	-50° C
5816	NBR	80	Black	-51° F	-46° C	-48° F	-44° C
5916	NBR	90	Black	-47° F	-44° C	-44° F	-42° C
4503	CR	50	Black	-67° F	-55° C	-65° F	-54° C
4603	CR	60	Black	-76° F	-60° C	-74° F	-59° C
4705	CR	70	Black	-67° F	-55° C	-43° F	-42° C
8703	Viton GLT	70	Black	-48° F	-44° C	-30° F	-34° C
9701	FKM	70	Black	-49° F	-45° C	-41° F	-41° C
9703	FKM	75	Purple	-49° F	-45° C	-40° F	-40° C
9705	FKM	70	Black	-67° F	-55° C	-51° F	-46° C
9901	FKM	90	Black	-49° F	-45° C	-41° F	-41° C
9905	FKM	90	Black	- 67° F	-55° C	-51° F	-46° C
19301	Silicone	30	Rust Red	< -130° F	< -90° C	< -103° F	< -75° C
19401	Silicone	40	Rust Red	< -130° F	< -90° C	< -103° F	< -75° C
19566	Silicone	50	Red	< -130° F	< -90° C	< -103° F	< -75° C
19601	Silicone	60	Rust Red	< -130° F	< -90° C	< -103° F	< -75° C
19701	Silicone	70	Rust Red	< -130° F	< -90° C	< -103° F	< -75° C
19801	Silicone	80	Rust Red	< -130° F	< -90° C	< -103° F	< -75° C
22716	EA (Vamac®)	75	Black	-62° F	-52° C	-50° F	-46° C
34703	FFKM	75	Black	N/A	N/A	-29° F	-34° C
55703	HNBR	70	Black	-55° F	-48° C	-40° F	-40° C
55903	HNBR	90	Black	-55° F	-48° C	-44° F	-42° C

Test results are typical. Customer should determine the suitability of our compound in their own application.

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