



Kalrez[®] perfluoroelastomer
parts

From DuPont Performance Elastomers

Physical Properties and Compound Comparisons

Kalrez[®] perfluoroelastomer parts are available in a number of different compounds that are formulated to optimize properties and give the best possible performance in various applications. Modification of the finished properties is achieved by use of fillers and other additives.

Table 1 summarizes the basic physical properties of the most commonly used compounds. Descriptions of the key attributes of each compound and their general areas of application follow.

Standard Compounds

Compound 6375—A carbon black-filled compound for general use in O-rings, seals, diaphragms and other parts specifically for the chemical process industry. This compound has excellent, broad chemical resistance, good mechanical properties, and outstanding hot-air aging properties. 6375 is well suited for use in mixed process streams because of its excellent resistance to acids, bases, and amines. In addition, it is the suggested compound for use in hot water, steam, ethylene oxide and propylene oxide. A maximum continuous service temperature of 275°C [525°F] is recommended.

Compound 7075—Kalrez[®] Spectrum[™] 7075 broadens Kalrez[®] sealing options with a perfluoroelastomer that has enhanced physical performance properties including very low compression set (12% pellets/15% O-rings per ASTM D 395B) and improved seal force retention. It is a carbon black filled compound utilizing new and proprietary cure chemistry technology with mechanical properties designed for improving sealing performance in both high temperature environments and temperature cycling situations. 7075 joins the family of Kalrez[®] Spectrum[™] products designed for the chemical processing industry. To provide even greater sealing performance in dynamic applications where low friction is required, 7075 O-rings have a glossier finish than other Kalrez[®] parts. 7075 was specifically developed to be used as an O-ring or custom-sealing component in the chemical and hydrocarbon industries, with an improved thermal resistance that extends maximum service temperature to 327°C (620°F). Kalrez[®] Spectrum[™] 7075 offers the enhanced elastomeric properties outlined above while providing a chemical resistance better than the industry standard set by Kalrez[®] 4079.

Table 1
Typical Physical Properties^a

Compounds	Standard			Specialty			
	6375	7075	4079	1050LF	1058	3018	2037
Durometer Hardness ^b , Shore A, points ±5	75	75	75	82	65	91	79
100% Modulus, ^c							
psi	1,050	1,100	1,050	1,800	675	2,450	900
MPa	7.2	7.6	7.2	12.4	4.7	16.9	6.2
Tensile Strength at Break ^c ,							
psi	2,200	2,600	2,450	2,700	1,300	3,150	2,450
MPa	15.1	17.9	16.5	18.6	9.0	21.7	16.9
Elongation at Break, ^c %	160	160	150	125	180	125	200
Compression Set ^d , % 70 hr at 204° C [400° F]	30	12	25	35	40	35	27
Brittle Point ^e ,							
°C	-	-	-50	-41	-40	-37	-54
°F	-	-	-58	-42	-41	-35	-65

^aNot to be used for specifications

^bASTM D2240

^cASTM D412, 500 mm/min (20 in/min)

^dASTM D395B, pellets

^eASTM D746

Note: Other specialty or custom compounds may be available or developed for applications that require different properties than the above compounds offer.

Compound 4079—A low compression set compound for general-purpose use in O-rings, diaphragms, seals, and other parts used in the process and aircraft industries. It is a carbon black-filled compound with excellent chemical resistance, good mechanical properties, and outstanding hot air aging properties. It exhibits low swell in organic and inorganic acids and aldehydes and has good response to temperature cycling effects. A maximum operating temperature of 316°C [600°F] is recommended, with short excursions to higher temperatures possible. This compound is not recommended for use in hot water/steam applications or in contact with certain hot aliphatic amines, ethylene oxide, or propylene oxide.

Specialty Compounds

Note: Before ordering Kalrez[®] parts in specialty compounds, please consult with DuPont Dow Elastomers or Distributor Technical Staff to determine properties needed for the application. Specialty compound products are generally not held in inventory.

Compound 1050LF—A general-purpose compound for O-rings, seals, and other parts used in chemical process industries. It has good hot water/steam, and excellent amine resistance. Maximum recommended service temperature of 288°C [550°F]. Not recommended for use in organic or inorganic acids at high temperatures.

Compound 1058—A carbon black-filled compound that has been plasticized with a perfluorinated oil. It is the softest, lowest modulus compound available. Generally, it is similar in chemical resistance to Compound 1050LF; it has an upper service temperature of 260°C [500°F]. Typically used in applications that require low sealing force or high extensibility including liquid chromatography septa, seals/seats for relief valves and tubing. Its shrinkage is greater than other Kalrez compounds; therefore, finished parts may differ from standard specifications.

Compound 3018—A carbon black-filled compound similar to Compound 1050LF, except for higher hardness/modulus. This compound is good in hot water/steam and offers the best high pressure extrusion resistance. Generally used in oil field and process industry applications where these

properties coupled with good amine and general chemical resistance are required. A maximum service temperature of 288°C [550°F] is recommended.

Compound 2037—A non-black-filled compound that is well suited for selected applications in the semiconductor and other markets that demand high purity elastomers. Compound 2037 has excellent chemical resistance exhibiting low swell in organic acids, inorganic acids, esters, ketones, and aldehydes. It also offers good mechanical properties. A maximum service temperature of 218°C [425°F] is recommended.

Miscellaneous Properties

Many miscellaneous properties are of interest for specific applications. Some of these are unaffected by compound choice, while others vary with hardness or extensibility. As an example, coefficient of friction typically increases as hardness decreases. In general, miscellaneous physical properties are similar to those of Viton® fluoroelastomer.

The following are some of the properties for Kalrez®:

Physical	
Specific Gravity	1.9–2.0
Coefficient of Friction Kalrez® to steel	0.25-0.60 (compound dependent)
Tear Strength, kN/m (lb/in)	3.06 [17.5] (1XXX Kalrez® compounds)
	4.52 [27] (3XXX Kalrez® compounds)
Abrasion Resistance, NBS ASTM D1630	121 [1050LF]

Thermal	Specific Heat
Linear Coefficient of Thermal Expansion [25–250°C]	at 50° C [122° F] = 0.945 J/g [0.226 cal/g]
$L = L_0 (1 + \alpha \Delta T)$	at 100° C [212° F] = 0.974 J/g [0.233 cal/g]
$\alpha = 3.2 \times 10^{-4} / ^\circ\text{C}$	at 150° C [302° F] = 1.053 J/g [0.252 cal/g]
$= 1.7 \times 10^{-4} / ^\circ\text{F}$	

Thermal Conductivity
at 50° C [122° F] = 0.19 W/m · K [1.30 Btu · in/hr. · °F · ft ²]
at 100° C [212° F] = 0.18 W/m · K [1.27 Btu · in/hr. · °F · ft ²]
at 200° C [392° F] = 0.17 W/m · K [1.19 Btu · in/hr. · °F · ft ²]
at 300° C [572° F] = 0.16 W/m · K [1.10 Btu · in/hr. · °F · ft ²]

Electrical	
Dielectric Constant (E) a 1000 Hz	4.9
Dissipation Factor (D) a 1000 Hz	5×10^{-3}
DC Resistivity (e)	5×10^{17} ohm · cm
Dielectric Strength	>17.7 kV/mm
[Breakdown Potential]	[>450 V/mil]

Miscellaneous	
Oxygen – Autogenous Ignition Temperature	
Compound 1050LF	313°C [595°F]

Permeation Rate of Gases

Gas	Temp. °C [°F]	Rate*	Gas	Temp. °C [°F]	Rate*
Nitrogen	30 [86]	0.30	Argon	30 [86]	0.68
Oxygen	30 [86]	1.00	Carbon Dioxide	30 [86]	2.53
Helium	30 [86]	11.20			

$$*\text{Units} = \frac{10^{-9} \cdot \text{cm}^3 \cdot \text{cm}}{\text{s} \cdot \text{cm}^2 \cdot \text{cm} \cdot \text{Hg} \Delta P}$$

These units represent 10^{-9} cm^3 of gas will permeate a cm into the sample each second when exposed to 1 cm^2 surface area with a cm of mercury pressure difference.

Product Safety

Although there is no record of serious injury caused by fumes from heated Kalrez[®] or its thermal decomposition products, fumes are increasingly toxic in heavy concentrations just as are the fumes or decomposition products of many common elastomers, resins, paints, and solvents as well as naturally occurring polymeric materials such as wood, silk, wool, and rubber. Parts heated above 400°C [752°F] can release fluorocarbon decomposition products and in sufficient concentration could be injurious to the respiratory system. Parts should not be exposed to molten or gaseous alkali metals such as sodium because a violent reaction could occur. Details are available upon request.