Product Selector Guide

DuPont™ Kalrez® Perfluoroelastomer Parts

In Energy / Oil & Gas

DuPont has more than 40 years of experience providing Kalrez® perfluoroelastomer seals to the oil and gas industry. Over this time, reservoir pressures and temperatures have both risen while an increased focus on safety margin has driven wider use of this most resilient of elastomeric material classes.

DuPont scientists have developed Kalrez® seals that can offer Rapid Gas Decompression (RGD) resistance to ISO 23939-2, NORSOK M-710 and TOTAL GS EP PVV 142 while resisting the harshest well fluid environments at temperatures that include both arctic surface conditions and high downhole temperatures and pressures. Kalrez® seals deliver proven reliability in extended lifetime services both above and below ground.

Typical Applications for Energy / Oil & Gas Industry

- Surface tools (upstream/midstream)
- Downhole tools (upstream)
- Oilfield production and completion equipment
- Wireline and drilling tools
- Pumps
- Valves
- Compressors
- Mechanical Seals
- O-Rings
- Custom parts (T-Seals, V-Rings, Boots, Chevron stacks, Packers)

Product Selector Guide by type of application

Application	Type	Suggested products
Drilling	Drilling tools	Kalrez® 0090 / OG193 Kalrez® Spectrum™ 7390
	Intervention tools	Kalrez® 0090 / OG193 Kalrez® Spectrum™ 7390
	MWD/LWD	Kalrez® 0090 Kalrez® Spectrum™ 7375 / 6375 (if no RGD resistance required)
Completion	Packing Elements	Kalrez® OG193, 0090, 7390, 3065
	Packers	Kalrez® OG193
	Formation Evaluation	Kalrez® 0090 / OG193
Production	Enhanced Oil Recovery (EOR) Water/steam	Kalrez® 0090 / OG193 Kalrez® Spectrum™ 7375 & 7390 (if no RGD resistance required)
	Enhanced Oil Recovery (EOR) Carbon dioxide	Kalrez® 0090 / OG193
	Enhanced Oil Recovery (EOR) Sour gas	Kalrez® 0090 / OG193
	Christmas Tree	Kalrez® 0090 / OG193 Kalrez® Spectrum™ 0040 (if no RGD resistance required)
	Pipeline Valves / Ball valves	Kalrez® 0090 Kalrez® Spectrum™ 6375 / 7375 / 7390 (if no RGD resistance required)
	Subsea Equipment	Kalrez® 0090 / OG193 If no RGD resistance required: Kalrez® Spectrum™ 7390 / Kalrez® Spectrum™ 0040 (for low temperature)
	Risers	Kalrez® 0090 / OG193 Kalrez® Spectrum™ 0040 (if no RGD resistance required)
	Monitoring/ Logging	Kalrez® Spectrum™ 0040 Kalrez® 0090 / OG193 (if RGD resistance required)

		Kalrez® Grades						
		OG193	0090	7390	7375	6375	0040	3065
Chemicals								
Well stimulation & EOR	Steam, 204 °C							
	Steam, 225 °C							
Corrosion inhibitors	Ethylene Diamine, 90 °C							
	Morpholine							
Drilling fluids	Water based							
Brines	Brines ASTM D1141, 204 °C							
Formates	Cesium formates / water							
Well interventions	Hydrochloric acid							
Sour environment	Hydrogen sulfide (H_2S)							
Inhibitor	Methanol							
Hydrocarbons	Various							
Application requirements								
Extrusion resistance / high pressure								
High temperature, above 250 °C								
Low temperature								
RGD resistance, CO_2								
Electrical insulation								

Best | Suitable | Not suggested

Current Kalrez® Product Offering

Kalrez® OG193

Best-in-class Rapid Gas Decompression (RGD) Resistance

RGD

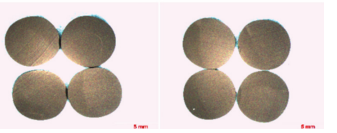
Kalrez® OG193 perfluoroelastomer parts exhibit an excellent balance of properties for oil and gas applications. Kalrez® OG193 combines **best-in-class Rapid Gas Decompression (RGD) performance and chemical resistance with good low temperature and thermal stability**.

This product also offers excellent versatility that allows it to be used for a variety of key parts including O-rings, Packers, Bonded Seals, Chevron Stacks, T-Seals, and many others. It is an ideal fit for various applications in both upstream and downstream, such as oilfield production/completion equipment, wireline and drilling tools, pumps, mechanical seals, valves, compressors and many more!

Chemical resistance:

Kalrez® OG193 is resistant to chemicals encountered in the oil and gas industry, including sour process streams containing H_2S and passing the acceptance criteria for the ISO23936-2 multi-phase sour ageing with 10% H_2S up to 215 °C.

Test conditions on AS568-349 O-rings	
Gas	10%/90% - CO_2/N_2
Pressure	150bar *(2,175 PSI)*
Temperature	**150 °C *(302 °F)***
Decompression rate	**127bar/min**
Number of cycles	5 (20hrs + 4x 6hrs)



Kalrez® OG193 RGD rating: 0000 / PASS
NO blisters / NO cracks

Kalrez® 0090

Best-in-class Extrusion Resistance

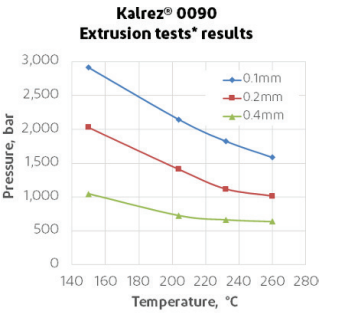
RGD

Kalrez® 0090 parts deliver durable, reliable sealing solutions for applications requiring **excellent Rapid Gas Decompression (RGD) properties** as well as **high hardness**, **high modulus properties**, and **excellent extrusion resistance** (even without backup rings). Potential oil and gas applications include downhole equipment such as drilling and completion tools, as well as industrial equipment including pumps, valves and compressors.

Kalrez® 0090 has been certified by two independent laboratories to meet rigorous requirements for resistance to RGD. In addition to demonstrated RGD resistance, Kalrez® 0090 seals provide superior performance regarding chemical and temperature properties.

Chemical resistance:

Kalrez® 0090 is resistant to chemicals encountered in the oil and gas industry, including sour process streams containing H_2S and passing the acceptance criteria for the ISO23936-2 multi-phase sour ageing with 10% H_2S up to 225 °C.



** Test up to extrusion: K-325 O-Rings, silicone oil, piston seal configuration, no Back-Up Ring*

Kalrez® 0090 - Extrusion resistance
vs. diametrical gap

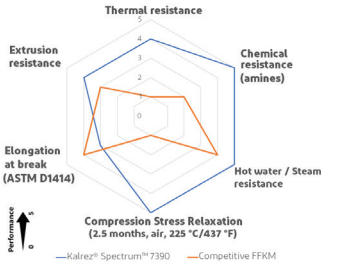
Kalrez® Spectrum™ 7390

High Temperature - High Hardness
Broad Chemical & Water/Steam Resistance

Kalrez® 7390 perfluoroelastomer parts is a versatile FFKM product based on a patented proprietary crosslinking system that can meet your 90 durometer (Shore A) FFKM specifications in numerous shapes and configurations where higher mechanical strength is needed.

Kalrez® Spectrum™ 7390 parts are designed to **reliably seal in the most demanding chemical and hot water/steam environments**.

Thermally stable up to 300 °C, it is an ideal fit for downstream and CPI applications such as valves, compressors, pumps, process instrumentation and sensors as well as mechanical seals.



Kalrez® Spectrum™ 7390
vs. competitive FFKM

Kalrez® Spectrum™ 7375

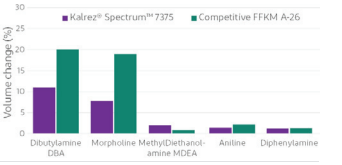
High Temperature
Broad Chemical & Water/Steam resistance

Kalrez® 7375 parts are an innovative FFKM product based on a patented crosslinking system for chemical process industry applications where **broad chemical and hot water/steam resistance** are needed at elevated temperatures.

Kalrez® 7375 parts exhibit excellent compression set resistance, outstanding physical property retention, and good mechanical strength properties.

Kalrez® 7375 parts exhibit excellent insulative properties making it an ideal perfluoroelastomer for use in harsh oil & gas applications such as electrical connectors/boots.
A maximum service temperature of 300 °C is suggested.

Volume change (%) after 672 hours in several amines at 90 °C



Kalrez® Spectrum™ 7375
vs. competitive FFKM

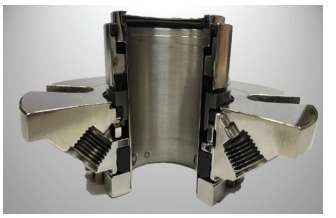
Legend: Thermal · Chemical · Low Temperature · Hot water & steam · High Pressure / Extrusion resistance · RGD RGD resistance

Kalrez® Spectrum™ 6375

Broadest Chemical Resistance

Kalrez® 6375 parts, developed specifically for the chemical processing industry, are designed to give **outstanding performance in the widest possible range of chemicals and temperatures**.

This product is an excellent choice for use in acids, bases, amines, steam, pure ethylene oxide, and many other aggressive chemicals. The curing system also allows for a maximum service temperature of 275 °C (527 °F). This high temperature stability translates to increased chemical resistance over all temperature ranges, especially if high temperature process excursions occur. This combination of chemical and thermal resistance provides advantages for chemical processors.



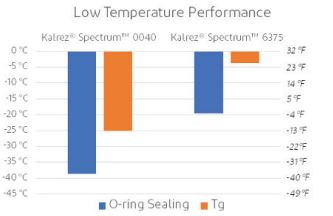
Mechanical Seal with Kalrez® Spectrum™ 6375 O-rings

Kalrez® Spectrum™ 0040

Low Temperature

Kalrez® 0040 parts are specifically designed for low temperature environments where **significant chemical resistance** is required. **Low temperature sealing performance (down to -42 °C)** typically unattainable for perfluoroelastomers parts is achievable with Kalrez® 0040.

Kalrez® 0040 is an excellent choice in applications such as couplings for the chemical transportation industry or for other applications where chemical resistance and elasticity are required in some of the coldest environments.



Low temperature static sealing (DuPont Proprietary test method)

Kalrez® 3065

Top tier performance for V-Rings

Kalrez® 3065 perfluoroelastomer parts are a highly filled product containing carbon black and fiber reinforcement, design to function without extrusion under extreme pressure. It has good overall chemical resistance and excellent resistance to sour oil and amines.

The mechanical properties and chemical resistance of 3065 make it a top choice for many oil and gas well applications.

Kalrez® 3065 is only available in the form of V-rings.

Conditions	
Depth	4,602 m (15,100 ft)
Temperature:	149 °C (300 °F)
Pressure:	46.2 MPa (6,700 psi)

Production
3,000 BBL/Day Oil 125 BBL/Day Water Gas/Oil Ratio: 1.3

Kalrez® 3065 V-Ring
Six-Year service record

Legend: Thermal · Chemical · Low Temperature · Hot water & steam · High Pressure / Extrusion resistance · RGD RGD resistance

For more detailed information about each product, please consult the Kalrez® Application Guide online at DuPont Kalrez® Application Guide or contact your DuPont regional location to request assistance from a Kalrez® Technical Service & Development Engineer to assess performance fit

Typical Physical Properties*

Kalrez® grade	Color	Service Temperature[1]		Shore A hardness[2]	Modulus at 100% elongation[3]	Tensile Strength[3]	Elongation at Break[3]	Compression Set[4] 70 hours 204 °C (400 °F)
		Lowest[7]	Maximum					
OG193	Black	-32 °C *(-26 °F)*	250 °C *(482 °F)*	94	13 Mpa* *(1850 psi)*	22 Mpa *(3150 psi)*	100%	29%
0090	Black	-27 °C *(-17 °F)*	250 °C *(482 °F)*	95	14.2 Mpa[5] *(2060 psi)*[5]	19.5 Mpa *(2830 psi)*	80%	19%
7390	Black	-22 °C *(-8 °F)*	300 °C *(572 °F)*	89	21.3 Mpa *(3090 psi)*	22.1 Mpa *(3210 psi)*	101%	14%[6]
7375	Black	-20 °C *(-4 °F)*	300 °C *(572 °F)*	79	10.2 Mpa *(1480 psi)*	16.9 Mpa *(2450 psi)*	128%	9%[6]
6375	Black	-20 °C *(-4 °F)*	275 °C *(527 °F)*	75	9.1 Mpa *(1320 psi)*	15.2 Mpa *(2200 psi)*	160%	24%
0040	Black	-42 °C *(-44 °F)*	220 °C *(428°F)*	70	5.2 Mpa *(750 psi)*	9.0 Mpa *(1300 psi)*	170%	42%
3065	Black	-8 °C *(18 °F)*	288 °C *(550°F)*	90	-	24.1 Mpa *(3530 psi)*	17%	-

[1] DuPont proprietary test method; useful temperature range may vary with seal design and application specifics

[2] ASTM D2240 (pellet test specimens unless otherwise noted)

[3] ASTM D412, (dumbbell test specimens)

[4] ASTM D395B, (pellet test specimens)

[5] Modulus at 50% elongation

[6] ASTM D395B & D1414 (AS568 K214 O-ring test specimens)

[7] Measured with "pressure first" test method at 60 psi

* value for modulus at 50% strain

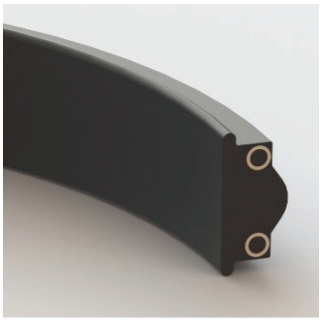
Certifications

Certifications		Kalrez® 0090	Kalrez® OG193	Kalrez® Spectrum™ 7375	Kalrez® Spectrum™ 7390
NORSOK M-710 (Rev. 2)	RGD	✓			
ISO 23936-2	RGD		✓		
	Sour multi-phase ageing	✓	✓	✓	✓
TOTAL GS EP PVV 142 (Rev. 5)	CSD 5.33	✓	To be tested		
	CSD 6.99	✓	To be tested		

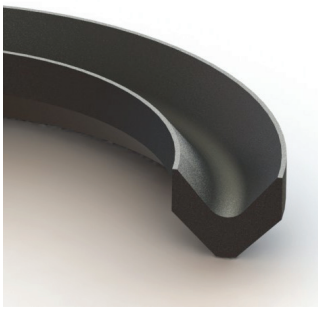
Seal type availability

T-Seal

Packer



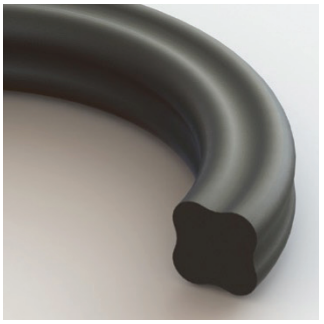
S-Seal



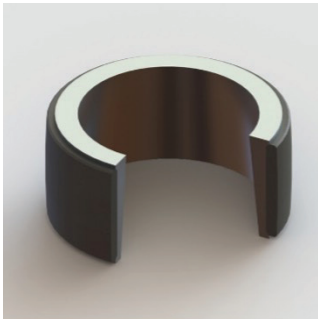
V-Ring

Chevron stack

Boots



X-Ring



Metal bonding

Suitability by application

Kalrez® grades	O-Ring	T-Seal	Packer	S-Seal	V-Ring	Chevron stack	Boot	X-Ring	Metal bonding
OG193	✓	✓	✓		✓	✓			✓
0090	✓	✓			✓	✓			✓
7390	✓	✓			✓	✓		✓	
7375	✓	✓		✓	✓	✓	✓	✓	
6375	✓	✓						✓	✓
0040	✓								
3065					✓	✓			

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