ENERGY
Oil & Gas

DuPont™ Kalrez®

Perfluoroelastomers solutions for exceptional valve sealing performance in extreme environments

Contents

DuPont™ Kalrez® parts deliver performance, reliability and safety where it matters most

Kalrez® valve seals

- **Excellent chemical and thermal resistance**
- **Exceptional sealing in demanding applications**

- **Successful application collaborations**
- **Proven, trusted solutions**
- **Increased equipment uptime**
- **Lower total operating costs for value in use**
- **Increased operation safety**

DuPont™ Kalrez® parts

Testing Capabilities

DuPont has a long history of collaborative innovation in material science to help customers develop solutions that meet the most pressing industry challenges. The DuPont™ Kalrez® portfolio offers a range of high-performance parts and testing capabilities. This can enable customers to meet the most stringent industry standards in terms of reliability, safety, traceability, and efficiency for critical applications in high pressure and high temperature environments.

DuPont's world-class Application Development Centers have a unique combination of global experts and state-of-the-art equipment. Contact your nearest DuPont representative to learn more about our testing capabilities.

DuPont™ Kalrez® Testing Facilities

Sealing Testing

- High pressure high temperature sealing tests using AS568-325 O-rings

RGD (also available for Vespel®)

- Rapid gas decompression testing in pure CO_2 gas and liquid up to 250 °C and 350 bars / 5000 psi
- Rapid gas decompression testing for market specifications using automatic cycling with temperatures up to 250 °C and pressures up to 700 bars / 10,000 psi

Chemical Resistance & Aging Tests

- Aging in gases including H_2S, H_2, CH_4, and CO_2
- Aging in fluids including ammonia, ethylene oxide, ammonium hydroxide
- Common air oven aging from 160 °C to 350 °C
- Fluids testing in amines, bases, water, detergents, and solvents

Compression Set Testing

- Compression set testing in various fluids and temperatures
- Compressive stress relaxation testing

Additional testing capabilities

- O-ring stiction testing
- Helium leak testing

Fugitive emissions control: a major opportunity to fight global warming

The oil and gas industry is a large contributor to global methane emissions, which are the second largest driver of global warming. Methane is considered even more dangerous than carbon dioxide, the primary greenhouse gas, because one tonne of methane corresponds to 28 tonnes of carbon dioxide equivalents.

Under the 2050 Net Zero Emissions Scenario, total methane emissions from fossil fuel operations must decrease by 74% by 2030 so that gas can play a supporting role in the energy transition.

Within the natural gas value chain, the majority of all methane fugitive emissions originate from valves.

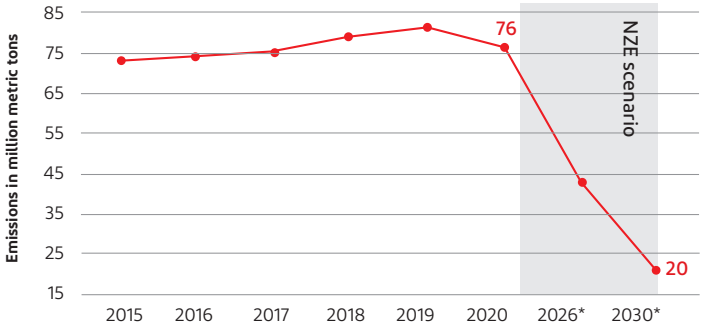
DuPont™ Kalrez® KVSP™ stem packing has the ability to drastically reduce stem-based fugitive emissions of methane and is adequate for handling other gasses including hydrogen.

Methane:
A greenhouse gas 28 times more harmful than CO_2

Source: Greenhouse Gas Protocol

Oil and gas sector methane emissions under the Net Zero Emissions (NZE) Scenario

worldwide from 2000 to 2030 (in million metric tons)

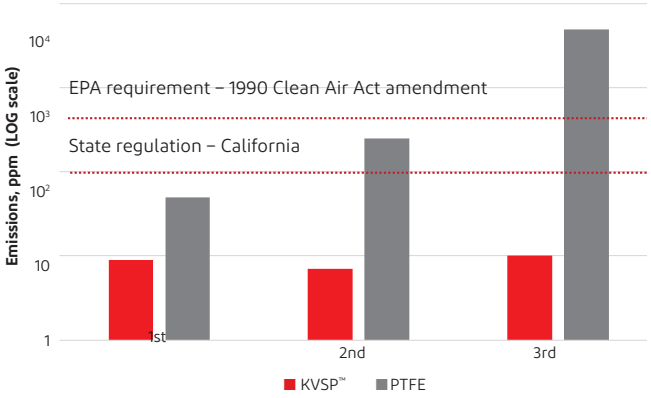


Source: https://www.iea.org/reports/methane-emissions-from-oil-and-gas

DuPont™ Kalrez® KVSP™ parts can help improve your sealing performance and reduce fugitive emissions

DuPont™ Kalrez® KVSP™ - Kalrez® Valve Stem Packing – is a combination of chemically resistant Kalrez® FFKM and Vespel® V-rings which can reduce stem friction and stem-based fugitive emissions and can improve ease of sealing over a long service life.

Controlling Fugitive Emissions: DuPont™ KVSP™ vs PTFE Packing System (EPA Method 21)



Three temperature swings up to 177 °C. 20M–30M full strokes cycles

Test performed three times according to EPA Method 21 for the determination of volatile organic compound leaks. Kalrez® KVSP™ systems provide performance that approaches zero leakage.

DuPont™ Kalrez® KVSP™ kits meet the sizing requirements of standard OEM rising-stem control valves and can include an additional graphite ring for API607 fire safe performance.

Valve Compatibility

- Kalrez® KVSP™ is available in 3- and 5-piece kits to meet the sizing requirements of OEM rising-stem control valves

Service Temperature

- Rated for continuous service from -20 °C to 260 °C (-4 °F to 500 °F)

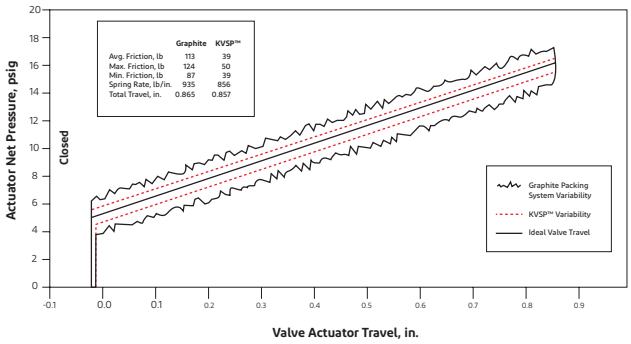
Installation

- Drop-in system with no valve modifications required
- Live loading preferred

Benefits

- Minimization of fugitive emissions over a long service lifetime
- Reduction of actuation force compared to graphite solutions, lowering the cost of the actuator
- Improved process control due to better alignment between the control system and valve response, thanks to low stem friction

Kalrez® KVSP™ Improves Process Control Performance Over Existing Materials



DuPont™ Kalrez® 0090 parts – Best in class for extrusion resistance

Kalrez® 0090

Best extrusion resistance

- 95 Shore A
- Black
- +250 °C*
- Elongation at break: 80%
- Best extrusion resistance
- Resistance to hot water, amines, bases, H_2S

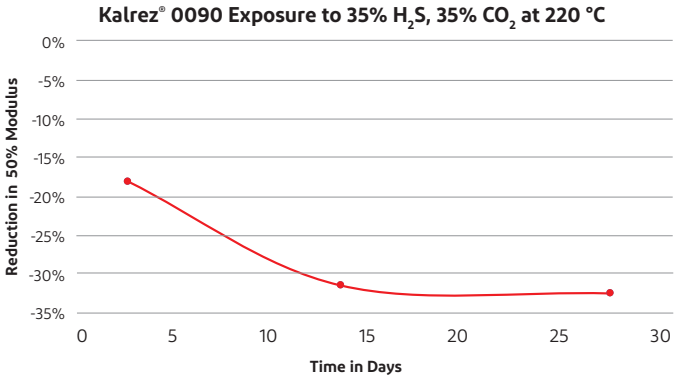
Product meets acceptance criteria for:

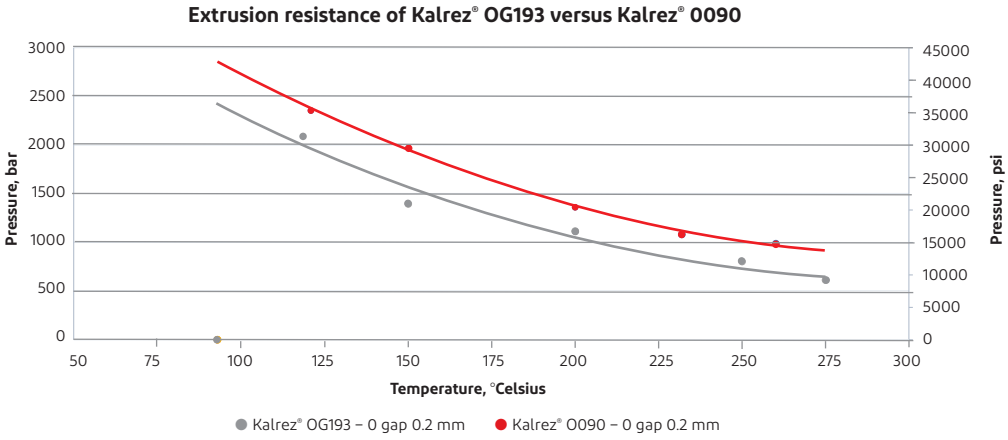
RGD – Total PVV 142
Norsok M710 rev2
ISO 23936-2
Sour aging up to 225 °C – SO23936-2

Excellent properties for oil & gas applications

For the best extrusion resistance combined with excellent performance in rapid gas decompression and resistance to chemicals encountered in the oil and gas industry, Kalrez® 0090 offers durable, reliable sealing solutions for a variety of applications.

Kalrez® 0090 is qualified to ISO 23936- 2:2011 for sour aging of elastomers in 10% H_2S. However, 0090 has shown excellent resistance to concentrations of H_2S up to 65%.





Test details

- Test media: silicone oil
- Diametric extrusion gap 0.2 mm
- Test on AS568-325 O-rings
- No Back Up Ring (BUR)
- Groove type: Piston seal
- Test up to extrusion

DuPont™ Kalrez® OG193 parts – For oil & gas applications requiring rapid gas decompression resistance in a broad range of conditions

Kalrez® OG193

Best RGD resistance

- 95 Shore A
- Black
- +250 °C*
- Elongation at break: 100%
- Best RGD resistance
- Resistance to hot water, amines, bases, H_2S

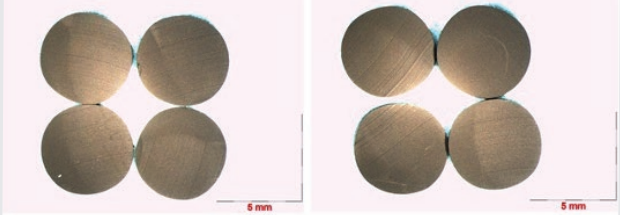
Product meets acceptance criteria for:

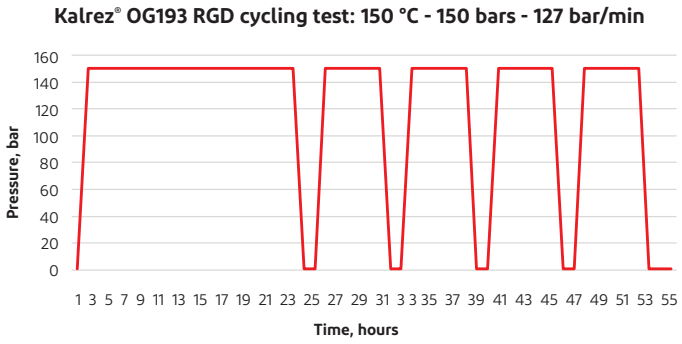
RGD – Total PVV 142
Norsok M710 rev2
ISO 23936-2
Sour aging up to 225 °C – SO23936-2

Best in class rapid gas decompression performance

For the best rapid gas decompression performance, excellent chemical resistance, and good low temperature and thermal stability, Kalrez® OG193 offers top performing 90+ durometer (Shore A) to meet the demands of the oil and gas industry.

Kalrez® OG193 parts exhibit high RGD performance even in substantially more aggressive conditions than required by ISO 23936-2 with a "0000 0000" rating. This means that no cracks or blisters were found after in any of the eight cross section samples after testing.





Test Conditions	
O-Ring dimensions	113.67 x 5.33mm (AS568-349)
Gas	10%/90% – CO2/N2
Pressure	150bar
Temperature	150 °C
Decompression rate	127bar/min
Number of cycles	5 (20hrs + 4x6hrs)
Dwell time	1 hr

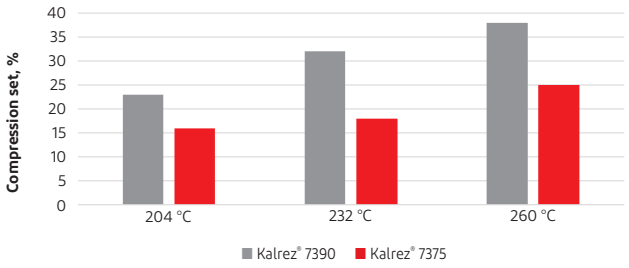
Kalrez® OG193 is ideal for applications where larger cross section thickness combined with chemical resistance, RGD performance, and high strength are a necessity.

DuPont™ Kalrez® Spectrum™ 7375 and 7390 perfluoroelastomer parts

For high temperature, chemical, and water/steam resistance in applications up to 300 °C

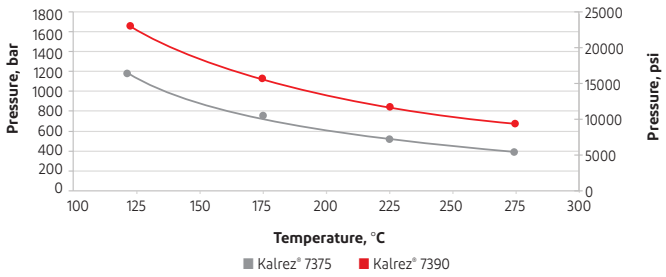
DuPont™ Kalrez® Spectrum™ 7375 and 7390 perfluoroelastomer parts are designed to reliably seal in the most demanding chemical and hot water/steam environments. Thermally stable up to 300 °C, Kalrez® 7375 and 7390 parts can meet your 80 and 90 durometer (Shore A) perfluoro-elastomer (FFKM) specifications, respectively. Numerous shapes and configurations are available to meet your exact needs.

Compression Set, % (with 25% squeeze) of Kalrez® 7390 and Kalrez® 7375 at various temperatures at 672 hours



Both Kalrez® 7375 and Kalrez 7390 have excellent extrusion resistance and compression set performance at elevated temperatures for extended periods of time, which helps provide long term sealing performance.

Extrusion resistance of Kalrez® 7375 versus 7390



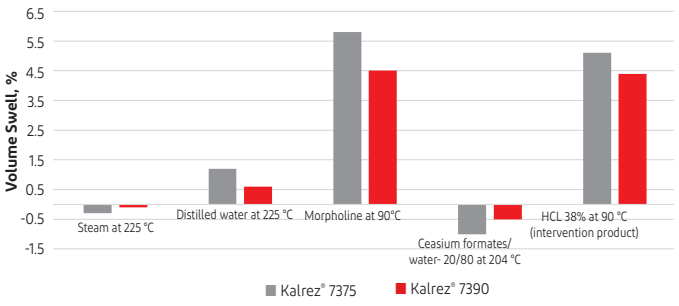
Typical Physical Properties

	Kalrez® 7375	Kalrez® 7390
Color	Black	Black
Hardness, Shore A	77	89
100% Modulus, MPa (psi)	15.2 (2200)	21.3 (3090)
Tensile Strength at Break, MPa (psi)	20.0 (2900)	22.1 (3210)
Elongation at Break, %	115	101
Compression Set, %, 70 hrs. at 204 °C (400 °F)	9	14
Maximum Application Temperature, °C, (°F)	300 (572)	300 (572)

Compatible with fluids commonly used in the O&G industry

Volume swell (%) is a good predictor of performance and low values typically translate to compatibility in the chemical environment. The example below represents typical analogs of fluids and amines found in drilling fluids, corrosion inhibitors, pump oil additives, etc. Test performed with AS-568 K214 O-rings.

Resistance to fluids commonly used in the O&G industry (after 672 hours)



Test details

- Test media: silicone oil
- Diametric extrusion gap 0.2 mm
- Test on AS568-325 O-rings
- No Back Up Ring (BUR)
- Groove type: Piston seal
- Test up to extrusion

Discover the Kalrez® product range

Our technical support team are here to answer your questions and find the best Kalrez® products to meet your most stringent requirements.

Kalrez® products for valves in energy and industrial

High service temperature	Special performances	High hardness & modulus
Kalrez® Spectrum™ 6375 Black, +275 °C Broad chemical and temperature, multi-purpose	**Kalrez® Spectrum™ 6380** Cream, +225 °C Hot amines (>80°C), chlorine dioxide, ethylene dioxide	**Kalrez® OG193** Black, +250 °C Best RGD resistance, custom parts, chemical resistance
Kalrez® Spectrum™ 7075 Black, +327 °C Highest temperature, low compression set	**Kalrez® Spectrum™ 0040** Black, +220 °C Lowest service temperature, O-rings	**Kalrez® 0090** Black, +250 °C Best extrusion resistance, good RGD resistance, hot water, amines, bases
Kalrez® 4079 Black, +316 °C Low compression set	**Kalrez® Spectrum™ 7275** Light brown, +300 °C Ethylene oxide, acrylic acid, chlorosilanes	**Kalrez® Spectrum™ 7090** Black, +325 °C Low compression set, high temperature
Kalrez® Spectrum™ 7375 Black, +300 °C Broad chemical and water/steam resistance		**Kalrez® 7390** Black, +300 °C Broad chemical and temperature, multi-purpose

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