DuPont™ Kalrez® 0090
perfluoroelastomer parts
Provides Outstanding Resistance to Rapid Gas Decompression

SEAL & DESIGN INC.

Technical Information — Rev. 4, November 2012

Product Description

DuPont™ Kalrez® 0090 perfluoroelastomer parts deliver durable, reliable sealing solutions for applications requiring excellent rapid gas decompression (RGD) properties as well as high hardness and high modulus properties. Some application areas include downhole equipment such as drilling and completion tools as well as industrial equipment including pumps and valves. Kalrez® 0090 has been certified by two independent labs (see Table 2) to meet rigorous requirements for resistance to RGD.

In addition to demonstrated RGD resistance, DuPont™ Kalrez® 0090 seals have other chemical and temperature properties that provide superior performance.

- Chemical resistance: Kalrez® parts withstand attack by more than 1800 chemical substances. Kalrez® 0090 can be resistant to sour multi-phase fluids containing H_2S as shown by the external NORSOK M-710 Rev 2 Sour Fluid ageing resistance certification provided by MERL (UK).
- Broad temperature capability: Kalrez® 0090 retains high levels of resilience up to temperatures as high as 250 °C (482 °F) and down to –21 °C (–5.8 °F). Under pressurized sealing conditions, Kalrez® 0900 has demonstrated low temperature performance down to –40 °C (–40 °F) in customer laboratory tests*.

* MERL presentation—Matoux 24 Oct 2012.

Table 1. Typical Physical Properties[1]

Color	Black
Hardness[2], Durometer Shore A	95
50% Modulus[3], MPa (psi)	14.18 (2057)
Tensile Strength at Break[3], MPa (psi)	19.49 (2827)
Elongation at Break[3], %	80
Compression Set—O-rings[4], 70 hr at 200 °C (392 °F), %	33
Compression Set—Pellets[4], 70 hr at 200 °C (392 °F), %	19
Compression Set —O-rings[4], 336 hr in nitrogen at 250 °C (482 °F), %	35
Upper Service Temperature[5], °C (°F)	250 (482)
Lower Service Temperature[6], °C (°F)	–21 (–5.8)
Tg[6], °C (°F)	–1 (30.2)
Tr10[7], °C (°F)	–7.4 (18.68)
Volume Swell[8], % change	
Steam, 225 °C (437 °F), 672 hr	<5
Ethylenediamine, 90 °C (194 °F), 672 hr	<5
H_2S/CO_2 (65%/35%), 220 °C (428 °F), 672 hr	<5

[1] Not to be used for specification purposes
[2] ASTM D2240 (pellet test specimens)
[3] ASTM D412, (AS568 K214 O-ring test specimens)
[4] ASTM D395B
[5] DuPont proprietary test method (anaerobic conditions)
[6] DuPont proprietary test method
[7] ASTM D1329 (slab test specimens)
[8] ASTM D471 (AS568 K214 O-ring test specimens)

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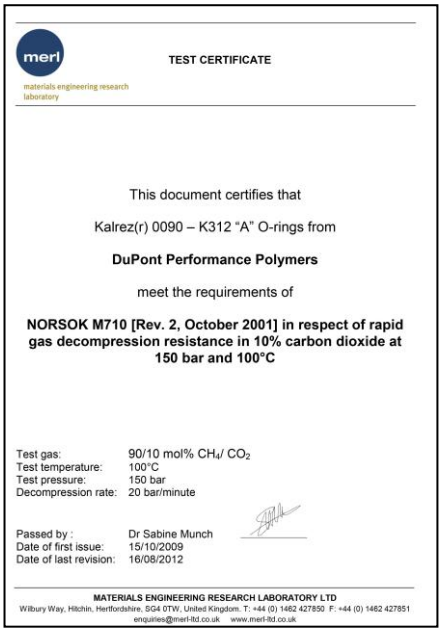
Table 2. Highest NORSOK and TOTAL Rating Demonstrates Outstanding RGD Resistance of DuPont™ Kalrez® 0090

	NORSOK M-710 (Rev. 2) Certified	TOTAL GS EP PVV 142 (Rev. 5) Qualified
Rating	No internal cracks, holes, or blisters	No internal cracks, holes, or blisters
Test conditions		
Gas	90/10 mol% CH_4/CO_2	80/20 mol% CH_4/CO_2
Temperature	100 °C (212 °F)	75 °C ±2 °C (167 °F ± 3.6 °F)
Pressure gradient	15 MPa (~2200 psi)* to ambient	19 MPa (~2756 psi)* to ambient
Decompression rate	2 MPa/min	12.67 MPa/min
Cycling	10 cycles, one every 24 h	5 cycles
Sample details		
Size	BS 1806 size 312	BS 1806 size 349
Section diameter	5.33 mm, nominal	5.33 mm, nominal
Groove fill	67%, nominal	73%, nominal

*Initial pressure maintained for at least 72 h prior to testing

NORSOK M-710 (Rev. 2) Certificate



merl
materials engineering research laboratory

TEST CERTIFICATE

This document certifies that

Kalrez(r) 0090 – K312 "A" O-rings from

DuPont Performance Polymers

meet the requirements of

NORSOK M710 [Rev. 2, October 2001] in respect of rapid gas decompression resistance in 10% carbon dioxide at 150 bar and 100°C

Test gas: 90/10 mol% CH_4/ CO_2
Test temperature: 100°C
Test pressure: 150 bar
Decompression rate: 20 bar/minute

Passed by : Dr Sabine Munch
Date of first issue: 15/10/2009
Date of last revision: 16/08/2012

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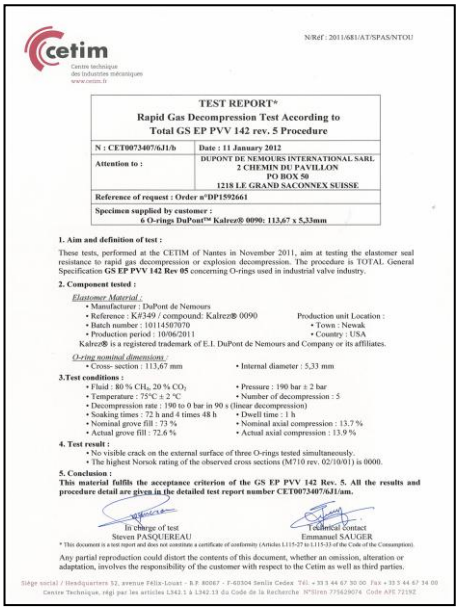
TOTAL GS EP PVV 142 (Rev. 5) Qualification



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N/Réf : 2011/681/AT/SPAS/NTOU

TEST REPORT*
Rapid Gas Decompression Test According to
Total GS EP PVV 142 rev. 5 Procedure

N : CET0073407/6J1/b — Date : 11 January 2012
Attention to : DUPONT DE NEMOURS INTERNATIONAL SARL, 2 CHEMIN DU PAVILLON, PO BOX 50, 1218 LE GRAND SACONNEX SUISSE
Reference of request : Order n°DP1592661
Specimen supplied by customer : 6 O-rings DuPont™ Kalrez® 0090: 113,67 x 5,33mm

1. Aim and definition of test :
These tests, performed at the CETIM of Nantes in November 2011, aim at testing the elastomer seal resistance to rapid gas decompression or explosion decompression. The procedure is TOTAL General Specification **GS EP PVV 142 Rev 05** concerning O-rings used in industrial valve industry.

2. Component tested :
Elastomer Material :
• Manufacturer : DuPont de Nemours
• Reference : K#349 / compound: Kalrez® 0090 — Production unit Location :
• Batch number : 10114507070 — • Town : Newak
• Production period : 10/06/2011 — • Country : USA
Kalrez® is a registered trademark of E.I. DuPont de Nemours and Company or its affiliates.
O-ring nominal dimensions :
• Cross- section : 113,67 mm — • Internal diameter : 5,33 mm

3.Test conditions :
• Fluid : 80 % CH_4, 20 % CO_2 — • Pressure : 190 bar ± 2 bar
• Temperature : 75°C ± 2 °C — • Number of decompression : 5
• Decompression rate : 190 to 0 bar in 90 s (linear decompression)
• Soaking times : 72 h and 4 times 48 h — • Dwell time : 1 h
• Nominal grove fill : 73 % — • Nominal axial compression : 13.7 %
• Actual grove fill : 72.6 % — • Actual axial compression : 13.9 %

4. Test result :
• No visible crack on the external surface of three O-rings tested simultaneously.
• The highest Norsok rating of the observed cross sections (M710 rev. 02/10/01) is 0000.

5. Conclusion :
This material fulfils the acceptance criterion of the GS EP PVV 142 Rev. 5. All the results and procedure detail are given in the detailed test report number CET0073407/6J1/am.

In charge of test — Steven PASQUEREAU
Technical contact — Emmanuel SAUGER

* This document is a test report and does not constitute a certificate of conformity (Articles L115-27 to L115-33 of the Code of the Consumption).

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Centre Technique, régi par les articles L.342-1 à L.342-13 du Code de la Recherche N°Siren 775620074 Code APE 7219Z