



DICHTOMATIK

Dichtomatik Limited
Donington House, Riverside Road, Pride Park, Derby DE24 8HX

PRESS RELEASE DL036

HIGH PERFORMANCE SEALS HANDLE RAPID GAS DECOMPRESSION IN EXTREME ENVIRONMENTS

Increasing oil extraction pressures and temperatures, aggressive chemicals and rapid gas decompression (RGD) in new, more difficult drilling sites are creating operating environments beyond the capabilities of most elastomers. DuPont™ Kalrez® 0090 (K-312 “A” O-rings) perfluoroelastomer sealing parts, however, were developed to provide enhanced rapid gas decompression resistance in aggressive environments and have received the industry best “0000” rating in accordance with the Norsok M-710 Rev. 2 standard and TOTAL GS EP PVV 142 specification.

These products, which are available from UK authorised distributor Dichtomatik Ltd, provide the optimum balance of chemical, heat and mechanical properties for different chemical and oil and gas sealing applications.

Their superior performance has also been substantiated by further tests conducted at the Centre Technique des Industries Mécaniques (CETIM) of France, in accordance with the TOTAL GS EP PVV 142, Rev. 5 procedure. CETIM found DuPont™ Kalrez® 0090 O-rings 113,67 x 5.33 mm also fulfil the acceptance criterion of the TOTAL General Specification GS EP EVV 142 Rev. 5. concerning O-rings used in the industrial valve industry. Kalrez® 0090 is the latest in a family of DuPont perfluoroelastomer parts for the oil and gas industry that includes Kalrez® Spectrum™ 6375 and Kalrez® Spectrum™ 7090.

Dichtomatik Limited

Donington House
Riverside Road
Pride Park
Derby DE24 8HX

Tel: 01332 / 524400
Fax: 01332 / 524404
www.dichtomatik.co.uk
Email@dichtomatik.co.uk

Company Reg. No.
2188991
V.A.T. Reg. No.
507 6262 52
Registered Office
as above



APPROVAL NUMBER 900521

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DuPont is the only fully integrated perfluoroelastomer seal manufacturer, having total upstream and downstream expertise of monomer, polymer, compounding and finished product. Their Kalrez® 0090 products with enhanced RGD-resistant properties have established proven provenance in commercial service, and are currently in use at several major oil and gas companies. Many leading oil OEMs have also qualified Kalrez® 0090 seals for use in surface and downhole valves, data logging drilling tools, packers, completion tools and mechanical seals.

The key performance characteristics of Kalrez® 0090 seals include:

- Exceptional resistance to rapid gas decompression, certified to highest 0000 rating in NORSOK M-710, Rev. 2 laboratory tests made with Kalrez® 0090 K-312_ “A_ O-rings
- Withstands attack by over 1800 chemicals, and resists ageing in sour fluid, including multi-phase fluids containing high concentrations of hydrogen sulphide
- Retains high levels of elasticity, recovery and extrusion resistance even after long-term exposure to temperatures as high as 250°C and as low as -40°C in high pressure environments.
- Although Kalrez® 0090 parts are a high hardness perfluoroelastomer, it remains elastomeric with low compression set under most aggressive HPHT environments.

The spectre of shrinking global oil reserves and the search for new, more difficult sources such as deep water and shale is well documented. Many new exploration sites challenge the oil and gas industry with increasing extraction pressures and temperatures, and by the presence of aggressive chemicals such as ammonia, carbon dioxide, hydrogen sulphide (sour gas), methane, and steam – exacerbated by the phenomenon of rapid gas decompression (RGD).

Often referred to as HPHT (high pressure/high temperature) environments, these more aggressive drilling conditions pose a new set of problems for suppliers and equipment operators within the industry because they create operating environments beyond the capabilities of many commonly used equipment-sealing elastomers like hydrogenated nitrile rubber (HNBR) and fluoroelastomers (FKM).

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Combinations of RGD, HPHT, and harsher chemicals can lead to premature seal failure, with the associated risks of costly financial, safety and environmental issues, and possibly resulting in plant premature shut downs. Because of this scenario the industry pressed for the establishment of a test standard to qualify non-metallic sealing materials. Norsok standard M-710, Rev. 2, October 2001, developed by the Norwegian petroleum industry, has been widely adopted internationally as the benchmark of performance for any elastomer seal in critical oil and gas service. Norsok certification for RGD is essential to qualifying performance of elastomer seals in HPHT and aggressive chemical environments, with the objective of reducing the risk of seal failure. Total general specification GS EP PVV 142, Rev. 5, developed by Total, is also widely accepted as an independent test of elastomer seal resistance to RGD in valve applications.

Perfluoroelastomer (FFKM) parts offer the highest temperature and chemical resistance of all elastomers, and are at the very top end of seal performance in the most aggressive chemical processing and oil and gas applications. “0000” is the highest rating in a Norsok certification, and Kalrez® 0090 achieves and maintains this highest rating.

DuPont has more than 30 years experience serving the oil and gas industry with Kalrez® perfluoroelastomer parts. With oil extraction environments becoming more and more challenging for elastomer seals, DuPont embarked on a new formulation program in 2008 with the primary objective of developing a new compound with enhanced RGD resistance. Due to its fully integrated supply chain, DuPont was able to test hundreds of different formulations – not only using various curing chemistries and fillers but also alternative polymers – leading to the development of DuPont™ Kalrez® 0090 perfluoroelastomer parts. Before launch in 2010, Kalrez® 0090 parts were submitted for rigorous RGD resistance testing in October 2009 by the Materials Engineering Research Laboratory (MERL) in the UK, according to the Norsok M-710 Rev. 2 standard.

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The samples were exposed to a test gas of 90% methane and 10% carbon dioxide at 150 bar and 100 °C, and a decompression rate of 20 bar/minute (see Table 1).

Table 1: Highest NORSOK and TOTAL ratings for DuPont™ Kalrez® 0090 seals tested.

	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

Further information is available from:

Dichtomatik Ltd, Donington House, Riverside Road, Pride Park, Derby DE24 8HX

Telephone: 01332 524401

Fax: 01332 524425

e-mail: kalrez@dichtomatik.co.uk

www.dichtomatik-kalrez.co.uk

(approximately 1,020 words
including photographic annotations)

General Information

Supplier: Dichtomatik Ltd

Press Release No: DL036

Press or publishing inquiries to: Steve Lloyd
Enterprise Marketing Services Ltd
The Coach House, 1 Dunstall Road, Barton under Needwood,
Burton on Trent, Staffordshire, DE13 8AX, UK
Tel: +44 (0) 1283 713185
Fax: +44 (0) 1283 716172
e-mail: info@enterprise-marketing.co.uk

Reader response inquiries to: Mr D Cook of Dichtomatik Ltd

Downloads: The press release text (MS Word and PDF format) and images are
Available for download at:
www.enterprise-marketing.co.uk/dl/dl036.html

Our Reference: DL036/02/15/V1

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Perfluoroelastomer seals offer the highest temperature and chemical resistance of all elastomers.

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New oil drilling environments challenge the performance of valve seals.

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Certified
for the petroleum industry

TEST REPORT

TEST REPORT*	
Rapid Gas Decomposition Test According to Test G3-EP PVV 142 rev. 9 Procedure	
TITEL/TESTNAAM	Item: 11 January 2011
Attention to:	REPORT DE VERKEER EN OVERTOEGANGS- DIENSTEN DE PAVILJOEN PO BOX 6 1016 LE GRASLANDENKENSSE Belgium
Reference of request - (order n°): 0910041	
Specimens supplied by customer: 4.0-Grade Diesel** Refueler 9000, 1347, 1, 2, 3, 4, 5	

1. Aim and definition of test:

These tests, performed at the CETIM of Valenciennes in November 2010, aim at proving the cleanness and suitability to cold use of the 4.0-Grade Diesel** supplied by the customer or engine manufacturer. The procedure is TOTAL Certified Specifications for G3-EP PVV 142 Rev. 9.

2. Component tested:

Engine/Engine test:

• Motor/Engine: "Cetane de 1000cm ³ "	Production site / Location:
• Fuel: "G3-EP 1" component Cetanulac 1000	• Engine: 1000
• Black number: "90-100/970"	• Capacity: 100L
• Production period: "1996-2002"	

Cetanulac is a registered trademark of V.O. 2. Cetane de 1000cm³ and Company in its affiliation.

Using standard conditions:

• T: 15°C, ambient: 13.47°C	• Humidity standard: 5.23 mm
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3. Test conditions:

• Fuel: 90/10 CH ₄ /CH ₄ 28% CH ₄	• Pressure: 104 bar ± 2 bar
• Temperature: 70°C ± 1°C	• Humidity of atmosphere: 1
• Decomposition rate: 100 g in 10 min at 400°C	• Number of cycles: 10
• Cooling time: 70 s and 10 min at 40°C	• Diffusion time: 1 s
• Normalized gas: 50% ± 5%	• Normalized acid composition: 11.5%
• Actual gases: 50% ± 5%	• Actual acid composition: 11.5%

4. Test result:

- No visible crack on the external surface of these 4.0-Grade Diesel** components.
- The engine Cetanulac, using the observed acid number (13.47 mm) (30000 g/1000 g).

5. Conclusion:

The engine fitted with the specimens extracted of the G3-EP PVV 142 Rev. 9, all the results and procedures should be given at the detailed test report number CET0007446-00.

By the company of the CETIM of Valenciennes, the results of this test report, whether a revision, alteration or supplement, involves the responsibility of the customer and/or engine manufacturer. CETIM is not responsible for the results of this test report, whether a revision, alteration or supplement, involves the responsibility of the customer and/or engine manufacturer. CETIM is not responsible for the results of this test report, whether a revision, alteration or supplement, involves the responsibility of the customer and/or engine manufacturer.

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NORSOK M-710/MERL and TOTAL GS EP PVV/CETIM certifications of Kalrez® 0090 RGD resistance.

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