< DUPONT >

DuPont[™] Kalrez[®] Perfluoroelastomer Parts

Rapid Gas Decompression Tests in Hydrogen

Hydrogen demand reached 94 million tons (Mt) in 2021, surpassing pre-pandemic levels (91 Mt in 2019), and containing energy equal to about 2.5% of global final energy consumption. Most of the increase came from traditional uses in refining and industry, though demand for new applications grew to approximately 40 thousand tons (up 60% from 2020, albeit from a low base) (source IEA.org). The broader production, use and new application of dihydrogen is leading to the creation and development of new standards and customer requirements. When it comes to elastomers two main questions are surfacing:

- 1. Can elastomer seals resist rapid gas decompression (RGD) with dihydrogen?
- 2. What is the permeation level of elastomers seals?

This technical report aims at providing some preliminary information on the RGD performance of Kalrez[®] pefluoroelastomer parts. The target of this test is to evaluate the RGD resistance of three Kalrez[®] grades in hydrogen gas (H₂) at high pressure and high temperature.

Rapid Gas Decompression Test Procedure

The test set up uses a "scouting test fixture" where several O-rings are piled up and compressed homogeneously whereas having an important contact surface with the gas as shown on the pictures on the right-hand side.

After assembling the O-rings, the whole test fixture is positioned into a pressure vessel which is then closed, heated up and pressurized.

Tested materials:

- Kalrez[®] 0090: 95 Shore A grade
- Kalrez[®] OG193: 95 Shore A RGD grade
- FFKM: 90 Shore A non RGD formulation

Specimen:

- Two O-rings per tested material
 - Kalrez[®] 0090 Specimen reference: A1 & A2
 - Kalrez® OG193 Specimen reference: B1 & B2
- 90 Shore FFKM non RGD formulation Specimen reference: C1 & C2
- Specimen size: AS568-315 (ID = 19.99 mm, CSD 5.33 mm)
- Four cuts per O-ring were made, according to the ISO 23936-2





Test Conditions	
Grades	0090, OG193, FFKM non RGD
Gas	H ₂
Seal Compression	13%
Pressure	200 bar / 2,900 psi
Temperature	150 °C / 302 °F
Specimen	O-ring K-315 (19.99 x 5.33mm)
Hold time	72 hrs
Cycle	1
Decompression Rate	120 bar/min

RGD rating analysis and pictures



Conclusion

The overall conclusion of this study is that both Kalrez[®] 0090 and Kalrez[®] OG193 have passed rapid gas decompression test using 100% dihydrogen gas based on the specific conditions used. A non RGD FFKM with 90 Shore A formulation might not be able to pass a rapid gas decompression event with dihydrogen.

Visit us at Kalrez.com

The information set forth herein is furnished free of charge and is based on technical data that DuPont believes to be reliable and falls within the normal range of properties. It is intended for use by persons having technical skill, at their own discretion and risk. This data should not be used to establish specification limits nor used alone as the basis of design. Handling precaution information is given with the understanding that those using it will satisfy themselves that their particular conditions of use present no health or safety hazards. Since conditions of product use and disposal are outside our control, we make no warranties, express or implied, and assume no liability in connection with any use of this information. As with any product, evaluation under end-use conditions prior to specification is essential. Nothing herein is to be taken as a license to operate or a recommendation to infringe on patents.

CAUTION: Do not use in medical applications involving permanent implantation in the human body. For other medical applications, discuss with your DuPont customer service representative and read Medical Caution Statement H-50103-3.

OUPONT>

DuPont[™], the DuPont Oval Logo, and all products, unless otherwise noted, denoted with [™], sm or ® are trademarks, service marks or registered trademarks of affiliates of DuPont de Nemours, Inc. © 2023 DuPont. All rights reserved.