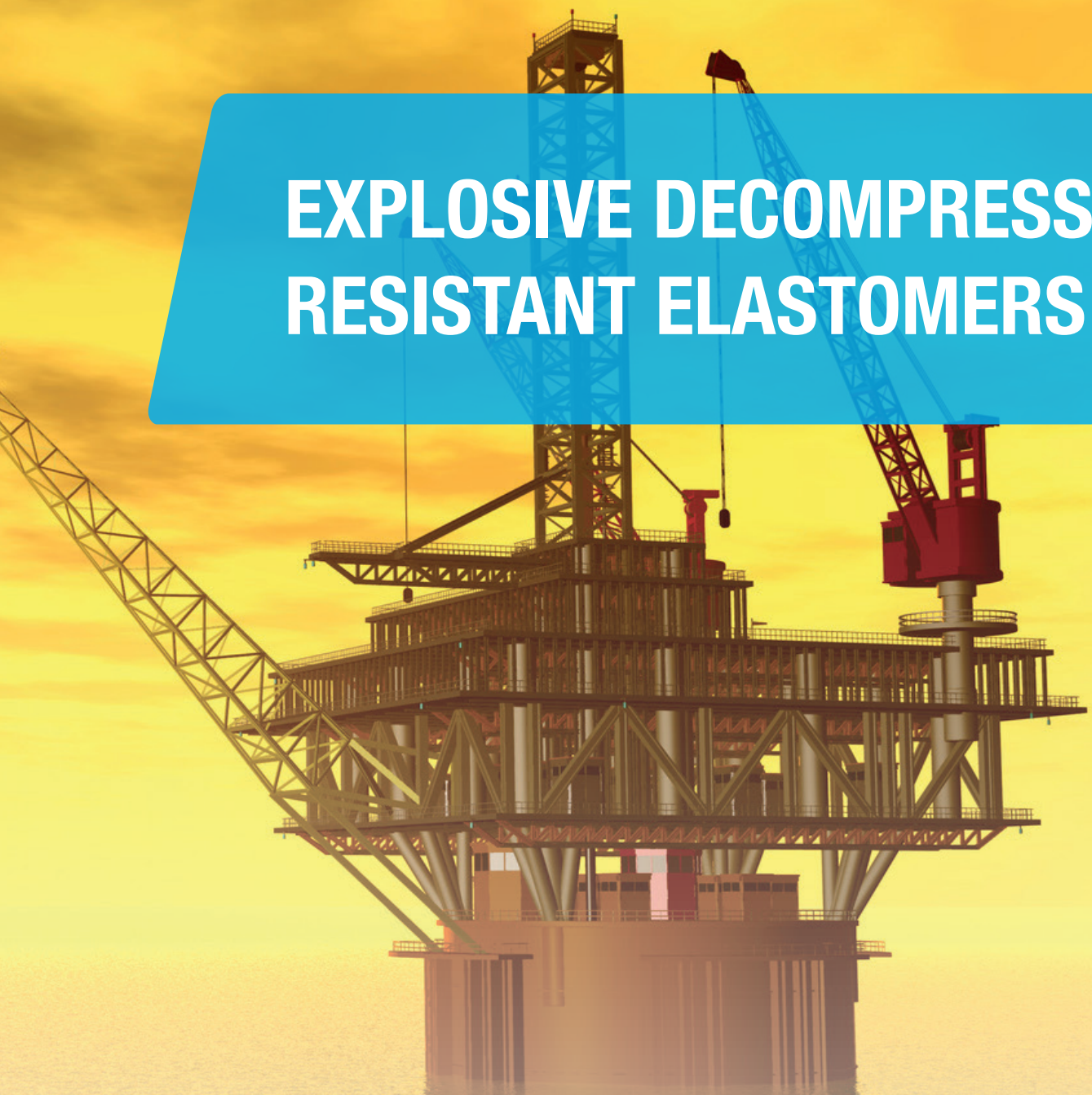
PPE

Precision Polymer Engineering

Advanced sealing solutions for critical applications

EXPLOSIVE DECOMPRESSION RESISTANT ELASTOMERS



IDEX SEALING SOLUTIONS

What is Explosive Decompression?

Explosive decompression (ED), also referred to as rapid gas decompression (RGD), is a failure mechanism of elastomer seals which is due to the rapid decompression of gaseous media. When elastomer seals are exposed to high-pressure gas at elevated temperatures for a prolonged period of time the gas absorbs into the polymer compound. When the external pressure is reduced, the gas dissolved within the material comes out of solution to form micro bubbles. As the gas expands, it will permeate out of the material. However, if the rate of decompression and expansion is high, the trapped gas within the seal expands beyond the materials ability to contain the gas bubbles, causing fissuring and resulting in seal failure.

Cross section of ED damaged O-ring

Explosive Decompression Testing

Precision Polymer Engineering (PPE) is a leading manufacturer and developer of anti-explosive decompression (AED) sealing solutions. PPE's materials development laboratories, located in UK and Houston, house the most sophisticated ED testing facilities for rubber in the industry.

The high pressure test rigs are capable of pressurizing various seal geometries up to 138 MPa or 20,000 psi over any time period, any number of depressurization cycles and any temperature up to 250°C (482°F). The programmable rigs can be used to test materials against various industry standards or simulate actual field operations found in oilfield tools and compressor applications.

The test rigs at PPE are capable of testing to the standards listed below as well as customer-specified parameters. The O-ring carrier inserts are interchangeable to accommodate various squeeze levels in face and piston geometries.

Explosive Decompression Standards

There are a number of international standards for testing elastomer materials in ED conditions:-

- **NORSOK M-710** rev 2 section 7.3 annex B: "Qualification of Non-metallic Sealing Materials and Manufacturers – Resistance to rapid gas decompression (RGD)"
- **TOTAL General Specification GS PVV 142 Appendix 8**: "Elastomer O-ring Seals Explosion Decompression Type Testing Procedure."
- **NACE TM0297**: "Effects of High Temperature, High Pressure Carbon Dioxide Decompression on Elastomeric Materials."
- **ISO 23936-2**: "Petroleum, petrochemical and natural gas industries - Non-metallic materials in contact with media related to oil and gas production – Part 2: Elastomers."

	NORSOK M710	TOTAL GS PVV 142	NACE TM0297	ISO 23936-2*
Specimen	ISO3601 -325 O-Ring	ISO3601 -349 or -425 O-Ring	ISO3601 -325 O-Ring	ISO3601 -312 O-Ring or larger
Constraint	20% Compression	13.5% Compression	Optimal	14.5% Compression
Replication	Three	Three	Nine	Four
Gas (%)	90/10 CH_4 /CO_2	80/20 CH_4 /CO_2	100 CO_2	90/10 CH_4 /CO_2
Temperature	100, 150, or 200°C	75°C	50, 100, 120, 150, 175, or 230°C	100°C
Pressure	15, 20 or 30 MPa	19MPa	7, 17, 28 or 38 MPa	15 MPa
Initial Soak Period	72hrs	78hrs	-	68hrs
Soak Period	24hrs	48hrs	24hrs	6 and 12 hrs alternating
Decompression Rate	2-4 MPa/min	19 to 0 MPa in 90 sec	7 MPa/min	2 MPa/min
Dwell at ambient pressure	1hr	1hr	-	1hr
Cycles	10	5	1	8

*Specification allows for bespoke media, temperatures and pressures following agreement between interested parties

Elastomer Materials Tested to Explosive Decompression Standards

The following PPE material grades have been developed for ED resistance and are available as fully molded O-rings and custom seals. Custom testing to meet specific application requirements is also available. For copies of test certificates please consult the PPE website:

www.prepol.com/AEDseals or contact your local PPE sales representative.

Material Grade	Description	NORSOK M710	TOTAL GS PVV 142	NACE TM0297	ISO 23936-2
EnDura® V91J	90 durometer, FKM	✓	✓	✓	
EnDura® V91K	90 durometer, low temperature FKM	✓	✓	✓	
EnDura® V91A	90 durometer, ultra low temperature FKM	✓		✓	✓
EnDura® A90H	90 durometer, Aflas® based FEPM	✓		✓	✓
EnDura® Z95X	90 durometer, medium ACN, HNBR	✓	✓	✓	
EnDura® Z85L	85 durometer, low ACN, HNBR			✓	
EnDura® E90SR	90 durometer, steam res. EPDM			✓	
Perlast® G92E	90 durometer FFKM	✓		✓	
Perlast® ICE G90LT	90 durometer, low temperature FFKM	✓		✓	

Custom Explosive Decompression Testing

In a world where standard tests often do not match real-life applications, PPE can carry out ED testing at customized parameters which more closely match actual service conditions. Many of PPE's EnDura materials have undergone customer-specific testing, which provides a high level of confidence that PPE seals will perform satisfactorily in a particular application.

PPE's advanced ED testing equipment can pressurize seals of various geometries up to 20,000 psi and can decompress over any desired cycle or time, while at a temperature of up to 250°C (482°F). Using this equipment, compounds can be developed and tested to overcome this condition, with pressure, temperature and pressure release cycles simulating actual field operation, confirming the performance of seal types and grades before installation. In-house tests can be witnessed and verified by external parties.

Case study

A leading oil service company required custom ED testing prior to installation of Perlast® ICE G90LT seals in a subsea valve.

The testing was carried out with custom sized test specimens of the size used in the customer's application. The test conditions were also customized to replicate the application environment.

The tests were externally witnessed and verified by Lloyds Register.

Test Conditions

Test specimen	113mm ID x 5.75mm CS
Squeeze (%)	15
Gas (%)	80/20 CH_4 /CO_2
Temperature	155°C (311°F)
Pressure	150 bar (15 MPa)
Soak period	24hrs (initial 72hrs)
Depressurization rate	30 bar/min (3 MPa)
Cycles	10

For further information or to download test certificates visit PPE at: **www.prepol.com**

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PERLAST® ICE

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EnDura®

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Local PPE sales agent:

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