PRECISION ASSOCIATES, INC.
Sealing Solutions...YOUR WAY!

TECHNICAL BULLETIN

RGD and Extrusion Resistant Compounds

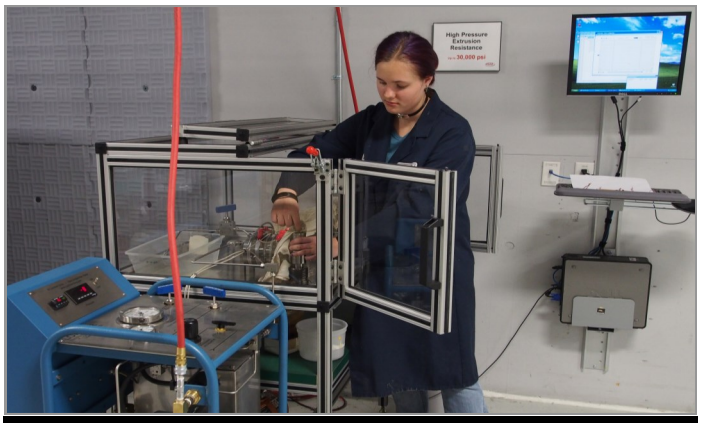
Oil and gas applications present some of the most challenging seal environments due to extreme temperatures, high pressures, and harsh chemicals. Understanding the service conditions and designing materials for optimal performance are the first steps in successful sealing.

Because of their critical nature, compounds used in this market require extensive testing and qualification before use in the field.

Precision Associates provides materials with proven performance in High Pressure Extrusion Resistance and Rapid Gas Decompression (RGD) applications.

Extrusion occurs when system pressure forces the seal from its groove and into the clearance gap within the seal housing. Proper groove dimensions and seal selection combined with elastomers designed to resist extrusion can prevent this type of failure. The potential for extrusion to occur is greater with a larger gap.

There is no standard test method to measure extrusion resistance. With the guidance and expertise of oil and gas industry professionals, Precision Associates developed a High Pressure Extrusion device to facilitate the testing of O-Rings at various temperatures and pressures to quantify a material's suitability for this type of environment. One AS568-325 O-Ring is installed in a groove using a .005 to .009 inch radial extrusion gap and tested at various temps. The fixture is pressurized to a maximum of 30,000 psi until the O-Ring extrudes and fails.



A technician is shown preparing the High Pressure Extrusion Device to run O-Rings through a test cycle.

Precision Associates developed **8990** (95 duro) a Viton® FKM compound to resist extrusion at high pressures.

O-Rings were molded from this material for testing in the High Pressure chamber. For comparison purposes, a general purpose FKM **9944** (90 duro) and a typical oil field RGD FKM **608905 (**90 duro) were also tested.

Results are shown below:

GAP	Compound tested @300F PSI at failure		
	8990 (95)	**608905 (90)**	**9944 (90)**
.005	**29,500**	26,000	12,000
.009	**24,000**	19,000	10,000

GAP	Compound tested @392F PSI at failure		
	8990 (95)	**608905 (90)**	**9944 (90)**
.005	**27,000**	19,000	9,000
.009	**16,000**	14,000	5,000

Compound 8890 showed consistently superior results in all tests.

Selecting the proper material at the design stage to prevent extrusion during operation can significantly improve seal life; reducing maintenance and system down time.

Contact Precision Associates for more information!

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What is RGD?

Pressurized gas can permeate an elastomer seal within a well or other system. If the pressure is released or decompressed rapidly, the gas rushes to exit the elastomer causing it to rupture. This is known as Rapid Gas Decompression (RGD) or Explosive Decompression (ED).

Splits, cracks, and blisters are generally evident in the seal when this occurs but there can be internal damage that is not visible.
Measuring the resistance of a compound to RGD failure is typically done by an independent test laboratory utilizing a variety of industry standards:

Example of a damaged O-Ring made from FKM that was not RGD Resistant.

Precision Associates successfully developed two materials that passed the requirements of the ISO 23936 -2 ANNEX B standard that has been adopted as the internationally accepted method of testing. All tests were performed using AS568–325 O-Rings as specimens. Test parameters are shown below.

Rapid Gas Decompression (RGD) Test Conditions

Media	Volume %
Carbon Dioxide CO_2	10%
Methane CH_4	90%
Pressure	150 bar (reduced 30 bar/min.)
Temperature	100°C

Each specimen is cut with a razor blade into 8 radial cross sections and ranked by this scale:

RGD Damage criteria per ISO 23936-2 Annex B	Rating	Pass/ Fail
No cracks, holes or blisters permitted	0	Pass
Any # of cracks, each <25% CSD; total crack length shall on exceed CSD. External cracks shall be <10% CSD; no splits permitted.	1	Pass
Any # of cracks, each < 50% CSD; total crack length shall not exceed 2xCSD. External cracks shall be <25% CSD; no splits permitted.	2	Pass
Any number of cracks of which 2 internal cracks can each have length 50% to 80% CSD; total crack length shall not exceed 3x CSD. External cracks shall be <50%CSD; no splits permitted.	3	Pass
Any number of cracks having total length greater than 3 x CSD or at least 2 inernal cracks >80% CSD or 3 or more internal cracks each>50% CSD or any external crack >50% CSD. No splits permitted.	4	Fail
Any split, regardless of location and length.	5	Fail

Compound #	Duro	Type	Rating	ISO
8990	95	FKM	0	Pass
608905	90	FKM	0	Pass
25895	85	Aflas®	0	Pass

Precision Associates tests materials to NACE TMO 192-2012 to gauge their suitability for RGD resistance prior to submitting them for ISO 23936-2 testing.

The best overall rating for this test is a “1”. Results are shown below.

Compound #	Duro	Type	Rating	NACE
55995	95	HNBR	1	Pass

*ISO 23936-2 results pending.

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