The new generation of performance materials from the experts at James Walker

Includes Vermilion Three

The first and only elastomer Shell TAT approved to Shell MESC SPE 85/301

Because it’s a harsh world
The industry is evolving and so are we...

Global access to customer support, technical advice and design capability in both materials and applications engineering.

Local support is available around the globe and all our customers have access to the knowledge and expertise of our centre of excellence for elastomer materials engineering in the UK.
As the Oil & Gas industry evolves, our materials technology evolves to stay ahead of the game.

Based on 50 years of expertise and innovation the versatile Vermilion® range will offer superior performance where it matters most. As the Oil & Gas industry evolves, our materials technology evolves to stay ahead of the game.

Always one step ahead.
Developed specifically for the Oil & Gas industry, the Vermilion® range extends the envelope of elastomer performance.

Whilst these materials have been formulated to meet the varied, evolving challenges of tomorrow they can also enhance the performance of existing sealing solutions and enable us to deliver superior solutions for our customers operating in the harshest environments.

Over the years James Walker has developed a great variety of elastomer components and seals for oil and gas applications, many of which can now be offered in the new range of Vermilion® materials using existing tooling to provide immediate benefits of improved performance and increased operational safety margins.

Where the new Vermilion® materials are required to be validated against customer specifications or proven through application specific testing, James Walker possesses some of the most advanced test facilities and regularly collaborates with customers in such test programmes.
This is a graphical overview of material performance characteristics.
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Qualified to Norsok M-710 / ISO 23936-2
Additional testing for RGD resistance
'0000' rating at 100°C
5.33mm / 150bar / 90% CH₄ 10% CO₂ / 10 cycles

Low temperature performance
TR10 -43°C (-45°F)
T70 -39°C (-38°F)

High temperature performance
Continuous
+200°C (+392°F)

Sour qualification
Qualified to Norsok M-710 ISO 23936-2
'sour'

Low temperature performance, TR10

High temperature performance
Continuous
+200°C (+392°F)

sour qualification
Qualified to Norsok M-710 ISO 23936-2
'sour'

Low temperature performance, TR10

High temperature performance
Continuous
+200°C (+392°F)

Vermilion®

One
A fluoroelastomer (FKM) with ultra-low temperature capability and excellent methanol resistance. Providing typical FKM tolerance of H₂S, aromatics and hot water, this material also offers good resistance to rapid gas decompression (RGD).

Sealing capability confirmed down to -60°C (-76°F) in product configured testing

(See material data sheet for test details)
Low temperature performance
TR10 -28°C (-18°F)
T70 -24°C (-11°F)

High temperature performance
Continuous +205°C (+401°F)

Sour qualification
Qualified to Norsok M-710 ISO 23936-2 'sour'

Qualified to Norsok M-710 / ISO 23936-2

Additional testing for RGD resistance
'0000' rating at 65°C
10.82mm / 150bar / 90% CH₄ 10% CO₂ / 10 cycles

'0000' rating at 50°C
5.33mm / 150bar / 100% CO₂ / 8 cycles

'0000' rating at 150°C
5.33mm / 150bar / 90% CH₄ 10% CO₂ / 8 cycles

This is a graphical overview of material performance characteristics.
A fluoroelastomer (FKM) with excellent resistance to methanol and rapid gas decompression (RGD), providing good low temperature performance and the typical FKM tolerance of H₂S, aromatics and hot water plus inherent extrusion resistance.

Sealing capability confirmed down to -49°C (-56°F) in product configured testing

(See material data sheet for test details)

Details of all approvals are available on our material data sheets. Full third party test reports are also available.
Low temperature performance
TR10 -32°C (-26°F)
T70 -30°C (-22°F)

High temperature performance
Continuous +200°C (+392°F)

Sour qualification
Qualified to Norsok M-710 ISO 23936-2 ‘sour’

Qualified to Norsok M-710 / ISO 23936-2
Additional testing for RGD resistance
0000’ rating at 100°C
6.99mm / 150bar / 90% CH4 10% CO2 / 8 cycles

This is a graphical overview of material performance characteristics. Those characteristics highlighted in bold text represent the areas of enhanced performance over existing technology.
A fluoroelastomer (FKM) offering excellent temperature performance and rapid gas decompression (RGD) resistance plus the typical FKM tolerance of H₂S, aromatics and hot water.

Vermilion® Three is a next generation development of James Walker FR25/90

Sealing capability confirmed down to -46°C (-51°F) in product configured testing

(See material data sheet for test details)

Details of all approvals are available on our material data sheets. Full third party test reports are also available.
Low temperature performance
TR10 -19°C (-2°F)
T70 -16°C (+3°F)

High temperature performance
Continuous +200°C (+392°F)

Sour qualification
Qualified to Norsok M-710 ISO 23936-2
'sour'

Qualified to Norsok M-710 / ISO 23936-2

Additional testing for RGD resistance

'0000' rating at 100°C
6.99mm / 150bar / 100% CO₂ / 8 cycles

'0000' rating at 150°C
5.33mm / 150bar / 100% CO₂ / 8 cycles

'0000' rating at 100°C
8.40mm / 150bar / 90% CH₄ 10% CO₂ / 8 cycles

'0000' rating at 175°C
6.99mm / 150bar / 90% CH₄ 10% CO₂ / 8 cycles

This is a graphical overview of material performance characteristics. Those characteristics highlighted in bold text represent the areas of enhanced performance over existing technology.
An excellent cost-effective general purpose fluoroelastomer (FKM) providing outstanding resistance to rapid gas decompression (RGD) at larger cross sections and higher temperatures, this material also provides the resistance to H₂S, aromatics and hot water typical of an FKM.

Vermilion® Four is a next generation development of James Walker FR58/90

Sealing capability confirmed down to -33°C (-27°F) in product configured testing

Details of all approvals are available on our material data sheets. Full third party test reports are also available.
Qualified to Norsok M-710 / ISO 23936-2

Additional testing for RGD resistance

0000’ rating at 100°C
5.33mm / 150bar / 90% CH4 10% CO2 / 10 cycles

0000’ rating at 45°C
10.82mm / 150bar / 90% CH4 10% CO2 / 8 cycles

This is a graphical overview of material performance characteristics. Those characteristics highlighted in bold text represent the areas of enhanced performance over existing technology.
This hydrogenated nitrile (HNBR) material offers excellent low temperature performance combined with good resistance to rapid gas decompression (RGD) and sour conditions.

Vermilion® Five is a next generation development of James Walker Elast-O-Lion® 985

Sealing capability confirmed down to -55°C (-67°F) in product configured testing

(See material data sheet for test details)

Details of all approvals are available on our material data sheets. Full third party test reports are also available.
This is a graphical overview of material performance characteristics. Those characteristics highlighted in bold text represent the areas of enhanced performance over existing technology.
With typical characteristics of outstanding heat, amine, acid, H₂S and hot water resistance, this Aflas® material also provides good levels of resistance to rapid gas decompression (RGD).

Sealing capability confirmed down to -15°C (+5°F) in product configured testing

(See material data sheet for test details)
This is a graphical overview of the intended material performance characteristics.
An hydrogenated nitrile (HNBR) material that will offer excellent rapid gas decompression (RGD) resistance and good resistance to sour conditions combined with outstanding physical robustness.

Coming soon
Choosing the right material

Our Technical Support Team is always available to assist with material selection and seal design.

Low Temperature Performance

Establishing the operational low temperature performance of elastomers is a highly complex task and ultimately dependent on other application conditions such as pressure, seal configuration, storage, assembly and media. For this reason it is essential that customers discuss specific application conditions with the James Walker Technical Support Team.

In order to provide transparency when comparing performance between compounds we have used two common laboratory test methodologies: Temperature retraction and Gehman torsional modulus.

Whilst these tests do not provide absolute figures for performance in application, they do offer a basis for the accurate comparison of low temperature capability between different materials.

**TR10 temperature retraction (ISO 2921)**

Material sample is stretched and cooled then allowed to retract freely as the temperature is raised. The temperature at which the sample has recovered by 10% is referred to as TR10.

**T70 Gehman torsional modulus (ISO 1432)**

The temperature at which an elastomer sample stiffens and the limit of technically useful flexibility is reached. This is commonly defined by a torsional modulus value of 70MPa.

These tests offer a degree of accuracy and are less susceptible to the flexibility of interpretation of other low temperature performance assessments.

**Sealing capability testing**

In an effort to provide greater clarity on materials capability James Walker uses a product configured test in an effort to determine the lowest possible temperature at which each material will effect a seal. We make this assessment using an O ring in a constrained housing to replicate conditions of designed groove fill, squeeze and surface finish.

The results only relate to the product in the format and conditions tested and offer no accurate guidance to performance in application where the media, pressure, product design, housing design and housing surface finish will all have a bearing on performance.

It is our belief that, when selecting and specifying materials, relying solely on published low temperature claims utilising undisclosed test methodologies is unwise and potentially dangerous. The only true method to determine whether the low temperature sealing capability of a material will be suitable is to undertake product configured tests under conditions as close as possible to those found in application.
A variety of industry standards and test methods exist for evaluating rapid gas decompression resistance in a way that allows compound performance to be compared. Regardless of the test used, James Walker maintains a position that only materials capable of sustaining no damage under industry standard RGD testing will provide optimum operational safety in critical applications.

NORSOK M-710 Annex B Rev. 2/3
Media: 90% CH₄, 10% CO₂
Temperature: 100°C (212°F)
Pressure: 150bar/15MPa (2176psi)
Decompression rate: 40 bar/min
Number of cycles: 10/8

ISO 23936-2
Media: 90% CH₄, 10% CO₂
Temperature: 100°C (212°F)
Pressure: 150bar/15MPa (2176psi)
Decompression rate: 40 bar/min
Number of cycles: 8

Total GS EP PVV 154 and PVV 155
Media: 80% CH₄, 20% CO₂
Temperature: 75°C (167°F)
Pressure: 190bar/19MPa (2756psi)
Decompression rate: 127 bar/min
Number of cycles: 5

Both media and temperature have a major influence on RGD performance and because of this, testing beyond standard industry approvals is required to assess full capability for resistance to RGD in operational conditions. James Walker operates one of the most comprehensive facilities for RGD testing and regularly undertakes testing for customers to validate seal performance in application specific conditions.
There is no substitute for experience

Chemical Resistance

Sour (H₂S)
Hydrogen sulphide, H₂S is present in oilfield media in quantities from a few ppm to high percentages but its effects on elastomeric materials are highly temperature dependent.

The resistance of our materials to sour media is assessed through undergoing the industry-recognised Norsok M-710 test regime. This provides a solid indication of a material’s response to exposure to H₂S and through measuring the effects over differing time periods across a range of concentrations it is possible to generate a predicted life expectancy using the Arrhenius model.

Whilst such figures are not necessarily representative of an operational life, they do allow meaningful comparison of ‘sour’ resistance across different materials.

Although some materials are shown to have excellent resistance to H₂S this is always dependent on other application parameters and often at the expense of performance in other areas. For this reason it is always advisable to consult our Technical Support Team.

Carbon Dioxide (CO₂)
CO₂ is a small molecule and will readily diffuse into elastomers. During depressurisation, CO₂ absorbed into a seal will generate large volumes of gas during the reverse transition.

It is for this reason that CO₂ is so aggressive towards elastomeric seals and because of this James Walker has invested in an extensive test programme to evaluate performance and develop materials suitable for this environment.

Methanol
The use of Methanol is important and extensive in the Oil & Gas industry in applications such as hydrate inhibitors, drying pipelines or as a chemical solvent.

Methanol can cause excessive volume swell in elastomeric seals but to combat this James Walker has specifically formulated materials in the Vermilion® range that have excellent methanol compatibility – greatly extending their use within oil and gas applications.
Steam and hot water

Water is frequently present in oil & gas pipelines and comes from a variety of sources – either associated with the oil and gas reservoir, as an injection media or incorporated in control fluids. Hot water and steam can chemically attack elastomers and the severity of the attack depends on the elastomer and the temperature.

HNBRs and FKMs are the main elastomers used in the Oil & Gas industry. In general terms, for long service life, HNBRs should be restricted to maximum 120°C and peroxide cured FKMs to 150°C in service with water and steam. Aflas® is an exception to this general rule as it has exceptional resistance to steam and can be used up to 200°C in its presence, although this may incur compromise in other performance parameters.

Both HNBRs and FKMs will survive intermittent spikes in temperature higher than these general limits, but their total time exposed above 120°C and 150°C respectively should be limited as it will have an impact on operational life performance.

In many cases a variety of chemicals can be present, dissolved in the water and these can also chemically attack elastomers. For example, amine based corrosion inhibitors in control fluids will attack FKMs. The effects of these chemicals must be taken into account separately to that of the water itself.

Selecting the correct material for any specific application is a complex task due to the number of influencing factors. For this reason we recommend that you take advantage of James Walker’s unrivalled expertise in this field and discuss the detail of your application by contacting your local James Walker company in the first instance.
Information given in this publication is given in good faith and represents the results of specific individual tests carried out by James Walker in accordance with the methodologies described in this publication, performed in a laboratory. No representation or warranty is given in relation to such information. Values and/or operating limits given in this publication are not to be taken as indications that these values and/or operating limits can be applied simultaneously. Values and/or operating limits given in this publication are not to be taken as indications that these values and/or operating limits can be applied simultaneously. While such results may constitute useful additional information and are industry standard tests, they are no substitute for conducting (or procuring from James Walker) your own tests and engineering analyses and satisfy yourself as to the suitability of the material for your use. These describe the material tested and the environment in which it was tested. Results may vary from user to user or from test to test or from material to material due to a variety of reasons, including but not limited to the design of the product made with the material, handling, test temperature, humidity, etc. Any specifications that are given are for guidance only and should not be used as a basis for design. No warranty is given in relation to the performance of the material in application. Values and/or operating limits given in this publication are not to be used in isolation and may not be applied simultaneously. Where such results may constitute useful additional information and are industry standard tests, they are no substitute for conducting (or procuring from James Walker) your own tests and engineering analyses and satisfy yourself as to the suitability of the material for your use. These describe the material tested and the environment in which it was tested. Results may vary from user to user or from test to test or from material to material due to a variety of reasons, including but not limited to the design of the product made with the material, handling, test temperature, humidity, etc. Any specifications that are given are for guidance only and should not be used as a basis for design. No warranty is given in relation to the performance of the material in application. Values and/or operating limits given in this publication are not to be used in isolation and may not be applied simultaneously.

Health warning: If fluoroelastomer (e.g. FKM, FFKM, FEPM) products are heated to elevated temperatures, fumes will be produced which may give unpleasant effects, if inhaled. Whilst some fumes are emitted below 250°C from fluoroelastomers the effect at these temperatures is negligible. Care should be taken to avoid contaminating tobacco with particles of fluoroelastomer, which may remain on hands or clothing. Safety Data Sheets (SDS) are available on request.

For more information visit www.harshworld.info