

THERMANITE®

AN ELASTOMER THAT PERFORMS IN EXTREME CONDITIONS

STEAM RESISTANCE

HEAT RESISTANCE

Rubberatkins **THERMANITE®** brand of elastomers are an industry leading proprietary grade of materials developed in-house to provide unparalleled resistance to steam and hydrocarbons. These materials offer sealing solutions for enhanced heavy oil recovery with steam injection at extreme temperatures up to 600 °F.

SERVICE TEMPERATURE: 0 °C to 315 °C (32 °F to 600 °F)

FEATURES:

- Increased downhole life expectancy
- Exceptional physical property retention at extreme temperatures
- Proven field history
- Fully compatible in steam and most hydrocarbon environments
- Excellent abrasion resistance
- Rapid gas decompression (RGD) resistant

BENEFITS:

- Outstanding steam resistance
- Increased life expectancy minimises installation and intervention costs whilst reducing NPT
- Unrivalled sealing integrity
- Cost-effective solution
- Excellent chemical resistance
- High sour gas resistance

TYPICAL APPLICATIONS:

- Steam injection and stimulation applications
- Geothermal
- Enhanced Oil Recovery (EOR)
- Packer / Bridge Plug Elements
- O-rings and seal stacks
- BOP and wellhead seals
- Surface pressure control equipment seals
- High pressure cup seals

THERMANITE® approved under:
ISO 23936-2
NORSOK M710
NACE TM0187

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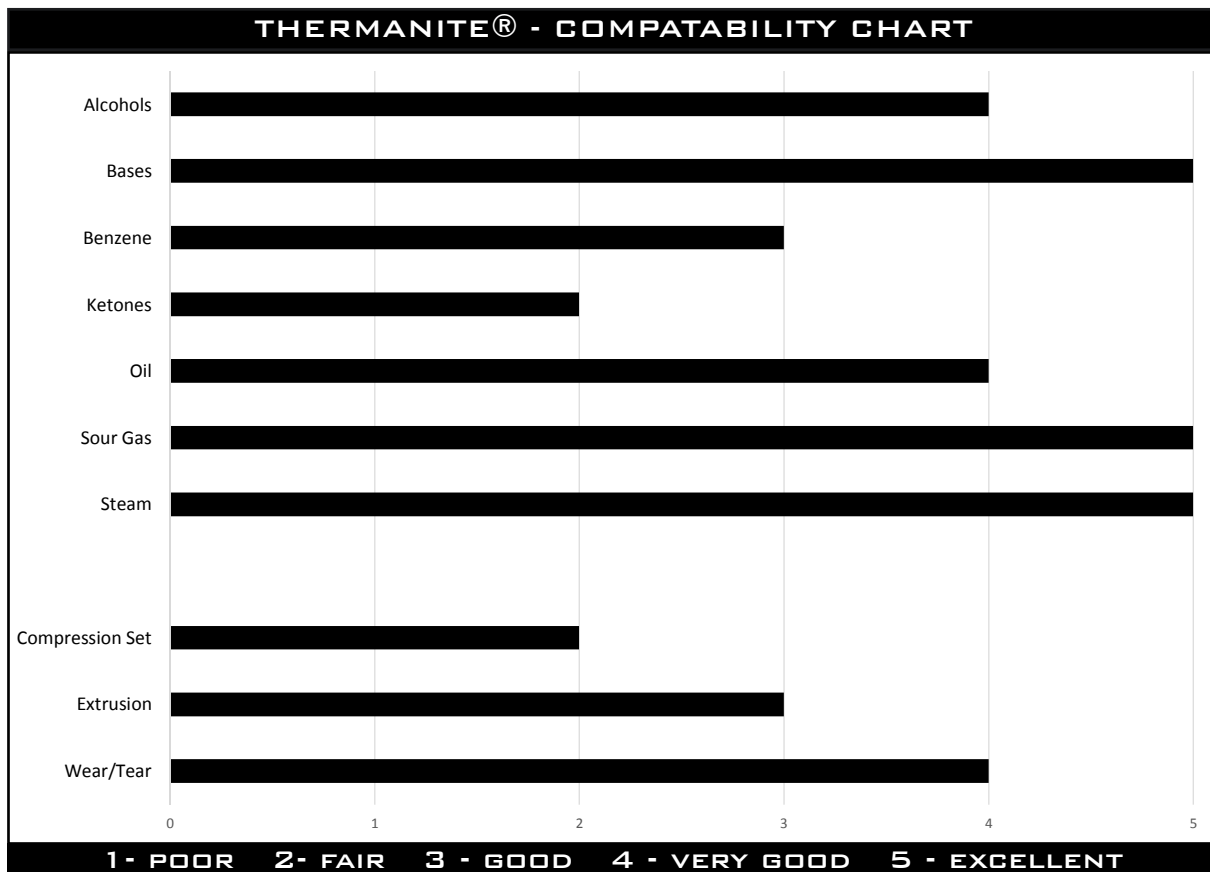
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| THERMANITE® - MATERIAL DATA | | | | | |
|-----------------------------|--------------------------------------|---------------|--------------------------------------|---------------|---------------|
| Elastomer | Thermanite® 1195TH (85 – 90 IRHD) | | Thermanite® 1185TH (90 – 95 IRHD) | | Test standard |
| | Conditions | Typical value | Conditions | Typical value | |
| Tensile strength (MPa) | ambient | >16.0 | ambient | >17.0 | ISO 37 |
| Elongation at break (%) | ambient | >180 | ambient | >100 | ISO 37 |
| 100% modulus (MPa) | ambient | >11.0 | ambient | >16.5 | ISO 37 |
| Compression set (%) | 22 hrs @ 200 °C | <55 | 22 hrs @ 200 °C | <40 | ISO 815 |
| Hardness (IRHD) | ambient | 85 - 90 | ambient | 90 - 95 | ISO 48 |
| Tear strength (N/mm) | ambient | >30 | ambient | >30 | ISO 48 |
| Effects of fluids | bespoke | - | bespoke | - | ISO 1817 |
| Glass transition (°C) | - | -2 | - | 0 | ISO 22768 |



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| THERMANITE® - COMPARISON CHART | | | | | |
|--------------------------------|-----------------|--------------------|-----------|-----------|--------------|
| Elastomer type | Fluoroelastomer | Ethylene Propylene | Aflas® | Perfluoro | Rubberatkins |
| | FKM | EPDM | TFE/P | FFKM | Thermanite® |
| Thermal Capabilities | | | | | |
| Max. continuous, °C | 200 | 100 | 200 | 250 | 250 |
| Max. intermittent, °C | 240 | 150 | 250 | 315 | 315 |
| Low temp resistance, °C | -15 | -50 | 0 | -10 | -5 |
| Special grades, °C | -40 | - | - | -40 | - |
| Chemical Resistances | | | | | |
| Oil resistance | Excellent | Poor | Good | Excellent | Very good |
| Alcohols | Grade dependent | Good | Good | Excellent | Good |
| Ketones | Poor | Good | Poor | Excellent | Fair |
| Aromatics | Good | Poor | Poor | Excellent | Fair |
| Acids | Very good | Very good | Very good | Excellent | Very good |
| Bases | Grade dependent | Excellent | Excellent | Very good | Excellent |
| Steam | Poor | Excellent | Excellent | Excellent | Excellent |
| Sour gas | Grade dependent | Excellent | Excellent | Very good | Excellent |
| Physical Properties | | | | | |
| Tear & abrasion resistance | Poor | Good | Good | Poor | Very good |
| Extrusion resistance | Poor | Fair | Fair | Poor | Good |
| Compression set | Very good | Very good | Poor | Excellent | Fair |

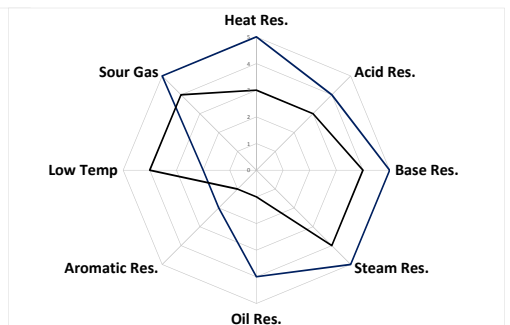
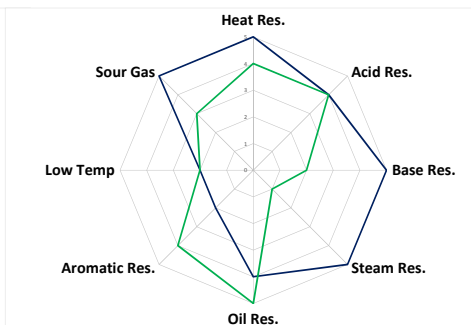
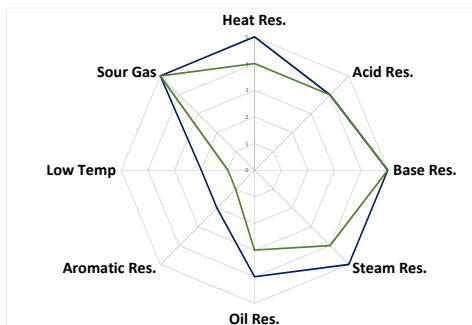
Disclaimer:

The Compatibility Chart above is for guidance only and is very much dependent upon the elastomer formulation which will vary from vendor to vendor. Rubberatkins cannot take responsibility for a selection based on this information and is presented purely to give general guidance. Please consult Sales@Rubberatkins.com who will be able to help you make the correct material selection.

THERMANITE® VS. AFLAS

THERMANITE® VS. FKM

THERMANITE® VS. EPDM



THERMANITE®

AFLAS

THERMANITE®

FKM

THERMANITE®

EPDM

THERMANITE®

| THERMANITE® - STEAM EXPOSURE, 600 °F, 2 MONTHS | | |
|---|--------------------|----------------|
| Property | Thermanite® 1195TH | Aflas® 907/20 |
| | (85 - 90 IRHD) | (90 - 95 IRHD) |
| Initial Results | | |
| Tensile strength (MPa) | 13.8 | 16.7 |
| Elongation at break (%) | 197 | 193 |
| 100% modulus (MPa) | 11.5 | 11.9 |
| Hardness (IRHD) | 89 | 90 |
| Post-Exposure Results | | |
| Change in tensile (%) | -6 | -38 |
| Change in elongation (%) | -6 | -9 |
| Change in 100% modulus (%) | -14 | -23 |
| Change in hardness (IRHD) | -5 | -5 |

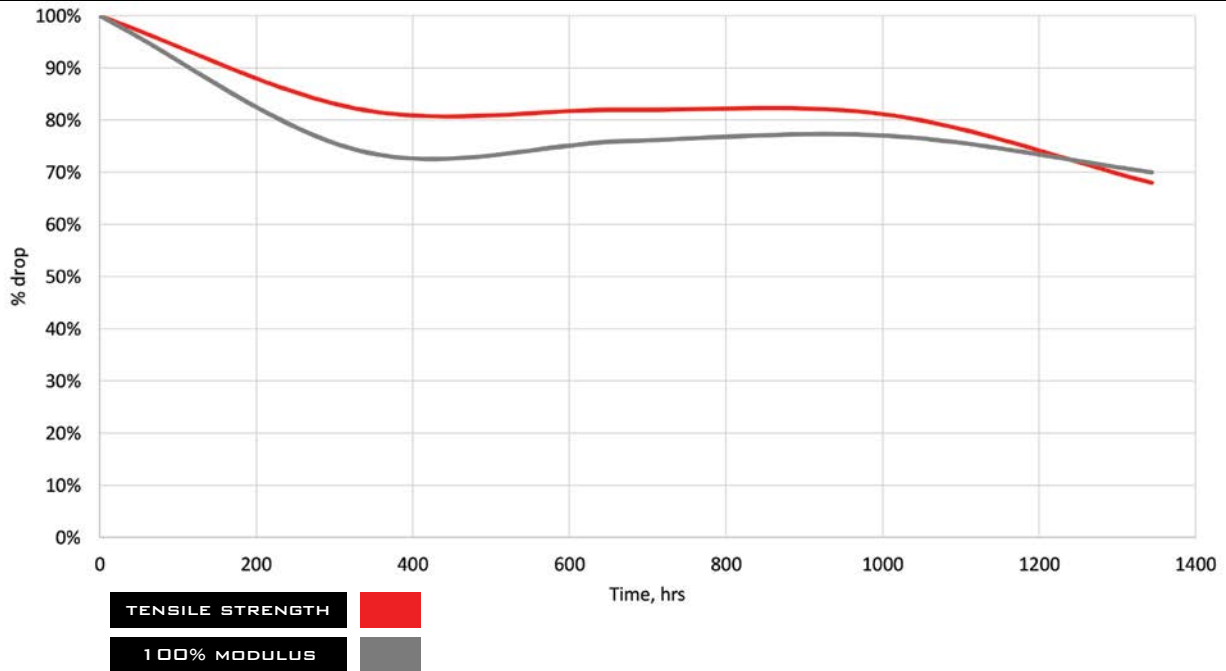
THERMANITE® materials were tested for rapid gas decompression (RGD) resistance to ISO 23936-2 Annex B using standard gas mixture B.1.ii. Temperature, pressure and duration were standard as per the specification. Samples showed no visible signs of RGD on the surface.

| THERMANITE® - ISO 23936-2 RAPID GAS DECOMPRESSION | | |
|--|--------------------|--------------------|
| Material | Thermanite® 1195TH | Thermanite® 1185TH |
| | (85 - 90 IRHD) | (90 - 95 IRHD) |
| Post-test seal ratings, 312 size o-rings | | |
| Test replicate 1 | 2100 | 0000 |
| Test replicate 2 | 0000 | 0000 |
| Test replicate 3 | 0000 | 0000 |
| Test replicate 4 | 1100 | 0000 |

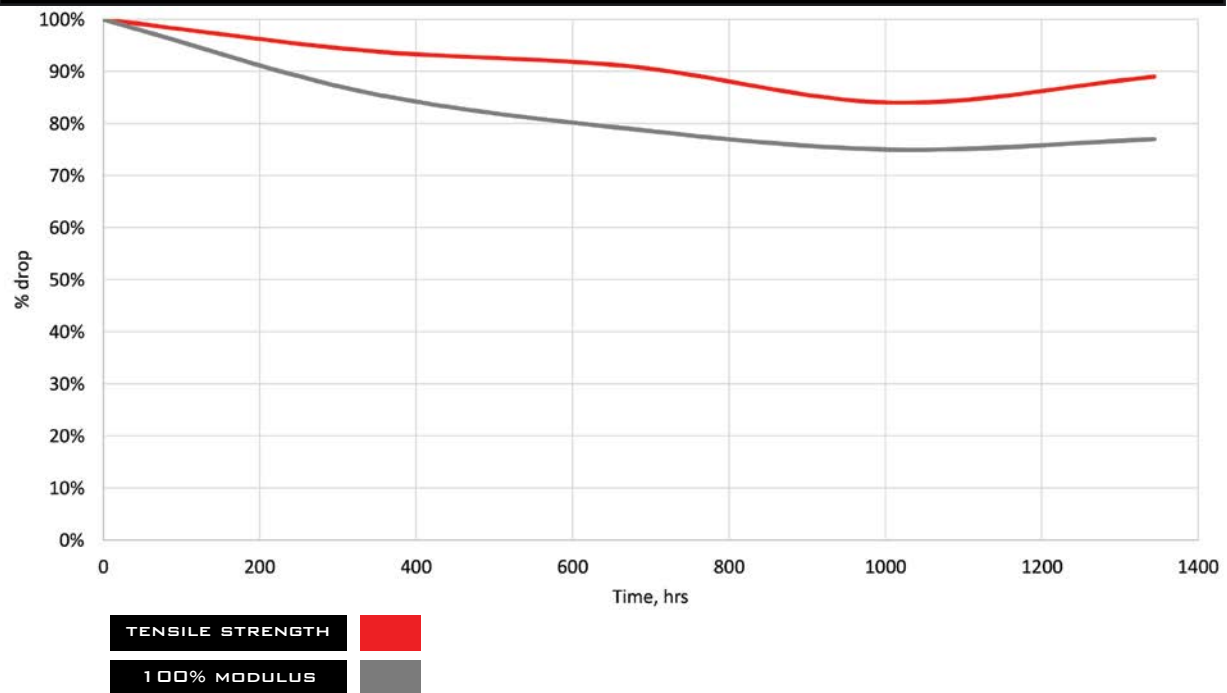
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THERMANITE® 1185TH STEAM AGEING 315 °C (600 °F)



THERMANITE® 1195TH STEAM AGEING 315 °C (600 °F)



THERMANITE® - CASE STUDY

ELASTOMER EXCELLENCE AT WORK

CHALLENGE

A leading service company operating within the challenging environment of steam injection wells in Colombia asked Rubberatkins to develop a cup able to successfully perform in temperatures of 550 °F whilst withstanding differential pressures above 1200psi. Additionally, the cup was required to handle hydrocarbon exposure, offer long working life expectancy, and be compatible with existing strings. The difficulties of processing high grade polymers, as well as handling severe thermal expansion and contractions were acknowledged as the main challenges.

SOLUTION

Rubberatkins formulated a material able to achieve high physical properties for long durations whilst at extreme elevated temperatures. Axisymmetric Finite Element Analysis (FEA) was conducted to evaluate stress levels imposed on the elastomer both whilst travelling in casing and when pressurised. Due to the elevated service temperature, the seal and components of the tool are subject to significant thermal expansion. The Rubberatkins R&D team designed a cup optimised for the tribological effects encountered as a result of thermal expansion. The cup would also feature a back-up system which would offer full radial support to the elastomer whilst subjected to differential pressure. The cup was then rigorously tested in-house at 600 °F for a period of one month with pressure constantly applied showing leak free sealing. It showed excellent performance whilst subjected to pressure and temperature fluctuations and was observed to be in excellent condition on retrieval.

VALUE TO CLIENT

Steam Injection has posed significant challenges to elastomeric seals over the years with seals failing early in the steam injection cycle resulting in less than optimal oil recovery. **THERMANITE® 7" 23 # Steam Cups** have been successfully deployed in steam injection wells at 288 °C/550 °F in Columbia for 15 months. Rubberatkins **THERMANITE® Steam Cups** showed integrity throughout all injection stages and handled sudden temperature fluctuations due to intervention and fluid changes.

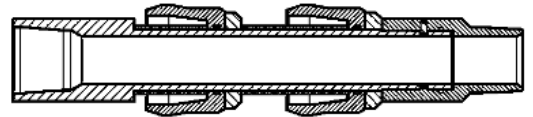


Figure 1: A typical THERMANITE® Dual Steam Cup Packer Assembly.

Orientation and connections to suit your requirements.

CLIENT: Major Service Company
REGION: Colombia

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