THERMANITE®

AN ELASTOMER THAT PUSHES THE LIMITS OF SAGD

STEAM RESISTANCE

HEAT RESISTANCE

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

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.

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
NACE TM0187
NACE TM0296

RUBBERATKINS
experience elastomer excellence

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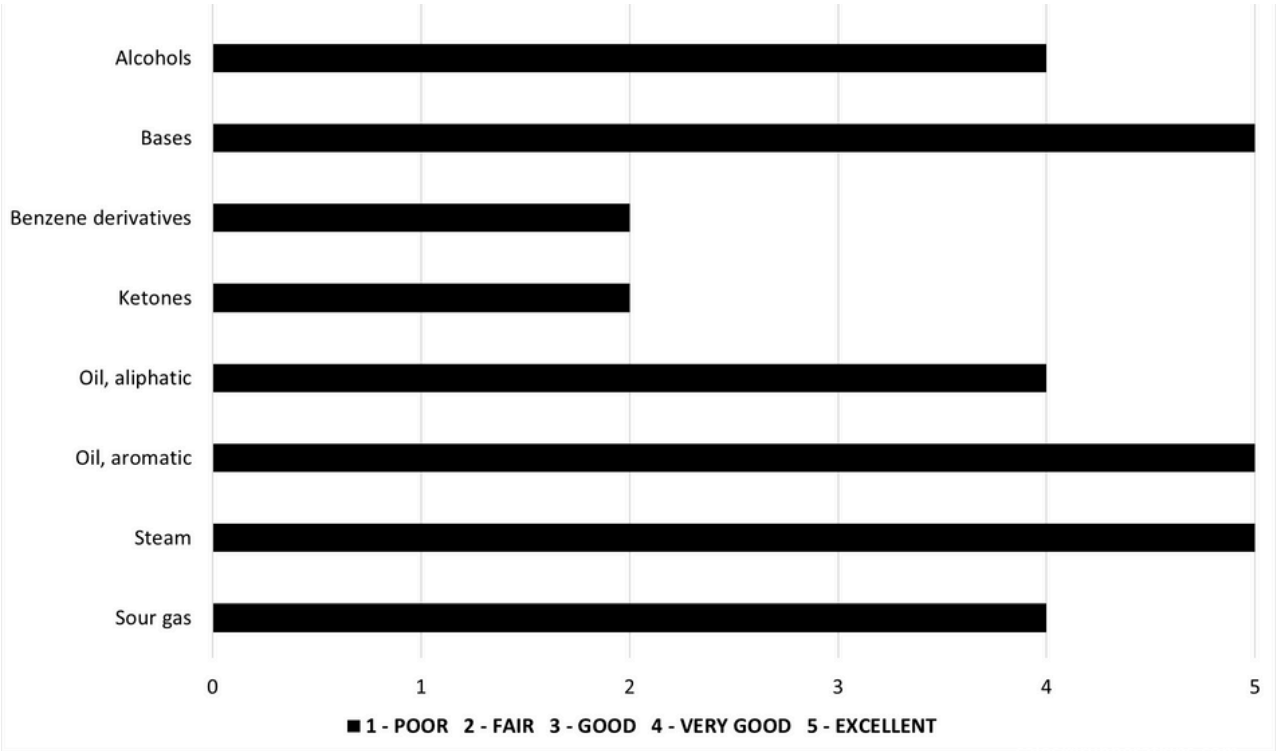
THERMANITE® - TYPICAL PROPERTIES - AMBIENT			
ELASTOMER	**THERMANITE®** 1195TH	**THERMANITE®** 1185TH	
PROPERTY	AMBIENT	AMBIENT	STANDARD
Hardness, IRHD	**85**	**95**	ISO 48
Tensile strength, MPa	**16.8**	**16.3**	ISO 37
Elongation at break, %	**184**	**145**	ISO 37
50 % Modulus, MPa	**9.5**	**11.3**	ISO 37
100 % Modulus, MPa	**14.1**	**15.2**	ISO 37
Comp set, %, (22 hrs, 200 °C)	**44**	**33**	ISO 815-1
Oil Ageing: ISO 1817, IRM 903 Oil, 70 hrs, 392 °F			
Volume change, %	**29**	**24**	ISO 1817
Tensile change, %	**-18**	**-19**	ISO 37
Elongation at break change, %	**-8**	**-4**	ISO 37
Hardness change, IRHD	**-10**	**-12**	ISO 48

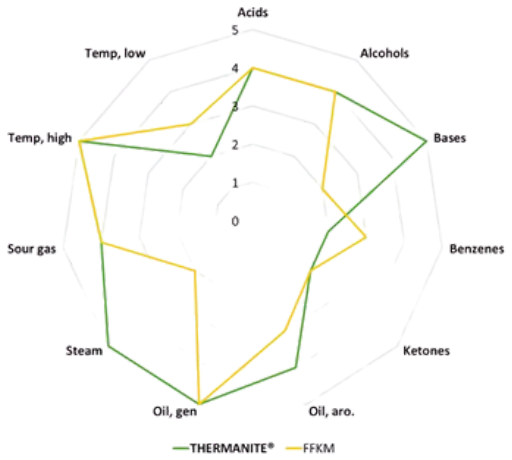
THERMANITE® - COMPATABILITY CHART

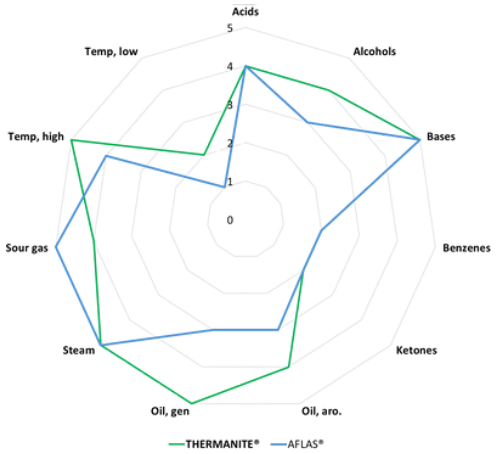


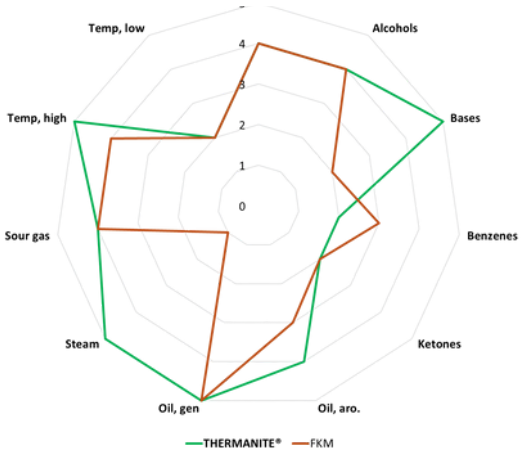
THERMANITE® - COMPARISON CHART					
ELASTOMER	**THERMANITE®**	FFKM	FEPM	FKM	EPDM
THERMAL PROPERTIES					
Max., cont., °F	**482**	**482**	**392**	**392**	**212**
Intermittent, °F	**600**	**600**	**482**	**464**	**347**
Min. operating, °F	**23**	**14**	**41**	**5**	**-58**
CHEMICAL RESISTANCES					
Acids	**VG**	**VG**	**VG**	**VG**	**G**
Alcohols	**VG**	**TD**	**G**	**TD**	**G**
Bases	**EX**	**P**	**EX**	**P**	**EX**
Benzenes	**F**	**G**	**P**	**G**	**P**
Ketones	**F**	**P**	**P**	**P**	**G**
Oil, aromatic	**VG**	**G**	**G**	**G**	**P**
Oil, general	**EX**	**EX**	**G**	**EX**	**P**
Steam	**EX**	**P**	**EX**	**P**	**EX**
Sour gas	**VG**	**VG**	**EX**	**VG**	**VG**
MECHANICAL PROPERTIES					
Compression set	**F**	**EX**	**P**	**VG**	**VG**
Extrusion res.	**G**	**P**	**F**	**P**	**F**
Stress-strain	**G**	**F**	**G**	**F**	**G**
Tear & abrasion	**VG**	**P**	**G**	**P**	**G**
EX – EXCELLENT | VG – VERY GOOD | G – GOOD | F – FAIR | P – POOR | TD – TYPE DEPENDENT					

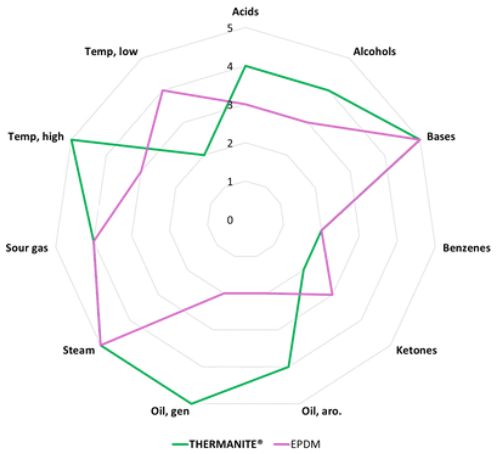
Disclaimer: The Compatibility Chart above is for guidance only and is very much dependent upon the elastomer formulation which will vary from vendor to vendor. Rubberatkins cannot take responsibility for a selection based on this information and is presented purely to give general guidance. Please consult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

THERMANITE® vs Other Materials







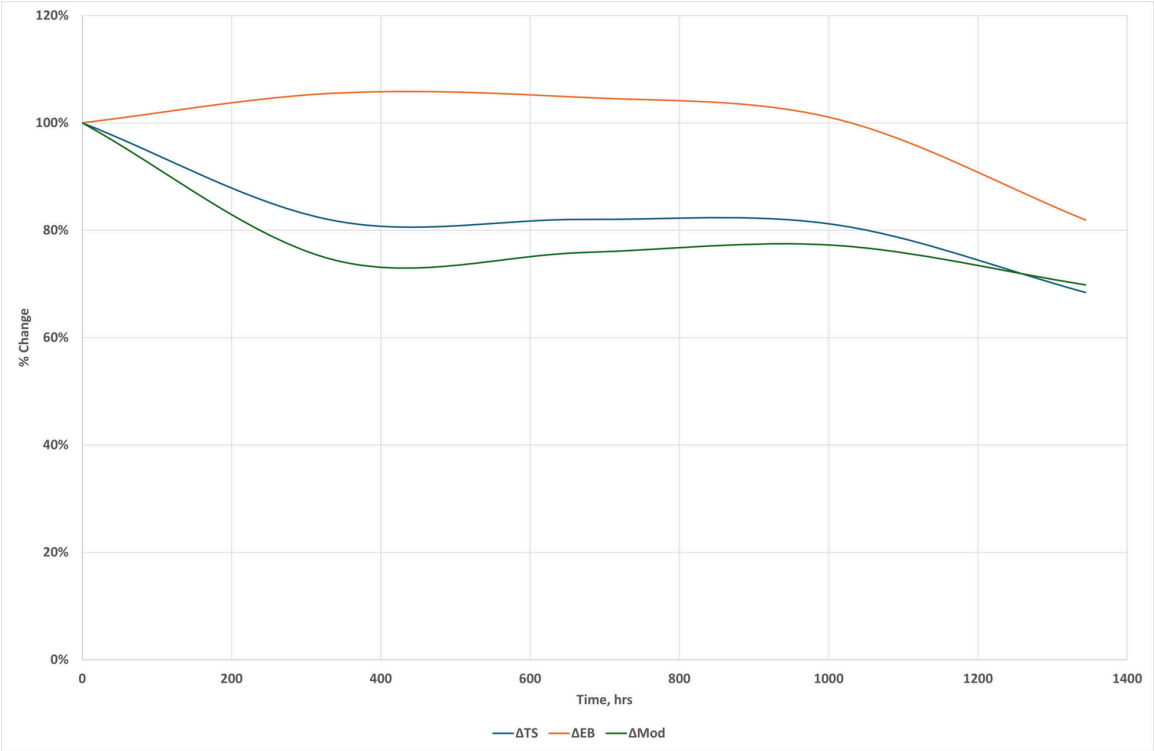


THERMANITE® - ISO 23936-2 Annex B Rapid Gas Decompression		
ELASTOMER	**THERMANITE®** 1195TH	**THERMANITE®** 1185TH
PROPERTY	ISO 23936-2 Annex B Rating	ISO 23936-2 Annex B Rating
Hardness, IRHD	**85**	**95**
Test replicate 1	**2100**	**0000**
Test replicate 2	**0000**	**0000**
Test replicate 3	**0000**	**0000**
Test replicate 4	**1100**	**0000**
Final result	**PASS**	**PASS**

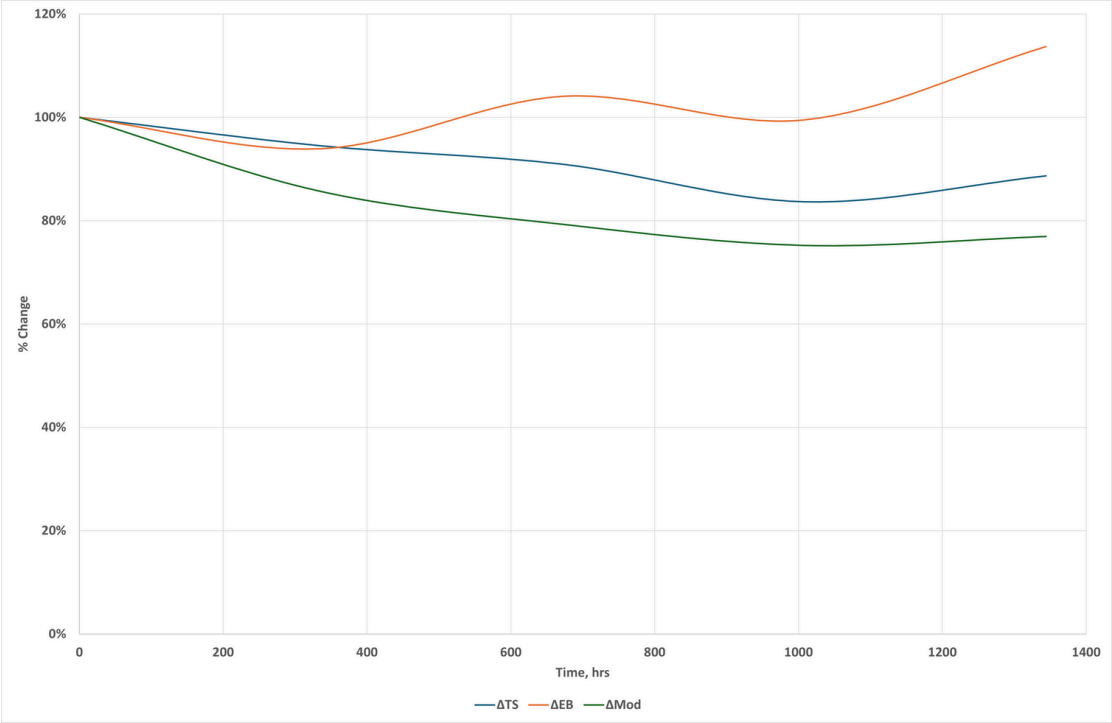
THERMANITE® materials returned excellent test results when tested to ISO 23936-2 Annex B

THERMANITE® - 600 °F STEAM EXPOSURE, 2 MONTHS			
ELASTOMER	**THERMANITE®** 1195TH	**THERMANITE®** 1185TH	
CHANGE IN:	Value	Value	Standard
Hardness, IRHD	**-5**	**-5**	ISO 48
Tensile strength, %	**-6**	**-38**	ISO 37
Elongation at break, %	**-6**	**-9**	ISO 37
100 % Modulus, %	**-14**	**-23**	ISO 37

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



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



THERMANITE® - NACE TM0187, 20 % Sour Gas, 347 °F		
ELASTOMER	**THERMANITE®** 1195TH	**THERMANITE®** 1185TH
PROPERTY	NACE TM0187	NACE TM0187
Mass change, %	**6**	**7**
Volume change, %	**44**	**13**
Hardness change, ShA	**-10**	**-10**
Compression set, %	**39**	**33**
50 % Mod. change, %	**-35**	**-36**
100 % Mod. change, %	**-33**	**-32**
Tensile change, %	**-33**	**-36**
Elongation change, %	**-2**	**-4**

THERMANITE® - NACE TM0296, 20 % Sour Gas, 347 °F		
ELASTOMER	**THERMANITE®** 1195TH	**THERMANITE®** 1185TH
PROPERTY	NACE TM0296	NACE TM0296
Mass change, %	**14**	**12**
Volume change, %	**30**	**27**
Hardness change, ShA	**-14**	**-14**
Compression set, %	**3**	**35**
50 % Mod. change, %	**-51**	**-55**
100 % Mod. change, %	**-54**	**-**
Tensile change, %	**-55**	**-57**
Elongation change, %	**-11**	**-19**

THERMANITE®

CASE STUDY

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 1200 psi. 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 550 °F (288 °C) 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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experience elastomer excellence

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