ERIKS sealing elements

application information

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Content

Responsibility

1. Oil & Gas Chemical Compatibility

Description
Applications in the Oil & Gas Industry range from seals and components involved in exploration and drilling to high-pressure / high-temperature sealing components in down-hole wells. Extreme temperatures and pressures place great demands on elastomers for this industry.
In addition, many chemicals either experienced in the reservoir, or used in the drilling, completion or intervention process can degrade many common elastomers.

Solutions
Regulating agencies for this industry are primarily the American Petroleum Institute (AP) Series 6 - Valves and Wellhead Equipment.

Oil & Gas Industry Applications

	Segments	*Environment*	*Elastomers*	*Sealing Considerations*
WELL CONSTRUCTION	Drilling	-40 to 250 F to 7,500 psi	HNBR, FKM	Abrasion resistance, low compression set, drilling mud and hydrocarbon resistance
	Measurement while drilling (MWD)	-40 to 250 F to 7,500 psi	HNBR, NBR	Extrusion resistance, low friction, high flex life drilling mud resistance
	Blow-out Preventors (BOP)	-40 to 250 F to 1,500 psi	NBR, HNBR	Abrasion resistance, resiliency, AED, Ambient temperature stability
	Cementing Equipment	-40 to 250 F to 1,500 psi	NBR, HNBR	Abrasion resistance, chemical resistance
	Logging Equipment	-40 to 250 F to 1,500 psi	NBR, HNBR	High pressure, high temperature, chemical resistance
	Perforating Equipment	-40 to 250 F to 7,500 psi	HNBR, FKM	High temperature, high pressure, chemical resistance
COMPLETION SYSTEMS	Well Head BOP/Choke & Kill	-40 to 250 F to 1,500 psi	NBR, HNBR, FKM	Abrasion resistance, resiliency, AED, ambient temperature stability
	Flow Control	32 to 300 F to 10,000 psi	HNBR, FKM	High pressure, high temperature, chemical resistance, abrasion resistance
	Sand Control	32 to 300 F to 10,000 psi	HNBR, FKM	Abrasion resistance, chemical resistance
	Packers	32 to 300 F to 10,000 psi	NBR, HNBR, FKM, FEPM	High pressure, high temperature, resiliency, chemical resistance
	Safety Valves	32 to 300 F to 10,000 psi	HNBR, FKM	Resiliency, AED, chemical resistance
RESERVOIR MANAGEMENT	Fracturing Equipment	-40 to 250 F to 7,500 psi	HNBR, FKM	Chemical resistance, high pressure
	Pumps	-40 to 250 F to 7,500 psi	HNBR, FKM	Chemical resistance, high pressure, high temperature
	Chemicals	-40 to 250 F to 7,500 psi	HNBR, FKM, FEPM	Chemical resistance, high pressure, high temperature

1. Oil & Gas Chemical Compatibility

Description

The following guide is designed to assist the user in determining the suitability of different elastomers in various oil field environments.
The ratings are based on published literature and chemical testing.
No representation, guarantees or warranties of any kind are made to the accuracy or suitability of the information presented.
Users are recommended to conduct their own evaluation to determine suitability for their specific application.

Oil & Gas Chemical Compatibility

Application	*Nitrile NBR*	*Hydrog. HBR*	*Viton® FKM*	*Aflas® FEPM*	*Perfluoro FFKM*
Acetone	Poor	Poor	Poor	Poor	Excellent
Alkaline (Na/KOH)	Fair to good	Excellent	Poor	Excellent	Excellent
Brines High Density (Na/CaBr)	Poor	Fair to good	Excellent	Excellent	Excellent
Brines High Density (ZnBr)	Poor	Poor	Excellent	Excellent	Excellent
Brines Low Density (Ca/NaCl)	Excellent	Excellent	Excellent	Excellent	Excellent
Completion Fluid, acidic (pH=2)	Poor	Poor	Excellent	Fair to good	Excellent
Completion Fluid, basic (pH=11)	Fair to good	Fair to good	Poor	Excellent	Excellent
Completion Fluid, oil based	Fair to good	Fair to good	Excellent	Fair to good	Excellent
Corrosion Inhibitors, amine based	Poor	Excellent	Poor	Excellent	Excellent
Corrosion Inhibitors, K2C03 based	Poor	Fair to good	Poor	Excellent	Excellent
Crude Oil, sour (<2,000 ppm H2S)	Poor	Excellent	Fair to good	Excellent	Excellent
Crude Oil, sour (>5% H2S)	Poor	Poor	Poor	Excellent	Excellent
Crude Oil, sweet	Fair to good	Fair to good	Excellent	Fair to good	Excellent
Drilling Mud, diesel based	Fair to good	Excellent	Fair to good	Fair to good	Excellent
Drilling Mud, ester based	Poor	Poor	Poor	Fair to good	Excellent
Drilling Mud, silicate based	Fair to good	Excellent	Fair to good	Excellent	Excellent
Explosive Decompression (AED)	Poor	Excellent	Poor	Excellent	Excellent
Hydraulic Fluid, oil/water (HFA)	Fair to good	Excellent	Poor	Excellent	Excellent
Hydraulic Fluid, water/glycol (HFC)	Excellent	Excellent	Excellent	Excellent	Excellent
Hydraulic Fluid, phosphate ester (HFD)	Poor	Poor	Excellent	Poor	Excellent
Hydrogen Sulfide, dry	Poor	Excellent	Poor	Excellent	Excellent
Hydrogen Sulfide, wet	Poor	Fair to good	Poor	Excellent	Excellent
Methyl Alcohol (Methanol)	Excellent	Excellent	Poor	Excellent	Excellent
Methyl Ethyl Ketone (MEK)	Poor	Poor	Poor	Poor	Excellent
Steam	Poor	Fair to good	Poor	Excellent	Excellent
Toluene	Poor	Poor	Excellent	Fair to good	Excellent

1. Oil & Gas Elastomer Temperature Range

Description

Applications in the Oil & Gas Industry can often be served by more than one type of elastomer. The following chart presents typical application ranges for several traditional elastomers based on the service temperature and environment.

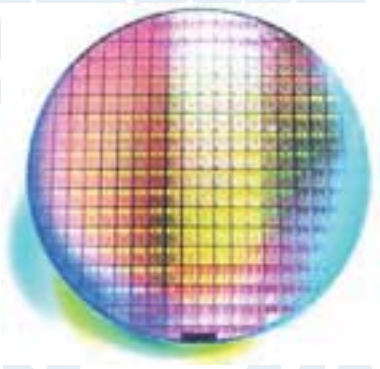
Oil & Gas Elastomer Temperature Range

	-50 °C		0		50		100		150		200		250		300
Completion Fluid Acidic (pH=2)			FKM							FEPM		FFKM			
Completion Fluid Acidic (pH=11)	NBR								HNBR FEPM			FFKM			
Completion Fluid Oil based	NBR								HNBR FEPM	FKM		FFKM			
Crude Oil - sweet	NBR								HNBR FEPM	FKM		FFKM			
Crude Oil - sour (wet + amines)	NBR						HNBR		FEPM			FFKM			
Crude Oil - sour (kerosene/H2S/H2O)	NBR							FKM FEPM				FFKM			
Sour gas - wet (H2S, C02, CH4)	HNBR							FEPM				FFKM			
Explosive decompression		HNBR		FEPM											
Geothermal	EPDM										FEPM	FFKM			
Drilling Mud oil based	NBR								HNBR FEPM	FKM		FFKM			
Drilling Mud water based	NBR								FEPM			FFKM			
	-58 °F		32		122		212		302		392		482		572

2. Semiconductor Industry Applications

Description
Applications in the Semiconductor Industry range from seals and components for process equipment used in the fabrication of integrated circuits or semiconductors.

Solutions
SEMI (Semiconductor Equipment and Materials International) is a pseudo-regulatory organisation offering some standards and testing procedures.



Semiconductor Industry Applications

	Segments	*Environment*	*Elastomers*	*Sealing Considerations*
FRONT END PROCESSES	Crystal Growth (Pulling)	25 to 200 C .001 - .01 torr	FKM	High thermal stability, chemical resistance, good vacuum performance
	Thermal (LPCVD) Nitride, Oxide, ...	23 to 300 C .5 - 1.0 torr	FKM, VMQ, FFKM	High thermal stability, chemical resistance, good vacuum performance
	Track & Lithography	25 to 100 C ambient	FKM, EPDM FFKM (AU)	Chemical resistance - solvents
	Dry Etch	25 to 200 C .1 - 1.0 torr	FKM, FFKM	Chemical resistance, plasma resistance, thermal stability, non-black preferred
	Wet Etch	25 to 200 C ambient	FKM, TFE, FFKM	Chemical resistance, no elemental contamination
	Resist Stripping	25 to 250 C .001 - .01 torr	FVMQ, VMQ, FKM, FFKM	Chemical resistance - especially oxygen-rich and ozone environment
	Cleaning	25 to 200 C ambient	FKM, FFKM	Acid and solvent resistance, some high pH chemical resistance
	Chemical Vapor Deposition (CVD)	25 to 250 C .001 - .01 torr	FKM, FFKM	High vacuum performance, chemical resistance, thermal stability
	Ion Implant	25 to 200 C .0000001 torr	NBR, FKM	Ultrahigh vacuum performance, low outgassing and permeation
	Physical Vapor Deposition (PVD)	25 to 200 C .000001 - .02 torr	FKM	Ultrahigh vacuum performance, low outgassing and permeation
	Chemical Mechanical	25 to 80 C ambient	EPDM, FFKM	Abrasion resistance, high pH chemical resistance

Ask our Kalrez semicon application guide !

3. Chemical & Petrochemical Industry Applications

Description
Applications in the Chemical and Petrochemical Industry are sometimes critical. Next to the broad chemical resistance is also the low and high temperature resistance of great importance. ERIKS has 50 years of experience in this field.

Solutions
In close collaboration with DuPont-Dow-Elastomers, ERIKS has a lot of original Viton® and Kalrez® compounds for different applications.

Chemical and Petrochemical Industry Applications

Elastomer	*Compound*
NBR	36624 (black), 47702 (black), 366185 (black)
EPDM	55914 (black), 55914 PC (black)
VMQ	714777 (red-brown)
CR	32906 (black)
Aflas® (TFE/P)	223001 (black), 223002 (black), 223301 (black)
Genuine Viton® A	51414 (black), 51414 (green), 514320 (black)
Genuine Viton® B	514021 (black)
Genuine Viton® GF	514141 (black)
Genuine Viton® GLT	514019 (black)
Genuine Viton® GFLT	514017 (black), 514712 (black)
Genuine Viton® Extreme ETP	514016 (black)
Kalrez®	4079, Spectrum™ 6375, Spectrum™ 7075, 1050LF, 2035, 2037, 3018

4. Food & Beverage Industry Applications

Description
One of the largest applications for specialty elastomers and plastics is in Food Processing and Beverage Equipment.

These seals are required to resist the chemical and thermal environments present in the equipment, while not releasing any unwanted or unknown contaminants into the process.

Many applications require the sealing materials to be 'capable of being cleaned and receiving effective bactericidal treatment while still maintaining physical properties'.

Solutions
Regulating agencies and documents for applications in the Food and Beverage industry include the Code of Federal Regulations (CFR), Title 21, Chapter 1, Subchapter B, part 177, Subpart C, Paragraph 2600 - also known as FDA 177.2600.

Seperate categories for expected food contact include I -foods, including edible oils, butter, milk and cooking oil; and II - water, soft drinks, alcoholic beverages, etc.

The US Deparment of Agriculture (USDA) has standards for meat and poultry as well as the '3A' standards for dairy equipment and the 'E-3A' standards for egg processing equipment. Moreover compounds following 3A, BGA, Bfr (BGVV), E4 and USDA are possible.

Food and Beverage Industry Applications

Elastomer	*Compound*
EPDM	559270, 559272 (white), 559004, 559006 (white), 559003, 559008, 559187
NBR	366011, 366010 (grey), 366185, 366472 (white), 366480, 366490
Genuine Viton®	514670, 514672 (white), 514674 (blue), 514680, 514690, 514694 (blue)
Kalrez®	Kalrez® 6221 (white), Kalrez® 6230 (black)
VMQ	714724 (white), 714747 (transparent), 714748 (red) 714762 (white), 714767 (transparent), 714768 (red) 714782 (white), 714787 (transparent), 714788 (red)
Teflex®	FEP - or PFA encapsulated on Genuine Viton® - or silicone core

Kalrez® and Viton® are registered trademarks of the company DuPont Dow Elastomers.

5. Potable Water Applications

Description
Elastomers and plastics used in potable water treatment facilities as well as distribution and dispensing eauipment may be subject to many demands.

Chlorine has long been used in a disinfectant in water systems, but they can react and form toxic disinfectant by-products (DBP). Ammonia is often added to reduce the DBP - which react to form chloramines which can be damaging to some elastomers.

Solutions
The most important regulations are:
- KTW - Germany
- WRAS (WRC) - UK
- ACS - France
- FDA - USA
- DVGW - Germany
- KIWA - Holland
- Belgaqua - Belgium

Potable Water Applications

Elastomer	*ACS*	*DVGW*	*FDA*	*KIWA*	*KTW*	*NSF*	*WRAS*
EPDM	559003	559003	559270 559272		55940 559003	55960 559003	55950 559003
NBR	366016		366472 366490	55111	366015 366016	366016	366015
Genuine Viton®		514002	514670 514674		514002	514023	514001
Kalrez®			Kalrez® 6221, 6230				
VMQ			714767 714768		714008 714940	714008	714950

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6. Automotive Industry Applications

Description
The demands for the automotive industry are very typical and depend on the application (motor - cooling or heating systems - fuel systems, etc). ERIKS has some VW (BMW/Daimler Chrysler) compounds.
Ask our engineers for specific details.

Automotive Industry Applications

BMW N602.00.0		*Daimler Chrysler DBL 6038.xx*		*Volkswagen VW 2.8.1-xx*
ACM 335001	05	HNBR 886001 (green) HNBR 886004 (red-brown)	A70	NBR 366005
	06	HNBR 886012 (green)	C70	NBR 366006
	10	EPDM 559016	E75	FKM 514012
	15	EPDM 559017	G60	EPDM 559018
	20	ACM 335001	G70	EPDM 559013
	40	FKM 514005	R134	HNBR 886008 (green)

7. Pharmaceutical, Analytical & Biotechnical Applications

Description
Sealing and technical components used in the Biotechnology industry are used in a wide range of applications. Laboratory and analytical equipment sealing products include gaskets and miniature components.

Drug discovery an d genetic research techniques often employ aggressive chemical environments that also demand ultra-high purity sealing components.

Pharmaceutical applications range from drug discovery to development and full production of a wide range of chemical, biological and radiological products.

Solutions
Chemically resistant seals and gaskets are available for many applications.

The U.S. Pharmacopoeia publishes information on drugs, dietary supplements and veterinarian medicine. Class VI materials testing includes system toxicity and intracutaneous toxicity.

The U.S. Food and Drug Administration issues regulations for material in contact with food. The central regulation for elastomer materials is contained in 21 CFR 177.2600 - 'Rubber articles intended for repeated use'.

Pharmaceutical, Analytical & Biotechnical Applications

Elastomer	*USP Class 6-Compound*
EPDM	559273 (black), 559274 (white)
Genuine Viton®	514010 (white)
Kalrez®	Kalrez® 6221 (white), Kalrez® 6230 (black)
Silicone VMQ	714001 (transparent), 714002 (transparent)
Teflex®	FEP - or PFA encapsulated on Genuine Viton® - or silicone core

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