ALFA LAVAL

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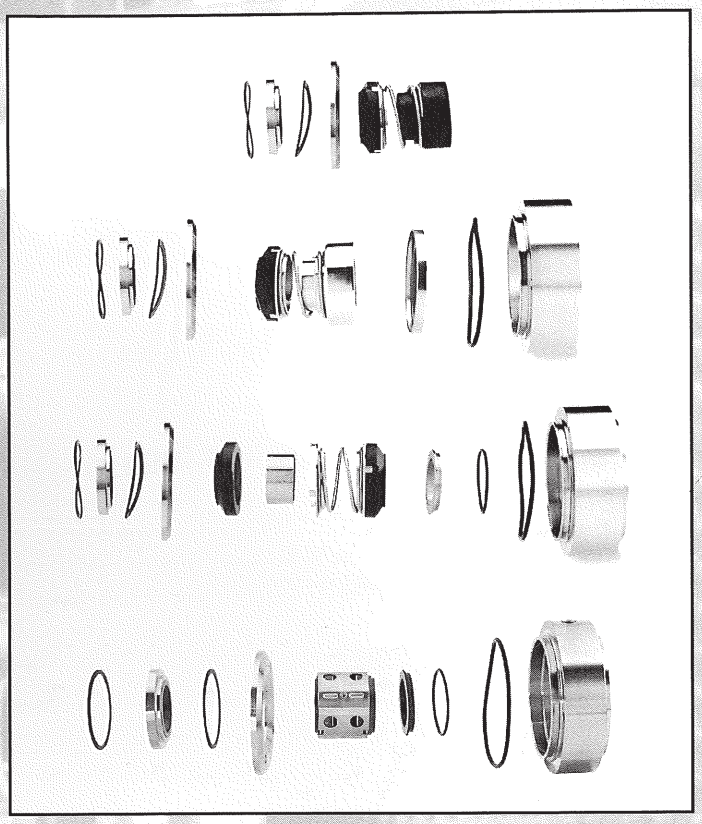


Tri-Flo® CL Series Seals

Single, Single Flush, and Double

Service Manual

Central States Industrial Equipment & Service Inc.

2700 PARTNERSHIP BLVD. SPRINGFIELD, MO 65803-8208

800-654-5635 • FAX: 417-831-5314

Tri-Clover Inc.

CONTENTS

IMPORTANT: This manual is intended as a guide to seal selection. Before final selection, please contact Tri-Clover to ensure it is suitable for your application.

INTRODUCTION

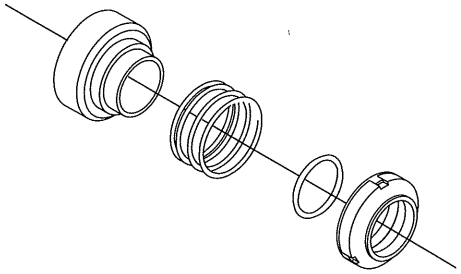
INTRODUCTION AND FEATURES

The Tri-Clover CL Series Mechanical Seal has been specifically designed for use with the CL Series Centrifugal Pump.

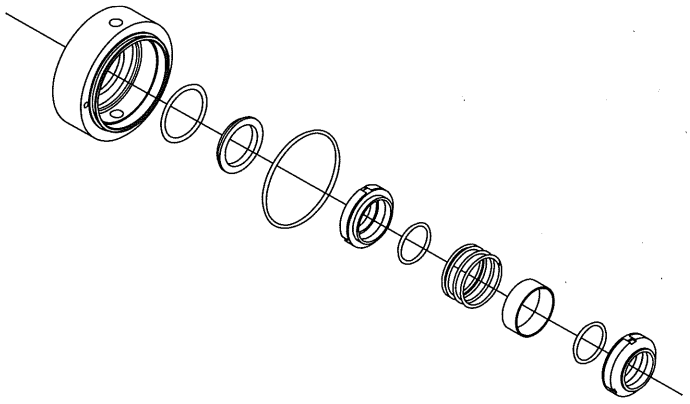
The CL Series Mechanical Seal offers the following product features:

- Rigid construction
- Clamped static seat ensures anti-rotation
- Pressure and speed performance to match pump capability.
- Positive rotary seal drive via rotor cup meeting drive slots in rotary face.
- Working length set by pump shaft.
- Large seat bore clearances allow improved cleanability.
- Easily disassembled for cleaning and sterilization.

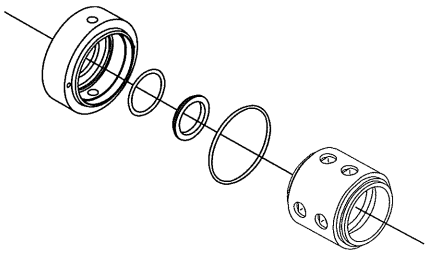
SINGLE SEAL (DG)



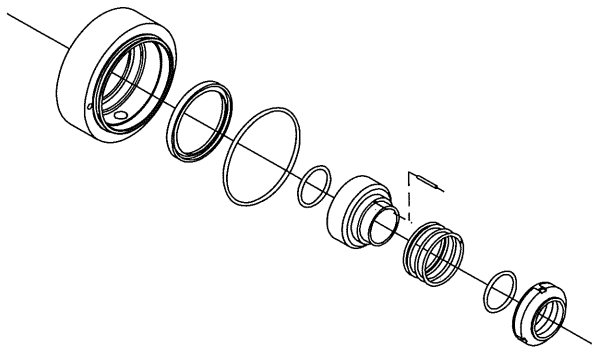
DOUBLE SEAL (EG)



JOHN CRANE DOUBLE 8 SEAL



SINGLE FLUSH SEAL (FG)



TECHNICAL DATA

SEAL MATERIAL DATA

SILICON CARBIDE

Material	Self-Sintered Silicon Carbide	
Manufacturing Procedure	High density silicon carbide grains molded and sintered. No free graphite or silicon present.	
Specific Characteristics	- silicon carbide content is 98% minimum - Impermeable without impregnation - Chemically compatible with strongly acidic and caustic solutions. - The material conforms to FDA requirements for Generally Recognized As Safe (GRAS) for materials in contact with food stuff.	
Density, ρ,	193 (lbs/cu-ft)	3100 (kg/m^3)
Hardness (Knoop)	2800	
Compressive Strength, σ_c	5656 (ksi)	3900 (MPa)
Modulus of Elasticity, E	59 x 10^3 (ksi)	410 (GPa)
Thermal Conductivity, λ ,at 104°F (38°C)	873 (Btu x in/ft2 x h x °F)	126 (W/m x °C)
Thermal Expansion, α, , at 68 to 500°F at 20 to 260°C	2.2 x 10^{-6} (in/in/°F)	4.0 x 10^{-6} (m/m/°C)
Temperature Limit in Air	3000 (°F)	1650 (°C)

CARBON

Material	Resin Impregnated Carbon	
Specific Characteristics	- The material conforms to FDA requirements for Generally Recognized As Safe (GRAS) for materials in contact with food stuff.	
Density, ρ,	114 (lbs/cu-ft)	1830 (kg/m^3)
Hardness (Shore C2)	95	
Compressive Strength, σ_C,	34 (ksi)	235 (MPa)
Tensile Strength, σ_B,	7 (ksi)	48 (MPa)
Flexural Strength, σ_{FI},	11 (ksi)	79 (MPa)
Modulus of Elasticity, E,	3 x 10^3 (ksi)	24 (GPa)
Thermal Conductivity, λ, at 104°F (38°C)	63 (Btu x in/ft^2 x h x °F)	9 (W/m x °C)
Thermal Expansion, α, at 68 to 500°F at 20 to 260°C	2.7 x 10^{-6} (in/in/°F)	4.9 x 10^{-6} (m/m/°C)
Temperature Limit in Air	500 (°F)	260 (°C)

TECHNICAL DATA

STAINLESS STEEL

Material	Ferrite-austenitic	
Specific Characteristics	- Duplex stainless steel (ferrite-austenitic) of the ELC type. - High resistance to corrosion, pitting and crevice corrosion. - High mechanical strength - roughly twice the yield strength of austenitic stainless steels. - High resistance to stress corrosion cracking in chloride -bearing environments and environments containing hydrogen sulphide. - High resistance to erosion corrosion and corrosion fatigue. - In accordance with: SS 2377 UNS S31803 W.-Nr. 1.446 din x 2 cRnImOn 2253	
Density, ρ,	490 (lbs/cu-ft)	7850 (kg/m^3)
Hardness (Vickers)	260	
Yield Strength, $\sigma_{0,2}$, at 212°F (100°C)	54 (ksi)	370 (MPa)
Tensile Strength, σ_B, at 212°F (100°C)	91 (ksi)	630 (MPa)
Modulus of Elasticity, E, at 212°F (100°C)	28 x 10^3 (ksi)	190 (GPa)
Thermal Conductivity, λ, at 212°F (100°C)	116 (Btu x in/ft^2 x h x °F)	17 (W/m x °C)
Thermal Expansion, α, at 68 to 572°F at 20 to 300°C	2.8 x 10^{-6} (in/in/°F)	4.0 x 10^{-6} (m/m/°C)
Specific Heat Capacity, c, at 100°C	0.12 (cal/g x °C)	500 (J/Kg x °C)

	C %	Si %	Mn %	P %	S %	Cr %	Ni %	Mo %	N %
Nominal						22	5.5	3.2	0.18
Minimum	-	-	-	-	-				
Maximum	0.030	1.0	2.0	0.030	0.020				

TECHNICAL DATA

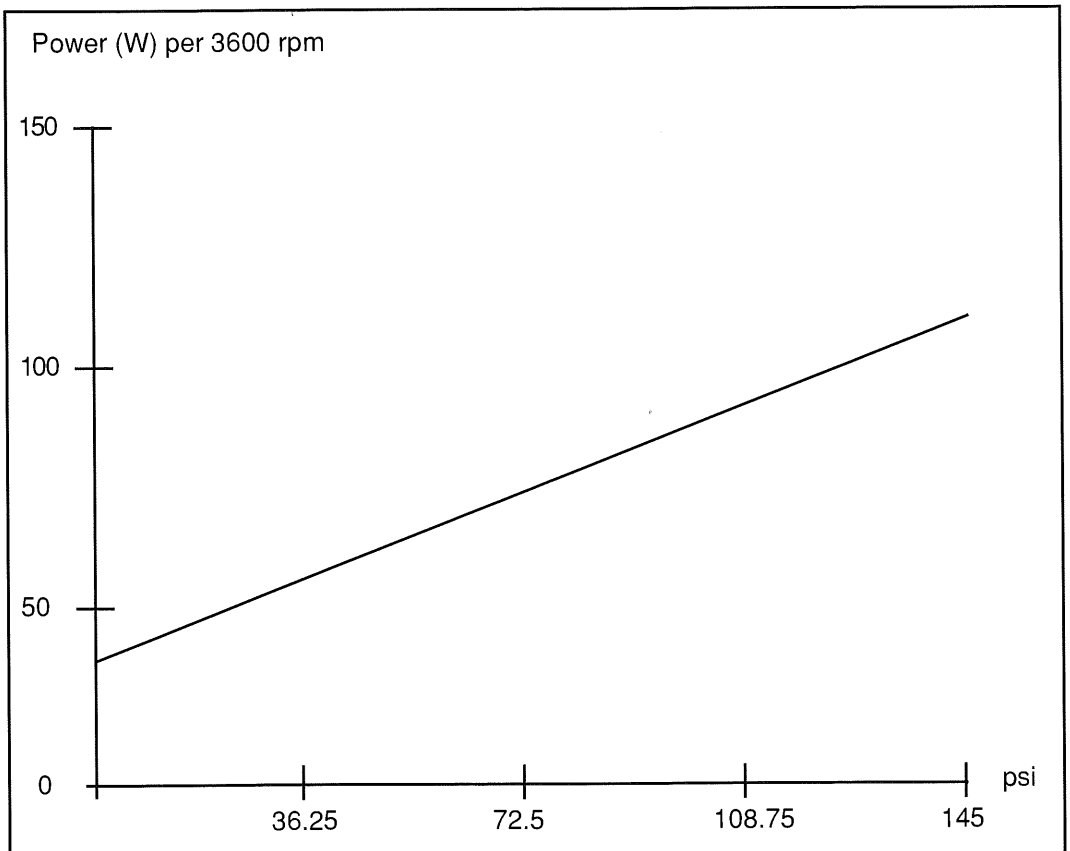
ELATOMERS—MATERIALS OF CONSTRUCTION

Properties	Buna N	Fluoroelastomer (SFY)	EPDM	Kalrez®
Tensile Strength (MPa) (psi):				
Pure gum	Below 6,9 (1000)	Over 12,4 (1800)	Below 6,9 (1000)	Not applicable
Black loaded stocks	Over 13,8 (2000)	Over 13,8 (2000)	Over 13,8 (3000)	Over 13,8 (2000)
Hardness range (Durom. A)	40 - 95	55 - 95	50 - 90	65 - 95A
Specific gravity (Base material)	1,00	1,85	0,86	2,01
Adhesion to metals	Excellent	Fair to good	Good to excellent	Fair
Adhesion to fabrics	Good	Good to excellent	Good	Good
Tear resistance	Fair	Fair	Fair to good	Fair
Abrasion resistance	Good	Good	good to excellent	Good
Compression set	Good	Fair to good (Exc. at high temp.)	Good	Fair
Rebound: Cold	Good	Fair to Good	Very good	Not available
Hot	Good	Good (Exc. at high temp.)	Very good	Not available
Dielectric strength	Poor	Good	Excellent	Excellent
Permeability to gases	Low	Very low	Fairly low	Fair
Acid resistance: Dilute	Good	Excellent	Excellent	Excellent
Concetrate	Good	Excellent	Excellent	Excellent
Solvent resistance:				
Alipheric hydrocarbons	Excellent	Excellent	Poor	Excellent
Aromatic hydrocarbons	Good	Excellent	Poor	Excellent
Oxygenated (Ketones, etc.)	Poor	Poor	Good to very good	Excellent
Lacquer solvents	Fair	Poor to fair	Poor to Fair	Excellent
Resistance to:				
Swelling in lubricating oil	Very Good	Excellent	Poor	Excellent
Oil in gasoline	Excellent	Ecellent	Poor	Excellent
Animal and vegetable oils	Very Good	Excellent	Good	Excellent
Water absorption	Good	Very Good	Very good to excellent	Very good
Oxidation	Good	Outstanding	Excellent	Outstanding
Ozone	Fair	Outstanding	Outstanding	Outstanding
Sunlight aging	Poor	Outstanding	Outstanding	Outstanding
Heat aging (upper limit cont. service)	239°F (115°C)	401°F (205°C)	293°F (145°C)	554°F (290°C)
Flame	Poor	Excellent	Poor	Excellent
Heat	Good	Outstanding	Excellent	Very outstanding
Cold	Fair to Good	Good	Excellent	Good

TECHNICAL DATA

SEAL LIMITATIONS

Maximum Pressure	145 psi (10 bar)
Maximum Speed	3600 rpm
Maximum Viscosity	500 CP
Elastomer Temperature Range:	
Kalrez	-4 to 482°F (-20 to 250°C)
SFY (Fluoroelastomer)	-4 to 392°F (-20 to 200°C)
EPDM	-40 to 302°F (-40 to 150°C)
Buna N	-40 to 212°F (-40 to 100°C)
PTFE Encapsulated Fluorocarbon	-22 to 392°F (-30 to 200°C)
Seal Face Temperature Range:	
Carbon v Silicon Carbide:	32 to 284°F (0 to 140°C)
Silicon Carbide v Silicon Carbide	32 to 284°F (0 to 140°C)



Notes:
1. Power requirements shown are per 3600 rpm.
2. Figures based on water at 68°F (20°C). Power requirements will increase or decrease with change of viscosity.
3. Figures are based on a single seal.

TECHNICAL DATA

AUXILIARY SEAL SERVICES

IMPORTANT: All flush seals must flow from lower to upper flush pipe.

SINGLE SEAL FLUSH

Typical applications for use are:

- Crystallizing media on contact with the atmosphere (e.g. caustic, sugar solutions, etc.). The water flush washes away the formed crystals, thus preventing a build up which could eventually lead to face separation and leakage.
- Thermosensative product where flush is at a specified temperature to ensure product at seal faces is controlled. Allow 68°F (20°C) for seal face heat generation.
- Liquids which are close to their boiling points (e.g., water maximum temperature 176°F (80°C) allowing 68°F (20°C) for seal face heat generation.
- Dry running pump duties to ensure a liquid is supplied to the seal faces.

Flow rate required:

Pressure Normally atmoshperic - maximum 14.5 psi (1 bar)

Water consumption: 4 to 8 GPH (0.25 to 0.5 L/min)

At atmospheric pressure adjust the flow so the outlet water temperature never exceeds 200°F (93°C)

DOUBLE SEAL (EG OR JOHN CRANE)

Typical applications for use are:

- Hazardous or dangerous fluid (seal chamber fluid passes into pump on inboard seal failure). However, ensure that the sealant used is compatible with the product to prevent contamination on an eventual inboard seal failure.
- Abrasive product (seal faces operating on fluid film of sealant and not the pumped product).
- High temperature product (seal faces running on cooled "sealant" and not the pumped product).
- Aseptic pump heads. A barrier liquid of sterile media to ensure product does not come into contact with the atmosphere.

Pressure Normally atmospheric - maximum 50 psi (3.5 bar) above inlet pressure.

Water consumption: 4 to 8 GPH (0.25 to 0.5 L/min)

At atmospheric pressure adjust the flow so the outlet water temperature never exceeds 200°F (93°C)

SEAL SELECTION

GUIDELINES FOR BEST SEAL OPERATION

The following table provides the guidelines you should follow in order to ensure that you select the best seal for your CL Series Centrifugal Pump.

Guideline	Refer To
Provide accurate data for the pump application.	Use the *Seal Selection Form* provided in this manual.
Select the correct seal options (Single, Single Flush, or Double Seal).	Refer to the *Auxiliary Seal Services* section in this manual.
Select the correct material of construction for the seal.	Refer to *Operating Parameters*, *Materials of Construction*, and the *Seal Selection Guide* in this manual.
Install the seal correctly.	See the *Assembly* section of the *CL Series Centrifugal Pumps Service & Installation Manual* (CLSM).
If they seal malfunctions, troubleshoot the seal.	Refer to the *Troubleshooting* section of this manual.

SEAL SELECTION

SEAL SELECTION FORM

To	Date:
From	

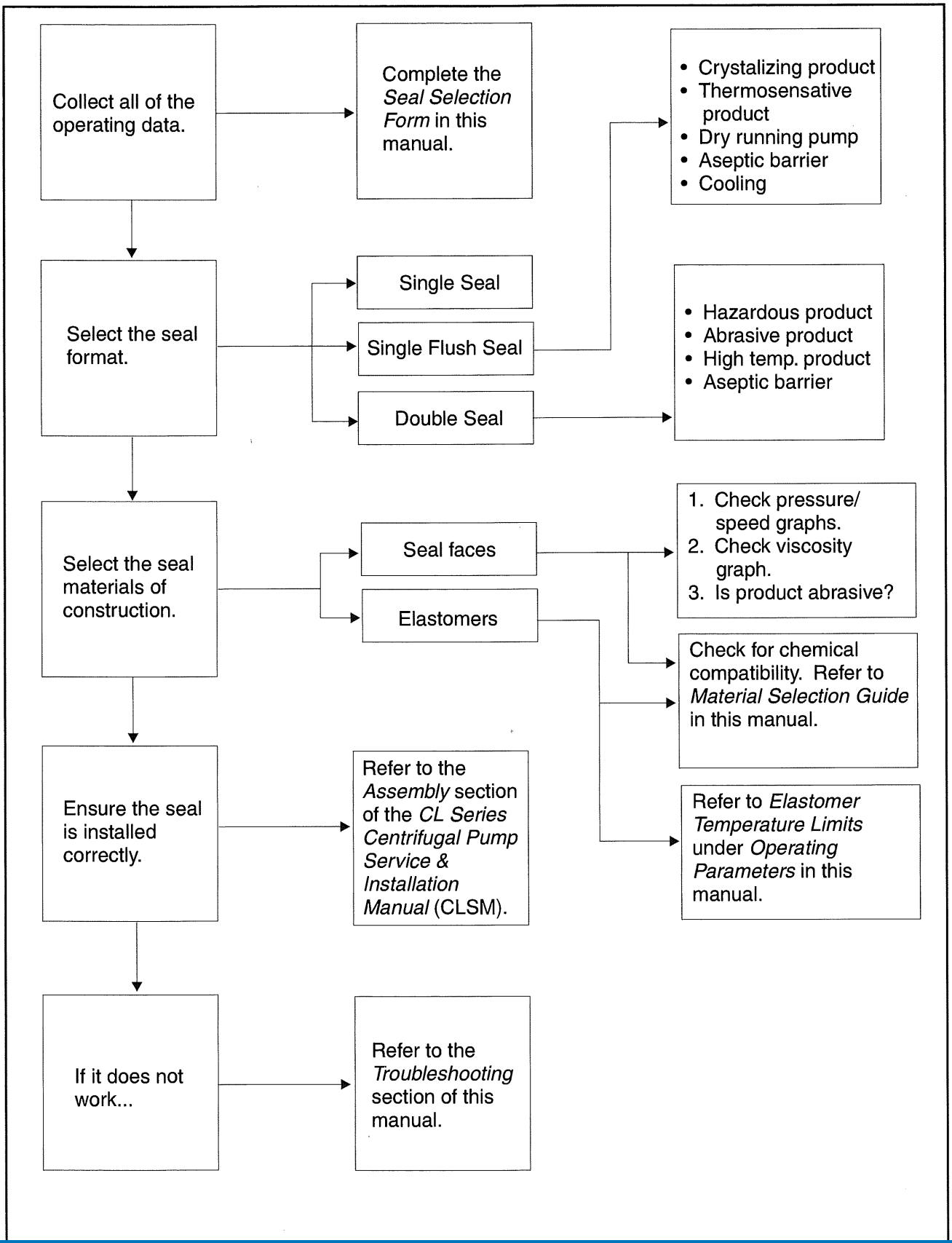
Please provide seal recommendation for the following:

Pump Type			
Product			
Pumping Temperature		Viscosity	
Discharge Pressure		Suction Pressure	
Speed		Shaft Size Model No.	
Additional Information			

RECOMMENDATION:			
Seal Type (circle one)	Single	Single Flush	Double
Face Materials			
Elastomers			
Auxiliary Services			
Comments			

SEAL SELECTION

SEAL SELECTION FLOWCHART



SEAL SELECTION

MATERIAL SELECTION GUIDE

The table below lists the material options for each part of the mechanical seal.

Parts	Material
Metal Parts	316 Stainless Steel (SS)
Stationary or Rotary Face	Carbon (C) Silicon carbide (SiC)
Secondary Seals	Nitrile (Buna N) Viton® (SFY FLUOROELASTOMER) Ethylene Propylene (E.P.) PTFE Encapsulated Kalrez®

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SEAL SELECTION

SEAL SELECTION CHARTS

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Flouroelastomer)	PTFE	Kalrez®
Acetaldehyde (Ethanal)		100	A	A	A	N	A	N	A	A*
Acetanilide				A	A					A
Acetates, Esters, Petroleum Derivatives				A	A					
Acetate Solvents		100	A	A	A					
Acetone, Dry			A	A	A	N	A	N	A	A
Acetic Anhydride (Ethanoic Anhydride)	68		A	A	A	N	C	N	A	A
Acetone Cyanohydrin				A	A					A
Acetophenone				A	A	N	A	N		A
Acetylene Gas			A	A	A	A	A	A	A	A
Acid, Abietic				A	A					A
Acid, Acetic (Ethanoic Acid)	cold	conc.	A	A	A	C	A	C	A	A
Acid, Acetic (Ethanoic Acid)	cold	dilute	A	A	A	C	A	C	A	A
Acid, Acetic (Ethanoic Acid)	hot	conc.	A	A	A	N	N	N	A	A
Acid, Acetic (Ethanoic Acid)	hot	< 15	A	A	A	N	N	N	A	A
Acid, Acetic & Propionic	cold		A	A	A	C	A	A	A	A
Acid, Acetylsalicylic				A	A					A
Acid, Alkyl- Arylsuphonic	158			A	A					A
Acid, Aqua Regia				N	A	N	C	C		A
Acid, Arsenic				A	A	A	A	A		A
Acid, Arsenic, Ortho			A	A	A	A	A	A	A	A
Acid, Ascorbic (Vitamin C)				A	A					A
Acid, Battery				C	A					
Acid, Benzensulfonic				A	A	N	C	A		A
Acid, Benzoic			A	A	A	N	N	A	A	A*
Acid, Boiler Phosphates				A	A					
Acid, Boric, Aqueous (Boracic Acid)			A	A	A	A	A	A	A	A
Acid, Boric (Boracic Acid)			A	C	A	A	A	A	A	A
Acid, Butyric (Butanic Acid)		100	A	A	A	N	C	C	A	A*
Acid, Carbolic (Phenol)	amb.		A	A	A	N	C	A	A	A*
Acid, Carbolic (Phenol)	401	all	A	A	A	N	C	A	A	A*

Key: A=Acceptable, C=Use with Caution, N=Not Recommended, ()=Unknown, *differences may exist between Kalrez compounds.

SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Flouroelastomer)	PTFE	Kalrez®
Acid, Carbonic, Aqueous			A	A	A	C	A	A	A	A
Acid, Chloric				C	A					A
Acid, Chlorous				C	A					
Acid, Chloroacetic (Ethyl Chloracetate)			N	A	A	N	C	N	A	A*
Acid, Chlorosulfonic	cool	< 50	N	A	A	N	N	N	A	A
Acid, Chromic, Aqueous	cool	< 90	C	C	A	N	C	A	A	A
Acid, Citric, Aqueous	cool	5	A	A	A	A	A	A	A	A
Acid, Citric, Aqueous	140	5								
Acid, Cocoanut, Fatty			A	A	A	C	A	A	A	A
Acid, Cresylic (Alkyl Phenols)			A	A	A	N	N	A	A	A*
Acid, Crotonic				A	A					A
Acid, Cyanic				A	A					
Acid, Dichloroacetic				A	A					A
Acid, Ethanedioic (Oxalic Acid)	cold		A	A	A	A	A	A	A	A
Acid, Ethanedioic (Oxalic Acid)	hot		A	A	A	C	A	A	A	A
Acid, Ethanoic (Acetic Acid)	cold	conc.	A	A	A	C	A	C	A	A
Acid, Ethonic				A	A					
Acids, Fatty, Oleic	203		C	A	A	C	N	A	A	A
Acid, Fluoboric				A	A	A	A			A*
Acid, Fluosilicic (Hydrofluosilicic Acid)			N	A	A	A	C	A	A	A
Acid, Palmitic, Stearic			C	A	A	C	N	A	A	A
Acid, Formic (Methanoic Acid)		90	C	A	A	C		A	A	A
Acid, Fruit			A	A	A	A		A	A	A
Acid, Fumaric				A	A	A	C	A		A
Acid, Gallic				A	A	C	C	A		A
Acid, Glutamic				A	A					A
Acid, Glutaric				A	A					
Acid, Hexadecanoic (Palmitic Acid)			A	A	A	A	C	A	A	A
Acid, Hydrobromic (Hydrogen Bromide)				A	A	N	A	A	A	A
Acid, Hydrobromic (Hydrogen Bromide)		>40		A	A	N	A	A		C

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Acid, Hydrochloric (Hydrogen Chloride)	< 122	conc	N	A	A	C	A	A	A	A
Acid, Hydrochloric (Hydrogen Chloride)	< 122	dilute	N	A	A	A	A	A	A	A
Acid, Hydrochloric (Hydrogen Chloride)	> 122	conc	N	A	A	N	C	C	A	A
Acid, Hydrochloric (Hydrogen Chloride)	> 122	dilute	N	A	A	N	C	C	A	A
Acid, Hydrocyanic (Hydrogen Cyanic, Prussic)			A	A	A	C	A	A	A	A
Acid, Hydrofluoric, Aqueous (H.F. Acid)	cold	< 55	N	N	A	N	C	C	A	A
Acid, Hydrofluoric, Aqueous (H.F. Acid)	cold	> 65	N	N	A	N	N	C	A	A
Acid, Hydrofluosilicic			N	A	A	C	A	A	A	A
Acid, Hydrogen Peroxide				A	A					
Acid, Hydroxyacetic				A	A					A
Acid, Hypochlorous			N	A	A	N	C	A	A	A*
Acid, Isophthalic (IPA)				A	A					
Acid, Lactic	hot	< 10	N	A	A	N	N	A	A	A
Acid, Lauric				A	A					A
Acid, Levulinic				A	A					
Acid, Maleic			A	A	A	N	N	A	A	A
Acid, Malonic				A	A					
Acid, Methanoic (Formic Acid)		90	C	A	A	C		A	A	A
Acid, Mine Water	< 68		A	A	A	N	N	A	A	A
Acid, Mixed, Sulphuric & Nitric	any	all		C	A					
Acid, Monochloro Acetic (MCA)			N	A	A	N	C	N	A	A*
Acid, Muriatic (See Hydrochloric Acid)			N	A	A	C	A	A	A	A
Acid, Napthenic	< 554	all	A	A	A	C	N	A	A	A
Acid, Nitric, Fuming	hot		A	C	A	N	C	N	A	A*
Acid, Nitric	cold	< 65	A	C	A	N	C	N	A	A*
Acid, Nitrous				A	A					A
Acid, Nordhausen				A	A					
Acid, Octadecanoic (Stearic Acid)			A	A	A	C	C		A	A
Acid, Oleic (Red Oil)			A	A	A	N	N	C	A	A
Acid, Oleum				C	A	C	N	A		A

Key: A=Acceptable, C=Use with Caution, N=Not Recommended, ()=Unknown, *differences may exist between Kalrez compounds.

SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Acid, Ortho- Phosphoric	< 176	all		A	A					A
Acid, Organic				A	A					A
Acid, Oxalic (Ethanedioic Acid)	cold		A	A	A	A	A	A	A	A
Acid, Oxalic (Ethanedioic Acid)	hot		A	A	A	C	A	A	A	A
Acid, Palmitic (Hexadecanoic Acid)			A	A	A	A	C	A	A	A
Acid, Perchloric				C	A	N	C	A		A*
Acid, Phenolacetic				A	A					
Acid, Phenyl Acetic			A	A	A				A	A
Acid, Phenolsulfonic				A	A					A*
Acid, Phosphoric	cold	100	A	A	A	N	C	A	A	A
Acid, Phosphoric	< 176	< 45	C	A	A	N	N	A	A	A
Acid, Phosphoric	cold	< 45	C	A	A	N	C	A	A	A
Acid, Phthalic				A	A					A
Acid, Picric, Molten			A	A	A	C	C	A	A	A
Acid, Picric, H2O Solution	< 68		A	A	A	A	A	A	A	A
Acid, Propionic				A	A					A
Acid, Prussic			A	A	A	C	A	A	A	A
Acid, Pyrogallic				A	A					A*
Acid, Pyroligneous			A	A	A	N	C	N	A	A
Acid, Salicic				A	A					
Acid, Salicylic				A	A	C	A	A		A
Acid, Sorbic				A	A					
Acid, Stearic (Octadecanoic Acid)			A	A	A	C	C		A	A
Acid, Stearic & Oleic			A	A	A	C	C		A	A
Acid, Succinic				A	A					A
Acid, Sulfonic	140	dilute	N						A	A
Acid, Sulphuric	cold	all	N	A	A	C	C	A	A	A
Acid, Sulphuric	< 248	< 60	N	A	A	N	C	A	A	A
Acid, Sulphuric	< 149	< 95	N	C	A	N	C	A	A	A
Acid, Sulphuric	< 167	< 10	N	A	A	C	C	A	A	A

Key: A=Acceptable, C=Use with Caution, N=Not Recommended, ()=Unknown, *differences may exist between Kalrez compounds.

SEAL SELECTION

	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Acid, Sulphuric, Fuming (Oleum)	cold	20-25	N	C	A	N	N	A	A	A
Acid, Sulphurous, Wet			N	A	A	C	C	A	A	A
Acid, Tannic	< 149		A	A	A	A	A	A	A	A
Acid, Tartaric, Aqueous	hot		A	A	A	A	C	A	A	A
Acid, Terephthalic			A	A	A					A
Acid, Toluenesulfonic				A	A					A
Acid, Toluic Alpha			A	A	A				A	A
Acid, Trichloroacetic (TCA)				A	A	C	C	N		A*
Acid, Uric				A	A					A
Acid, Uric, Methyl				A	A					
Acid, Valeric				A	A					A
Acid, Vinyl Acetate				A	A					
Acrolein				A	A					A
Acrylonitrile			A	A	A	N	N	N	A	A*
Air, Dry				A	A					
Air, Humid				A	A					
Alcoholos (Ethyl)			A	A	A	A	A	N	A	A
Alcohol, Allyl				A	A					
Alcohol, Butyl (Butanol)			A	A	A	A	C	A	A	A
Alcohol, Ethyl (Etanol)			A	A	A	A	A	N	A	A
Alcohol, Grain				A	A					
Alcohol, Hexyl (Hexanol)				A	A	A	N	A	A	A
Alcohol, Iso- Butyl			A	A	A	C	A	A	A	A
Alcohol, Iso- Propyl (Isopropanol)			A	A	A	C	A	A	A	A
Alcohol, Methyl (Methanol)			A	A	A	A	A	N	A	A
Alcohol, Octyl				A	A	C	N	A		A
Alcohol, Oleyl (Octadecanol)				A	A					A
Alcohol & Lubricating Oil				A	A					
Aldehyde			A	A	A	N	A	N	A	A
Ale				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Alkali Cleaner				A	A					
Alkanes			A	A	A	A		A	A	A
Alkyd Resins				A	A					
Alkyl- Arylsulphonics			A	A	A	N		A	A	A
Alkylaryl sulphonates				A	A					
Alkyl Acetone			A	A	A	N		N	A	A
Alkyl Alcohol			A	A	A	A		A	A	A
Alkyl Amine			A	A	A	A		A	A	A
Alkyl Benzene			A	A	A	N		A	A	A
Alkyl Chloride			A	A	A	N		N	A	A
Alkyl Phenols (Cresylic Acid)			A	A	A	N	N	A	A	A*
Alkylate, Light			A	A	A	A		A	A	A
Allyl Acetone				A	A					
Allyl Alcohol				A	A					
Allyl Amine				C	A					
Allyl Benzene				A	A					
Allyl Chloride				A	A					
Almond Oil				A	A					
Alpha Picoline			A	A	A				A	A
Alum, Ammonia				A	A					A
Alum, Chrome (Chromium Potassiumsulfate)		10	A	A	A	A	A	A	A	A
Alum, Potash			A	A	A	A		A	A	A
Alum Solution			C	A	A	A	A	A	A	A
Aluminium Acetate				A	A	C	A	N		A
Aluminum Chloride			C	A	C	A	A	A	A	A
Aluminum Chlorate				C	A					A
Aluminum Hydroxide (Boehmite)			A	A	C	A		A	A	A
Aluminum Nitrate				A	A	A	A	A		A
Aluminum Sulphate, Aqueous			A	A	A	A	A	A	A	A
Amine				A	A					A*

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Amine, Diethanol (DEA)			A	A	A	C	C	N	A	A
Amine, Fat Condensate			A	A	A	A	C	N	A	A
Aminobenzene (Aniline)			A	A	A	N	C	A	A	A
Ammonia, Anhydrous	< 122		A	C	C	A	A	N	A	A*
Ammonia, Aqua	< 122	> 10	A	A	A	A	A	N	A	A
Ammonia, Aqua	< 122	< 10	A	A	A	A	A	A	A	A
Ammonia, Dry Gas			A	A	A	A	A	N	A	A*
Ammonia, Wet Gas				A	A					
Ammonia, Liquid				A	A	C	A	N		A*
Ammonia & Oil				A	A					
Ammoniacal Liquor				A	A					
Ammonium Acetate				A	A					A
Ammonium Bicarbonate, Aqueous			A	A	A	A		A	A	A
Ammonium Bifluoride				A	A				A	A*
Ammonium Bromide				A	A					A
Ammonium Carbonate			A	A	A	N	A	A	A	A
Ammonium Chloride (Sal Ammoniac)			A	A	A	A	A	A	A	A
Ammonium Hydroxide			A	A	A	C	A	C	A	A*
Ammonium Nitrate			A	A	A	A	A	N	A	A
Ammonium Phosphate (Mono- Basic)			A	A	A	A	A	A	A	A
Ammonium Phosphate (Di- Basic)			A	A	A	A	A	A	A	A
Ammonium Phosphate (Tri- Basic)			A	A	A	A	A	A	A	A
Ammonium Sulfate (Aqueous)	any	all	A	A	A	A	A	N	A	A
Ammonium Sulphide				A	A					A
Ammonium Thiocyanate			A	A	A	A		A	A	A
Ammonium Thiocyanide				A	A					
Amyl Acetate			A	A	A	N	A	N	A	A
Amyl Alcohol			A	A	A	A	A	C	A	A
Amyl Amines				A	A					
Amyl Benzoate				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Amyl Butyrate				A	A					A
Amyl Formate				A	A					
Amyl Nitrate			A	A	A	N	A	N	A	A
Amyl Phthalate				A	A					
Amyl Propionate				A	A					A
Angamol Oil				A	A					
Aniline (Aminobenzene)			A	A	A	N	C	A	A	A
Aniline Hydrochlorine				A	A				A	A
Animal Fat (Lard)			A	A	A	A		A	A	A
Animal Oil			A	A	A	A	C	A	A	A
Anthracene				A	A					A
Anti- Biotic Fermentation Broth (w/o Solvent)				A	A					
Anti- Biotic Fermentation Broth (with Solvent)				A	A					
Antifreeze (Water, Alcohol or Glycol)			A	A	A	A	A	A	A	A
Arcanite (Potassium Sulfate)			A	A	A	A	A	A	A	A
Argon Gas			A	A	A	A	A	A	A	A
Arochlor 1248			A	A	A	N	C	A	A	A
Aromatic Fuels		< 40	A	A	A	C	N	A	A	A
Aromatic Fuels		> 40	A	A	A	N	N	A	A	A
Arsenic Trichloride				A	A	A	C			A
Asphalt			A	A	A	N	N	A	A	A
Aspirin				A	A					A
ASTM Oil # 1				A	A					A
ASTM Oil # 2				A	A					A
ASTM Oil # 3				A	A					A
ASTM Oil # 4				A	A					A
Aviation Gasoline				A	A					
Baking Soda (Sodium Bicarbonate)			A	A	A	A	A	A	A	A
Barium Carbonate				A	A					A
Barium Chloride, Aqueous		< 20	A	A	A	A	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Barium Hydroxide				A	A	A	A	A		A
Barium Nitrate, Aqueous			A	A	A	A	A	A	A	A
Barium Sulfate				A	A	A	A	A		A
Barium Sulfide (Black Ash)				A	A	A	A	A		A
Bauxite				A	A					
Beer			A	A	A	A	A	A	A	A
Beer Wort			A	A	A	A	A	A	A	A
Beet Juice			A	A	A	A	A	A	A	A
Beet Pulp			A	A	A	A	A	A	A	A
Beet Sugar Solution			A	A	A	A	A	A	A	A
Beet Sugar Liquors				A	A					
Benzaldehyde				A	A	N	A	N		A
Benzene (Coal Tar Product) (Benzol)			A	A	A	N	N	A	A	A
Benzene (Aliphatic)				A	A					
Benzine (Petroleumproduct) (Ligroin)			A	A	A	A	N	A	A	A
Benzoic Acid Sol			A	A	A	N	N	A	A	A
Benzol			A	A	A	N	N	A	A	A
Bichloride of Mercury	amb			A	A				A	A
Bischofite (Magnesium Chloride)			A	A	A	A	A	A	A	A
Bittern				A	A				C	A
Black Ash (Barium Sulfide)				A	A	A	A	A		A
Black Liquor			A	A	A	C	C	A	A	A
Bleach Powder				C	A					
Bleach Solutions			A	A	A	N	A	A	A	A*
Blood				A	A				C	
Blue Verdigris (Copper Acetate)			A	A	A	C	A	N	A	A
Blue Vitriol, Aqueous (Copper Sulfate)		50	A	A	A	A	A	A	A	A
Boehmite (Aluminum Hydroxide)			A	A	C	A		A	A	A
Boiler Feed Water			A	A	A	A	A	A	A	A
Bonderite Solution			A	A	A	A			C	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Borax Sol (Sodium Tetraborate)			A	A	A	C	A	A	A	A
Boron Trichloride			A	A	A				A	C
Boron Trifluoride				A	A					C
Bright Copper Plating Solution				A	A					
Bright Nickel Plating Solution				A	A					
Brine Calcium Chloride				A	A					
Brine Calcium pH 8			A	A	A	A	A	A	A	A
Brine, Calcium & Magnesium Chloride			A	A	A	A	A	A	A	A
Brine, Calcium & Sodium Chloride			A	A	A	A	A	A	A	A
Brine Chloride				A	A					
Brine, Chloride pH 8			A	A	A	A	A	A	A	A
Brine, Sea Water	< 176		C	A	A	A	A	A	A	A
Brine, Sodium Chloride			N	A	A	A	A	A	A	A
Bromine Gas				A	A					A
Bromine, Wet			N	C	A	N	N	A	A	A*
Bromomethane (Methyl Bromide)			A	A	A			A	A	A
Bromoethane (Ethyl Bromide)				A	A					A
Brucite (Magnesium Hydroxide)			A	A	A	C	A	A	A	A
Bunker C Fuel Oil			A	A	A	A	N	A	A	A
Butadiene			A	A	A		A	A	A	A
Butane (LPG)			A	A	A	A	N	A	A	A
Butanol (Butyl Alcohol)			A	A	A	A	C	A	A	A
Butter				A	A					
Buttermilk				A	A					
Butyl Acetate			A	A	A	N	C	N	A	A
Butyl Alcohol (Butanol)			A	A	A	A	C	A	A	A
Butylamine			A	A	A	N	N	N	A	A*
Butyl Benzoate				A	A	N	C	A		A
Butyl Butrate				A	A					
Butyl " Cellosolve "				A	A	N	A	N		A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Butyl Formate				A	A					
Buryl Phosphate				A	A					
Butyl Phthalate			A	A	A	N	A	C	A	A
Butyl Propionate				A	A					
Butylene (Butane) (Ethylethylene)			A	A	A	C	N	A	A	A
CAA, Aqueous (Copper Ammonium Acetate)			A	A	A				A	A
Calcium Bisulfide			A	A	A	A		A	A	A
Calcium Bisulfite		100	A	A	A	A	N	A	A	A
Calcium Carbonate (Aragonite)			A	A	A	A		A	A	A
Calcium Chlorate, Aqueous			N	A	A	C	A	A	A	A
Calcium Chloride, Wet			C	A	A	A	A	A	A	A
Calcium Hydroxide, Aqueous (Lime Water)			A	A	A	A	A	A	A	A
Calcium Hypochlorite			A	A	A	C	A	A	A	A
Calcium Magnesium Chloride			A	A	A	A	A	A	A	A
Calcium Nitrate				A	A	A	A	A		A
Calcium Oxide				A	A					A
Calcium Phosphate			A	A	A	A		A	A	A
Calcium Sulphate				A	A					A
Calgon® (Sodium Hexametaphosphate)				A	A					
Caliche Liquors				A	A					A
Camphor				A	A					A
Candelilla Wax				A	A					
Cane Juice			A	A	A	A	A	A	A	A
Cane Liquors			A	A	A	A	A	A	A	A
Carbinal				A	A					
Carbitols®				A	A	C	C	C		A
Carbonate of Soda, Aqueous				A	A					
Carbon Bisulfide			A	A	A	N	N	A	A	A
Carbon Dioxide, Dry			A	A	A	N	C	C	A	A
Carbon Dioxide, Wet			A	A	A	A	C	C	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Carbon Disulfide			A	A	A	N	N	A	A	A
Carbon Monoxide			A	A	A	A	A	A	A	A
Carbon Tetrachloride, Wet				C	A	C	N	A	A	A*
Carbon Tetrachloride, Anhydrous		> 10	A	C	A	C	N	A	A	A*
Casein				A	A					A
Castor Oil			A	A	A	A	C	A	A	A
Catsup			A	A	A			A	A	A
Caustic (Sodium Hydroxide)			A	A	A	C	A	C	A	A
Caustic Cyanogen			A	A	A	A		A	A	A
Caustic Manganese				A	A					
Caustic Potash, Aqueous (Potassium Hydroxide)		< 50	C	A	A	C	A	N	A	A
Caustic Soda, Aqueous (Sodium Hydroxide)	149	< 50	A	A	A	C	A	C	A	A
Caustic Strontia, Aqueous				A	A					
Caustic Sulfide				A	A					
Caustic Zinc Chloride, Aqueous				A	A					
Cellosolve®				A	A	N	C	N		A
Cheese				A	A					
Chinawood Oil (Tung Oil)			A	A	A	A	N	A	A	A
Chloroacetaldehyde				A	A					C
Chloral				A	A					A
Chlorox®				A	A	C	C	A		A
Chloride of Lime			N	A	A	C	A	A	A	A
Chloride of Zinc, Aqueous				A	A	A	A	A		A
Chlorinated Solvents, Dry			A	A	A	N	N	A	A	A
Chlorinated Solvents, Wet			A	A	A	N	N	A	A	A
Chlorine, Dry			A	A	A	N	N	A	A	A
Chlorine, Wet			N	A	A	N	C	C	A	C*
Chloracetone			A	A	A	N	A	N	A	A
Chlorobenzene			A	A	A	N	N	A	A	A
Chlorobenzene, Di-				A	A	N	N	A		

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Chlorobenzene, Tri-				A	A					A
Chloroethylene (Vinyl Chloride)			A	A	A			A	A	A
Chloroform			A	A	A	N	N	A	A	A
Chloromethyl Ether				A	A					
Chloropicrin			A	A	A				A	A
Chlorosilane				A	A					A
Chlorothene				A	A					
Chocolate				A	A					
Chrome Alum (Chromium Potassium Sulfate)			A	A	A	A	A	A	A	A
Chromic Oxide, Aqueous		50		C	A	N	C	A	A	A
Chromium Potassium Sulfate, Aqueous		10	A	A	A	A	A	A	A	A
Cider				A	A					
Citrus Juices				A	A					
Citric Acid, Aqueous	cool	5	A	A	A	A	A	A	A	A
Citric Acid, Aqueous	140	5								
Clay Slurry				A	A					
Coal Gas				A	A					
Coal Tar (Creosote)			A	A	A	A	N	A	A	A
Coal Tar Oil			A	A	A				A	A
Cocoa Butter			A	A	A	A		A	A	A
Cocoanut Oil			A	A	A	A	A	A	A	A
Cod Liver Oil			A	A	A	A	A	A	A	A
Coffee				A	A					
Cola Drinks				A	A					
Condensate (Water)			A	A	A	A	A	A	A	A
Cooling Tower Water			A	A	A	A	A	A	A	A
Copper Acetate (Blue Verdigris)			A	A	A	C	A	N	A	A
Copper Ammonium Acetate, Aqueous (CAA)			A	A	A				A	A
Copper Chloride				A	A	A	A	A	A	A
Copper Cyanide			A	A	A	A	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Copper Nitrate			A	A	A			A	A	A
Copper Strike Plating Solution				A	A					
Copper Sulfate, Aqueous (Blue Vitriol)		10	A	A	A	A	A	A	A	A
Copper Sulfate, Aqueous (Blue Vitriol)		50	A	A	A	A	A	A	A	A
Copperas, Green (Ferrous Sulfate)				A	A				A	A
Core Oils				A	A					
Corn Oil			A	A	A	A	N	A	A	A
Corn Starch				A	A					
Corn Syrup				A	A					
Cottonseed Oil			A	A	A	A	N	A	A	A
Creosote (Coal Tar)			A	A	A	A	N	A	A	A
Creosol Meta			A	A	A	N	N	A	A	A
Crotonaldehyde				A	A					A
Crude Oil			A	A	A	C	N	A	A	A
Cryogenics				A	A					
Cumene (Iso-Propylbenzene)				A	A	N	N	A		A
Cupric Sulfate, Aqueous			A	A	A	A	A	A	A	A
Cupros Ammonia Acetate, Aqueous			A	A	A				A	A
Cutting Oil			A	A	A	A	N	A	A	A
Cyanide, Aqueous				A	A					A
Cyanogen in Water			A	A	A				A	A
Cyclohexane (Hexahydrobenzene)			A	A	A	A	N	A	A	A
Cyclohexanol				A	A	C	N	A		
Cyclohexene (Tetrahydrobenzene)			A	A	A	C	N	A	A	A
Cyclohexylamine				A	A					A
Cycloxexanone			A	A	A	N	C	N	A	N
DDT Solution (Toluene Solv.)			A	A	A	N	N	A	A	A
DDT Solution (Kerosene Solv.)			A	A	A	A	N	A	A	A
DEA (Diethanolamine)			A	A	A	C	C	N	A	A
DEP (Diethyl Phtalate)				A	A					A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
De- Butanizer Reflux			A	A	A	A	N	A	A	A
De- Ethanizer Charge			A	A	A	A	N	A	A	A
De- Propanizer Reflux			A	A	A	A	N	A	A	A
Detergents				A	A	A	A	A		A
Dextrin				A	A					A
Dextrose (Glucose)			A	A	A	A	A	A	A	A
Diacetone			A	A	A	N	A	N	A	A
Diacetone Alcohol			A	A	A	N	A	N	A	A
Dibutyl Amine			A	A	A	N	N	N	A	A
Dibutyl Cellusolve Adipate			A	A	A				A	A
Dibutyl Phosphite				A	A					
Dibutyl Phthalate			A	A	A	N	A	C	A	A
Dibromoethyl Benzene			A	A	A	N	N	A	A	A
Dibutylether			A	A	A	N	N	N	A	A
Dichlorobenzene			A	A	A	N	N	A	A	A
Dichloroethane			A	A	A	N	N	A	A	A
Dichloromethane (Methylene Chloride)			A	A	A	N	N	C	A	A
Dichloropentane				A	A					
Dichlorohydrin				A	A					A
Diesel Fuel			A	A	A	A	N	A	A	A
Diethanolamine (DEA)			A	A	A	C	C	N	A	A
Diethylamine				A	A	C	C	N		A*
Diethylaniline				A	A					A
Diethylbenzene				A	A	N	N	A		A
Diethyl Carbonate (Ethyl Carbonate)			A	A	A				A	A
Diethyl Ether			A	A	A	N	N	N	A	A
Diethylene Glycol			A	A	A	A	A	A	A	A
Diethyl Sulfate (Ethyl Sulfate)				A	A					A
Diethylene Triamine			A	A	A				A	A
Diethyl Maleate				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Diethyl Phthalate (DEP, Ethyl Phtalate)				A	A					A
Di- Isobutyl Ketone			A	A	A				A	A
Di- Isopropyl Ketone			A	A	A	N	A	N	A	A
Dimethyl Benzene (Xylene)			A	A	A	N	N	A	A	A
Dimethyl Formaldehyde			A	A	A				A	A*
Dimethyl Methane (Propane)			A	A	A	A	N	A	A	A
Dimethyl Phthalate				A	A	N	C	C	A	A
Dimethyl Terephthalate (DMT)			A	A	A				A	A
Dimethyl Hydrazine (UDMH)			A	A	A	C	A	N	A	A
Dinitrochloro benzene & Styrene			A	A	A				A	A
Dinitrochloro benzene (DNCB)			A	A	A				A	A
Dinitrotoluene (DNT)				A	A	N	N	N	A	A
Dioctylamine			A	A	A	A			A	A
Dioctyl Phthalate (DOP)			A	A	A	N	C	C	A	A
Dioxane				A	A	N	C	N		A
Dipentene				A	A	C	N	A		A
Diphenyl			A	A	A	N	N	A	A	A
Dish Water			A	A	A	A	A	A	A	A
Disodium Phosphate			A	C	A	A	A	A	A	A
DMT (Dimethyl Terephthalate)			A	A	A				A	A
DNCB (Dinitrochloro Benzene)			A	A	A				A	A
DNT (Dinitrotoulene)				A	A	N	N	N	A	A
Doctor´s Solution				A	A					
DOP (Dioctyl Phthalate)			A	A	A	N	C	C	A	A
Dow Corning Silicone Fluid			A	A	A	A	A	A	A	A
Dowtherm				A	A	N	N	A		A
Dowtherm 'A', Dry			A	A	A	N	N	A	A	A
Dowtherm 'E', Dry			C	A	A	N	N	A	A	A
Drilling Mud				A	A					
Dye Wood Liquor				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Eggs				A	A					
Electrolytic Cell Liquors				A	A					
Enamel				A	A					
Epichlorohydrin				A	A	N	C	N		A
Epsom Salt, Aqueous (Magnesium Sulfate)	hot	50	C	A	A	A	A	A	A	A
Essential Oil			A	A	A	A	A	A	A	A
Ester- type Plasticizers				A	A					
Ethanal (Acetaldehyde)			A	A	A	N	A	N	A	A*
Ethane (Methylmethane)			A	A	A	A	N	A	A	A
Ethanedioic Acid (Oxalic Acid)	cold		A	A	A	A	A	A	A	A
Ethanedioic Acid (Oxalic Acid)	hot		A	A	A	C	A	A	A	A
Ethanoic Anhydride (Acetic Anhydride)	68		A	A	A	N	C	N	A	A
Ethanol (Ethyl Alcohol)			A	A	A	A	A	N	A	A
Ethanolamine			A	A	A	N	N	N	A	A
Ethanol Amine, Mono- (MEA)			A	A	A	N	C	N	A	A*
Ethanol Amine, Di- (DEA)			A	A	A	C	C	N	A	A
Ethanol Amine, Tri- (TEA)				A	A	C	A	N		A*
Ether			A	A	A	N	N	N	A	A
Ether- Diethyl			A	A	A	N	N	N	A	A
Ether- Petroleum			A	A	A	A	N	A	A	A
Ethyl Acetate			A	A	A	N	C	N	A	A
Ethyl Acrylate			A	A	A	N	C	N	A	A
Ethyl Alcohol (Ethanol)			A	A	A	A	A	N	A	A
Ethyl Benzene			A	A	A	N	A	A	A	A
Ethyl Benzoate				A	A	N	N	A	A	A
Ethyl Bromide (Bromoethane)				A	A					A
Ethyl Butyrate				A	A					A*
Ethyl Carbonate (Diethyl Carbonate)			A	A	A				A	A
Ethyl Cellosolve				A	A	N	C	N	A	A
Ethyl Cellulose				A	A	C	C	N		A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Ethyl Chloride, Dry (Chloroethane)			A	A	A	A	A	A	A	A
Ethyl Chloracetate (Chloroacetic Acid)			N	A	A	N	C	N	A	A*
Ethyl Chlorocarbonate				A	A	N	N	A	A	A
Ethyl Chloroformate				A	A	N	N	A	A	A
Ethyl Chlorohydrin				A	A	N	C	A	A	A
Ethyl Dichloride				A	A					
Ethyl Ether (Ethyl Oxide, Diethyl Ether)			A	A	A	N	N	N	A	A
Ethyl Formate				A	A	N	C	A	A	A
Ethyl Hexanol				A	A	A	A	A	A	A
Ethyl Mercapan				A	A	N	N	C		A
Ethyl Phthalate (DEP)				A	A					A
Ethyl Propionate				A	A					
Ethyl Pyridine			A	A	A				A	A
Ethyl Sulfate (Diethyl Sulfate)				A	A					A
Ethylene (Ethane)			A	A	A	A			A	A
Ethylene Chloride (Ethylene Dichloride)			A	A	A	N	N	A	A	A
Ethylene Chlorohydrin				A	A	N	C	A	A	A
Ethylene Diamine				A	A	A	A	N	A	A*
Ethylene Dichloride (Ethylene Chloride)			A	A	A	N	N	A	A	A
Ethylene Glycol			A	A	A	A		A	A	A
Ethylene Oxide			A	A	A	N	N	N	A	A
Ethylene Oxide & Freon 12		12/ 80	A	A	A	N	C	N	A	C*
Ethylene Thiourea				A	A					
Ethylene Trichloride				A	A	N	N	A	A	A
Ethylethylene (Butene-1)			A	A	A	A	N	A	A	A
Fatty Acids			C	A	A	C	N	A	A	A
Ferric Chloride, Aqueous	< 158		N	C	A	A	A	A	A	A
Ferric Sulfate, Aqueous			A	A	A	A	A	A	A	A
Ferrous Chloride				A	A					A
Ferrous Sulfate (Green Copperas)				A	A				A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Ferrous Sulfate & Lime				A	A					
Film Dope				A	A					
Fish Oil				A	A	A	N	A		A
Fluorine				C	A	N	N	C		C*
Flourolube			A	A	A	A	A	C	A	A
Formaldehyde			A	A	A	A	C	A	A	A*
Formalin		40	A	A	A	A		A	A	A
Formic Acid (Methanoic Acid)		90	C	A	A	C		A	A	A
Freon 11 & Refrig. Oil			A	A	A	C	N	A	A	C*
Freon 12 & Refrig. Oil			A	A	A	A	N	A	A	C*
Freon 13				A	A	A	A	C		C*
Freon 14				A	A					C*
Freon 21				A	A	N	N	N		A*
Freon 22 & Refrig. Oil			A	A	A	N	N	C	A	A*
Freon 31				A	A	N	A	N		A*
Freon 32				A	A	A	A	N		A*
Freon 112				A	A	C	N	A		A*
Freon 113 & Refrig. Oil			A	A	A	A	N	C	A	C*
Freon 114 & Refrig. Oil			A	A	A	A	A	C	A	C*
Freon 115				A	A	A	A	C		C*
Freon 121 & Refrig. Oil			A	A	A				A	
Freons, Liquid			A	A	A	A			A	
Fruit Juices			A	A	A	A		A	A	A
Fuel Oil			A	A	A	A	N	A	A	A
Fuel Oil Acidic			A	A	A	A	N	A	A	A
Fuel Oil # 6			A	A	A	C	N	A	A	A
Furfural			A	A	A	N	C	N	A	A*
Furfuryl Alcohol				A	A					A
Gas Oil			A	A	A	A	N	A	A	A
Gasoline Aromatic			A	A	A		N	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Gasoline, Automotive				A	A	A	A	N		
Gasoline, Ethyl				A	A					
Gasoline 100 & 130 Oct.			A	A	A	A	N	A	A	A
Gasoline HI- Test w/ Mercapian, H2S			A	A	A		N	A	A	A
Gelatin			A	A	A	A	A	A	A	A
Glaubers Salt, Aqueous (Sodium Sulfate)			A	A	A	N	C	A	A	A
Glucose (Dextrose)			A	A	A	A	A	A	A	A
Glue			A	A	A	A	A	A	A	A
Glue Sizing			A	A	A	A	A	A	A	A
Glycerine (Glycerol)			A	A	A	A	A	A	A	A
Glycols			A	A	A	A	C	A	A	A
Green Sulphate Liouor			A	A	A	C	A	A	A	A
Grape Juice			A	A	A	A		A	A	A
Grease			A	A	A	A	N	A	A	A
Helium				A	A	A	A	A	A	A
Heptane			A	A	A	A	N	A	A	A
Hexachloro Acetone				A	A				A	A
Hexahydro Benzene (Cyclohexane)			A	A	A	A	N	A	A	A
Hexane			A	A	A	A	N	A	A	A
Hexone (Iso-butyl Methyl Ketone)			A	A	A	N	A	N	A	A
Hexyl Alcohol (Hexanol)				A	A	A	N	A	A	A
High Speed Cooper Plating Solution				A	A					
Hops				A	A					
Hydraulic Oil, Petroleum based				A	A	A	N	A		A
Hydrazine			A	A	A	C	A		A	A*
Hydrazine Hydrate				A	A					A*
Hydrocarbons, Light				A	A					A
Hydrogen				A	A	A	A	A		A
Hydrogen Bromide (Hydrobromic Acid)			A	A	A	N	A	A	A	A
Hydrogen Chloride (Hydrochloric Acid)			N	A	A	N	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Hydrogen Cyanide (Hydrocyanic Acid, Prussic)			A	A	A	C	A	A	A	A
Hydrogen Fluoride (H F Acid) Anhydrous	cold	< 65	N	A	A	N	C	N	A	A*
Hydrogen Fluoride (H F Acid) Anhydrous	hot	all	N	A	A	N	N	N	A	A*
Hydrogen Fluoride (H F Acid) Anhydrous	cold	> 65	N	A	A	N	C	N	A	A*
Hydrogen Peroxide			A	A	A	N	N	A	A	A
Hydrogen Sulfide, Dry	cold	> 90	A	A	A	A	A	N	A	A
Hydrogen Sulfide, Dry	hot		A	A	A	N	A	N	A	A
Hydrogen Sulfide, Wet	cold		A	A	A	N	A	N	A	A
Hydrogen Sulfide, Wet	hot		A	A	A	N	A	N	A	A
Hydrogenated Fats				A	A					
Hydroflousilicic Acid (Flousilicic Acid)			N	A	A	A	C	A	A	A
Hydroquinone				A	A	C	C	A		N
Hydroxylamine				A	A					
Ice Cream				A	A					
Ink				A	A					A
Insecticides, Nonaromatic			A	A	A	A	C	A	A	A
Insecticides, Aromatic			A	A	A	N	N	A	A	A
Insulating Oil			A	A	A	A	N	A	A	A
Iodine, Wet			N	C	A	C	C	A	A	A
Iodoform			A	A	A		A		A	C*
IPA (Iso-Phthalic Acid)				A	A					
Iron Sulfate				A	A				A	A
Isobutane			A	A	A	A	N	A	A	A
Iso- Butyl Acetate				A	A					A
Isobutyl Alcohol			A	A	A	C	A	A	A	A
Isobutylene			A	A	A	N	A	A	A	A
Iso- Butyraldehyde				A	A					
Isobutyl Methyl Ketone (Hexone)			A	A	A	N		N	A	A
Isodecane				A	A	A	N	A	A	A
Iso- Octane			A	A	A	A	N	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Isopentane			A	A	A	A	N	A	A	A
Isopropanol (Isopropyl Alcohol)			A	A	A	C	A	A	A	A
Isopropyl Acetate			A	A	A	N	C	N	A	A
Isopropyl Acetone			A	A	A	N	C	N	A	A
Isopropyl Alcohol (Isopropanol)			A	A	A	C	A	A	A	A
Isopropylamine			A	A	A	A		A	A	A*
Isopropyl Benzene (Cumene)				A	A	N	N	A		A
Isopropyl Chloride				A	A	N	N	A	A	A
Isopropyl Ether				A	A	C	N	N	A	A
Jelly				A	A					
JP-3			A	A	A	A	N	A	A	A*
JP-4			A	A	A	A	N	A	A	A*
JP-5			A	A	A	A	N	A	A	A*
JP-6			A	A	A	A	N	A	A	A*
JP-X			A	A	A	A	N	N	A	A*
Kaoline Slip Suspension in Water				A	A					
Kerosene			A	A	A	A	N	A	A	A
Kerosene Oil			A	A	A	A	N	A	A	A
Ketchup				A	A					
Ketones				A	A					
Krypton				A	A					
Lacquer (Mek solv.)			A	A	A	N	N	N	A	A
Lard (Animal Fat)			A	A	A	A		A	A	A
Latex			A	A	A	C	N	A	A	A
Lavender Oil			A	A	A	C	N	A	A	A
Lead Acetate, Liquid			A	A	A	C	A	N	A	A
Lead, Molten				N	A					A
Lead, Carbonate				A	A					A
Lead Nitrate				A	A	A	A		A	A
Lead Sulphamate				A	A	C	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Ligroin (Petroleum Ether)			A	A	A	A	N	A	A	A
Lime Bleach				A	A	A	A	A	A	A
Lime Slurries				A	A					
Lime Water (Calcium Hydroxide)			A	A	A	A	A	A	A	A
Lindol			A	A	A	N	A	C	A	A
Linseed Oil			A	A	A	A	N	A	A	A
Liquid Oxygen			A	A	A	C	A	A	A	A
Liquid Petroleum Gas (LPG, Butane)			A	A	A	A	N	A	A	A
Liquor, Black			A	A	A	C	C	A	A	A
Liquor, Green				A	A					
Liquor, Lime				A	A					A
Liquor, Pulp Mill			A	A	A	C	C	A	A	A
Liquor, Steep				A	A					A
Liquor, Sulphate			A	A	A					A
Liquor Sulfite				A	A	C	C	A		A
Liquor White			A	A	A	C	C	A	A	A
Lissapol Paste				A	A					
Lithium Bromide Brine			A	A	A	A		A	A	A
Lithium Carbonate				A	A					A
Lithium Chloride (Aqueous)			A	A	A				A	A
Lithium Hydroxide				C	A					A
LPG (Butane, Liquid Petroleum Gas)			A	A	A	A	N	A	A	A
Lubricating Oil				A	A					A
Lye, Caustic (Sodium Hydroxide)			A	A	A	C	A	C	A	A
Lye, Salty				A	A					A
Magnesium Acetate				A	A					
Magnesium Chloride (Bischofite)			A	A	A	A	A	A	A	A
Magnesium Hydroxide (Brucite)			A	A	A	C	A	A	A	A
Magnesium Nitrate			A	A	A	A			A	A
Magnesium Oxide				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Magnesium Sulfate, Aqueous (Epsom Salt)	hot	50	C	A	A	A	A	A	A	A
Magnesium Sulfite, Aqueous				A	A	A	A	A	A	A
Maleic Anhydride			A	A	A	N	N	N	A	A
Maleic Hydrazide			A	A	A				A	A
Malt				A	A					
Manganese Chloride, Aqueous				A	A				A	A
Manganese Sulfate, Aqueous			A	A	A				A	A
Manganous Sulfate (Manganese Sulfate)			A	A	A				A	A
Maple Syrup				A	A					
Marsh Gas (Methane)			A	A	A	A	N	A	A	A
Marsh Anti- Biotic Fermentation, No Solvent			A	A	A	A			A	A
Marsh, With Solvent			A	A	A	N			A	A
Mayonnaise			A	A	A	A		A	A	A
MCA (Mono-Chloroacetic Acid)			N	A	A	N	C	N	A	A*
MEA (Mono-ethanolamine)			A	A	A	N	C	N	A	A*
MEA with Copper Sulfate			A	A	A	N	C	N	A	A*
MEK (Methyl Ethyl Ketone)			A	A	A	N	A	N	A	A
Melamine Resins				A	A				A	A
Mercaptan (Thiol)				A	A				A	A
Mercuric Chloride			C	A	A	A	A	A	A	A
Mercuric Nitrate				A	A					A
Mercurous Nitrate				A	A					A
Mercury			A	A	A	A	A	A	A	A
Mercury Salts			A	A	A	A	A	A	A	A
Mercury Vapors			A	A	A	A	A	A	A	A
Mesityl Oxide (Ketone)			A	A	A	N	C	N	A	A
Methane (Marsh Gas)			A	A	A	A	N	A	A	A
Methanoic Acid (Formic Acid)		90	C	A	A	C		A	A	A
Methanol (Methyl Alcohol)			A	A	A	A	A	N	A	A
Methyl Acetate				A	A	N	C	N	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Methyl Acrylate			A	A	A	N	C	N	A	A
Methyl Alcohol (Methanol)			A	A	A	A	A	N	A	A
Methyl Benzoate (Niobe Oil)				A	A					A
Methyl Bromide (Bromomethane)			A	A	A			A	A	A
Methyl Butyl Ketone (Propylacetone)				A	A	N	A	N	A	A
Methyl Butyrate				A	A					A
Methyl Cellosolve			A	A	A	N	C	N	A	A
Methyl Chloride, Anhydrous (Chloromethane)			A	A	A	N	N	A	A	A
Methyl Chlorosilanes				A	A				A	A
Methyl Cyclopentane				A	A	N	N	A	A	A
Methyl Dichloride			A	A	A	N	N	C	A	A
Methyl Ether (Di-Metyl Ether)				A	A	A	A	A	A	A
Methyl Ethyl Ether				A	A					
Methyl Ethyl Ketone (MEK)			A	A	A	N	A	N	A	A
Methyl Formate				A	A	N	C		A	A*
Methyl Isobutyl Ketone (Hexone)			A	A	A	N	N	N	A	A
Methyl Isopropyl Ketone				A	A	N	C	N	A	A
Methyl Isophthalate				A	A					
Methyl Metane (Ethane)			A	A	A	A	N	A	A	A
Methyl Methacrylate				A	A	N	N	N		A
Methyl Phthalate				A	A					
Methyl Propionate				A	A					
Methyl Salicylate				A	A	N	C			A
Methylene Chloride (Dichloromethane)			A	A	A	N	N	C	A	A
Methylene Dichloride			A	A	A	N	N	C	A	A
Milk			A	A	A	A	A	A	A	A
Milk of Lime			A	A	A	A		A	A	A
Mil F- 25558 (RJ-1)			A	A	A	A	N	A	A	A
Mil L- 7808			A	A	A	C	N	A	A	A
Mil H- 5606 (HFA)			A	A	A	A	N	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Mil H- 5606 (J43)			A	A	A	A	N	A	A	A
Mil O- 8515			A	A	A	C	N	A	A	A
Mil O- 8200 (Hydr.)			A	A	A	C	N	A	A	A
Mineral Oil				A	A	A	N	A		A
Mineral Spirits			A	A	A	A	N	A	A	A
Mine Water	68		A	A	A	N	N	A	A	A
Miscella 20 % Soya Oil			A	A	A	A		A	A	A
Molasses			A	A	A			A	A	A
Monochlorobenzene			A	A	A	N	N	A	A	A
Monoethanolamine (MEA)			A	A	A	N	C	N	A	A*
Monosodium Glutamate (MSG)				A	A					
Morphine				A	A					
MSG (Monosodium Glutamate)				A	A					
Mustard			A	A	A				A	A
Naptha			A	A	A	C	N	A	A	A
Naptha, Crude			A	A	A	C	N	A	A	A
Napthalene			A	A	A	N	N	A	A	A
Natural Gas Liquid			A	A	A	A	N	A	A	A
Neatsfoot Oil			A	A	A	A	C	A	A	A
Neon				A	A					A
Nickel Acetate				A	A	C	A	N	A	A
Nickel Chloride	hot	< 30	A	A	A	A	A	A	A	A
Nickel Nitrate				A	A					A
Nickel Plating Solution				A	A					
Nickel Cobalt Sulfate, 5 % H2SO4	203		N	A	A				A	A
Nickel Salts			A	A	A	A	A	A	A	A
Nickel Sulfate			A	A	A	A	A	A	A	A
Nicotine Sulfate			A	A	A				A	A
Niobe Oil (Methyl Benzoate)				A	A					A
Nitrating Acids				C	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Nitric Acid	cold	< 65	A	C	A	N	C	N	A	A*
Nitrochloroform			A	A	A				A	A
Nitrobenzene			A	A	A	N	N	C	A	A
Nitrobenzine			A	A	A	N	C	A	A	A
Nitroethane			A	A	A	N	C	N	A	A
Nitromethane			A	A	A	N	C	N	A	A
Nirtopropane			A	A	A	N	C	N	A	A
Nitric Oxide				A	A					
Nitric Tetraoxide				C	A					
Nitrogen Gas			A	A	A	A	A	A	A	A
Nitrous Oxide				A	A					A*
Nonyl Phenol				A	A					
Nut Oil				A	A					
Nylon Salt				A	A					
Oakite				A	A					A
Octadecanol (Oleyl Alcohol)				A	A					A
Octyl, Alcohol				A	A	C	N	A		A
Octyl Phenol				A	A					
Oil & Ammonia			A	A	A				A	A
Oil Animal Bone			A	A	A	A	C	A	A	A
Oil Animal Cod			A	A	A	A	C	A	A	A
Oil Animal Lard			A	A	A	A	C	A	A	A
Oil Animal Menhadden			A	A	A	A	C	A	A	A
Oil Animal Neatsfoot			A	A	A	A	C	A	A	A
Oil Animal Sperm			A	A	A	A	C	A	A	A
Oil Animal Whale			A	A	A	A	C	A	A	A
Oil Asphalt Base				A	A					
Oil Bunker ' C '			A	A	A	C	N	A	A	A
Oil Castor			A	A	A	A	C	A	A	A
Oil Chinawood (Tung Oil)			A	A	A	A	N	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Oil Coal Tar			A	A	A				A	A
Oil Cocoanut			A	A	A	A	N	A	A	A
Oil Corn			A	A	A	A	N	A	A	A
Oil Cottonseed			A	A	A	A	C	A	A	A
Oil Creosote, Sweet			A	A	A			A	A	A
Oil Crude, Sweet	cold		A	A	A	C	N	A	A	A
Oil Cutting				A	A					A
Oil Diesel #2D			A	A	A	A	N	A	A	A
Oil Diesel #3D			A	A	A	A	N	A	A	A
Oil Diesel #4D			A	A	A	A	N	A	A	A
Oil Diesel #5D			A	A	A	A	N	A	A	A
Oil Domestic				A	A					
Oil Edible				A	A					
Oil Essential			A	A	A	A	A	A	A	A
Oil Fish				A	A	A	N	A		A
Oil Fuel #1			A	A	A	A	N	A	A	A
Oil Fuel #2			A	A	A	A	N	A	A	A
Oil Fuel #3			A	A	A	A	N	A	A	A
Oil Fuel #5A			A	A	A	A	N	A	A	A
Oil Fuel #5B			A	A	A	A	N	A	A	A
Oil Fuel #6			A	A	A	C	N	A	A	A
Oil Fusal (Alcohol)				A	A					
Oil Gas			A	A	A	A	N	A	A	A
Oil Hydraulic (Petroleum based)				A	A	A	N	A		A
Oil Insulating			A	A	A	A	N	A	A	A
Oil Jet Fuel				A	A					
Oil Kerosene			A	A	A	A	N	A	A	A
Oil Lean			A	A	A	A	N	A	A	A
Oil Linseed (Raw)			A	A	A	A	C	A	A	A
Oil Lubricating #8			A	A	A	A	N	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Oil Fed. Spec. #10			A	A	A	A	N	A	A	A
Oil Fed. Spec. #20			A	A	A	A	N	A	A	A
Oil Fed. Spec. #30			A	A	A	A	N	A	A	A
Oil Lubricating Diesel #9110			A	A	A	A	N	A	A	A
Oil Fed. Spec. #9170			A	A	A	A	N	A	A	A
Oil Fed. Spec. #9250			A	A	A	A	N	A	A	A
Oil Fed. Spec. #9370			A	A	A	A	N	A	A	A
Oil Fed. Spec. #9500			A	A	A	A	N	A	A	A
Oil Mineral Sae 10			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 20			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 30			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 40			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 50			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 60			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 70			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 90			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 140			A	A	A	A	N	A	A	A
Oil Fed. Spec. SAE 250			A	A	A	A	N	A	A	A
Oil Mineral Lard Cutting. Fed. Spec. # 1			A	A	A	A	N	A	A	A
Oil Mineral Lard Cutting. Fed. Spec. # 2			A	A	A	A	N	A	A	A
Oil Navy Spec. Navy II			A	A	A	A	N	A	A	A
Oil Niobe (Methyl Benzoate)				A	A					A
Oil Nut				A	A					
Oil Olive			A	A	A	A	C	A	A	A
Oil Palm			A	A	A	A	C	A	A	A
Oil Parafinn Base				A	A					
Oil Peanut			A	A	A	A	N	A	A	A
Oil Pine				A	A	N	N	A		A
Oil Quenching			A	A	A	A	N	A	A	A
Oil Rapeseed			A	A	A	C	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Oil Red (Oleic Acid)			A	A	A	N	N	C	A	A
Oil Rich			A	A	A	A	N	A	A	A
Oil Silicone			A	A	A	A	A	A		A
Oil Soya Bean			A	A	A	A	N	A	A	A
Oil Transformer				A	A	A	N	A		A
Oil Tung (Chinawood Oil)			A	A	A	A	N	A	A	A
Oil Turbine Lube			A	A	A	A	N	A	A	A
Oil Ucon®				A	A					A
Oil Vegetable, Castor			A	A	A	A	C	A	A	A
Oil Vegetable, Chinawood (Tung Oil)			A	A	A	A	N	A	A	A
Oil Vegetable, Cocoanut			A	A	A	A	N	A	A	A
Oil Vegetable, Corn			A	A	A	A	N	A	A	A
Oil Vegetable, Cottonseed			A	A	A	A	C	A	A	A
Oil Vegetable, Linseed (Raw)			A	A	A	A	N	A	A	A
Oil Vegetable, Olive			A	A	A	A	C	A	A	A
Oil Vegetable, Palm			A	A	A	A	C	A	A	A
Oil Vegetable, Peanut			A	A	A	A	N	A	A	A
Oil Vegetable, Rape Seed			A	A	A	C	A	A	A	A
Oil Vegetable, Rosin			A	A	A	A	N	A	A	A
Oil Vegetable, Sesame			A	A	A	A		A	A	A
Oil Vegetable, Soya Bean			A	A	A	A	N	A	A	A
Oil & Ammonia				A	A					
Oil & Freons				A	A					
Oil & Methylene Chloride				A	A					
Oil & Sulfur Dioxide				A	A					
Olefin, Crude			A	A	A				A	A
Oleomargarine				A	A					
Oleums			N	C	A	N	N	A	A	A
Oleyl Alcohol (Octadecanol)				A	A					A
Olive Oil			A	A	A	A	C	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
OS 45 Type IV			A	C	A	C	N	A	A	A
Oxalic Acid (Ethanedioic Acid)	cold		A	A	A	A	A	A	A	A
Oxalic Acid (Ethanedioic Acid)	hot		A	A	A	C	A	A	A	A
Oxygen, Gas				A	A	N	N	C		A*
Oxygen, Liquid			A	A	A	C	A	A	A	A*
Paint				A	A					
Paint Vehicles				A	A					
Palm Oil			A	A	A	A	C	A	A	A
Paper Pulp (Sulfite Pulp)				A	A					A
Paper Stock < 1,5% Acidic				A	A					
Paper Stock < 3% Acidic				A	A					
Paper Stock > 3% Acidic				A	A					
Paper Stock < 1% Alakaline				A	A					
Paper Stock < 3% Alakaline				A	A					
Paper Stock > 3% Alakaline				A	A					
Paracymene			A	A	A	A			A	A
Paraffin, Liquid			A	A	A	A		A	A	A
Paradichlorobenzene				A	A					A
Paraformaldehyde				A	A					A
Paraldehyde				A	A					
Peanut Oil			A	A	A	A	N	A	A	A
Pectin, Liquor			A	A	A	A		A	A	A
Penicillin, Liquid			A	A	A			A	A	A
Pentachlorophenol			A	A	A				A	A
Pentane			A	A	A	A	N	A	A	A
Pentane Liquid				A	A					
Pentasol				A	A				A	A
Perchlorethylene			A	A	A	A	N	A	A	A*
Perchloric Acid				C	A	N	C	A		A*

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Peroxide of Hydrogen	cold	> 90	A	A	A	N	N	A	A	A
Petrolatum (Petroleum Jelly)			A	A	A	A	N	A	A	A
Petroleum Ether (Ligroin)			A	A	A	A	N	A	A	A
Petroleum Jelly (Petrolatum)			A	A	A	A	N	A	A	A
Petroleum Spirit < 20% Aromatics				A	A					
Petroleum Spirit > 20% Aromatics				A	A					
Phenol (Carbolic Acid)	401	all	A	A	A	N	C	N	A	A
Phenol, Formaldehyde Mix			A	A	A	N	N	N	A	A
Phenol & Water				A	A					
Phenolic Resins				A	A					
Phidolene				A						A
Phosphoric Acid	cold	100	A	A	A	N	C	A	A	A
Phosphoric Acid	< 176	<45	C	A	A	N	N	A	A	A
Phosphoric Acid	cold	<45	C	A	A	N	C	A	A	A
Phosgene				A	A					A
Phosphorous Oxychloride				A	A					A
Phosphorus Trichloride, Dry			A	C	A	N	A	A	A	A
Photographic Developers			A	A	A			A	A	A
Phthalic Esters			A	A	A				A	A
Phthalic Anhydride, Anhydrous			A	A	A	C			A	A
Pickle Solutions				A	A	N	N	C		A
Pine Oil				A	A	N	N	A		A
Plant Liqour (Potash)				A	A					A
Plasticizer			A	A	A				A	A
Plating Solutions. Chrome				C	A		A	A	A	A
Plating Solutions. Others				A	A	A	A	A	A	A
Poly Glycols			A	A	A	A	A	A	A	A
Polyethylene				A	A					
Polyphenyl Ether				A	A					
Polystyrene				A	A					
Polyurethane				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Peroxide of Hydrogen	cold	> 90	A	A	A	N	N	A	A	A
Petrolatum (Petroleum Jelly)			A	A	A	A	N	A	A	A
Petroleum Ether (Ligroin)			A	A	A	A	N	A	A	A
Petroleum Jelly (Petrolatum)			A	A	A	A	N	A	A	A
Petroleum Spirit < 20% Aromatics				A	A					
Petroleum Spirit > 20% Aromatics				A	A					
Phenol (Carbolic Acid)	401	all	A	A	A	N	C	N	A	A
Phenol, Formaldehyde Mix			A	A	A	N	N	N	A	A
Phenol & Water				A	A					
Phenolic Resins				A	A					
Phidolene				A						A
Phosphoric Acid	cold	100	A	A	A	N	C	A	A	A
Phosphoric Acid	< 176	<45	C	A	A	N	N	A	A	A
Phosphoric Acid	cold	<45	C	A	A	N	C	A	A	A
Phosgene				A	A					A
Phosphorous Oxychloride				A	A					A
Phosphorus Trichloride, Dry			A	C	A	N	A	A	A	A
Photographic Developers			A	A	A			A	A	A
Phthalic Esters			A	A	A				A	A
Phthalic Anhydride, Anhydrous			A	A	A	C			A	A
Pickle Solutions				A	A	N	N	C		A
Pine Oil				A	A	N	N	A		A
Plant Liqour (Potash)				A	A					A
Plasticizer			A	A	A				A	A
Plating Solutions. Chrome				C	A		A	A	A	A
Plating Solutions. Others				A	A	A	A	A	A	A
Poly Glycols			A	A	A	A	A	A	A	A
Polyethylene				A	A					
Polyphenyl Ether				A	A					
Polystyrene				A	A					
Polyurethane				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Poly Vinyl Acetate				A	A		A	N	A	A
Potash (Plant Liquor)				A	A					A
Potash Alum, Aqueous			A	A	A	A		A	A	A
Potash Sulfide			A	A	A	A		A	A	A
Potassium Alum				A	A					A
Potassium, Bicarbonate			A	A	A	A			A	A
Potassium, Bichromate, Aqueous			A	C	A	A			A	A
Potassium, Bisulfide				A	A					
Potassium Bromide			A	A	A	A		A	A	A
Potassium Carbonate, Aqueous			A	A	A	A		A	A	A
Potassium Chlorate			A	A	A	A		A	A	A
Potassium Chloride, Aqueous (Sylvite)			A	A	A	A	A	A	A	A
Potassium Cyanides, Aqueous			A	A	A	A	A	A	A	A
Potassium Dichromate			A	C	A	A	A	A	A	A
Potassium Hydroxide, Aqueous (Caustic Potash)		< 10	C	A	A	C	A	N	A	A
Potassium Hydroxide, Aqueous (Caustic Potash)		> 10	C	C	A	C	A	N	A	A
Potassium Iodide				A	A					A
Potassium Nitrate, Aqueous (Saltpeter)			A	A	A	A	A	A	A	A
Potassium Perfluoro Acetate			A	A	A				A	A
Potassium Permanganate			A	A	A				A	A
Potassium Phosphate (Mono-)				A	A					
Potassium Phosphate (Di-, Tri-)			A	A	A				A	A
Potassium Silicate				A	A					A
Potassium Sulfate, Aqueous (Arcanite)			A	A	A	A	A	A	A	A
Potassium Sulfide				A	A					A
Prestone® (Anti-Freeze)				A	A					A
Primary Flash Distillate (PFD)				A	A					
Producer Gas				A	A	A	N	A		A
Propane (Dimethylmethane)			A	A	A	A	N	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Propanol (Propyl Alcohol)				A	A	A	A	A		A
Propiolactone, beta	68		A	A	A				A	A
Propionaldehyde			A	A	A				A	A
Propyl Acetate				A	A	N	C	N		A
Propyl Acetone (Methyl Butyl Ketone)				A	A	N	A	N	A	A
Propyl Alcohol (Propanol)				A	A	A	A	A		A
Propyl Benzoate				A	A					
Propyl Butyrate				A	A					
Propyl Formate				Á	A					
Propyl Phthalate				A	A					
Propyl Propionate				A	A					A
Propylene (Propene)			A	A	A	N	N	A	A	A
Propylene Carbonate				A	A					
Propylene Dichloride				A	A					A
Propylene Glycol			A	A	A	N	N	A	A	A
Propylene Oxide			A	A	A	N	C	N	A	A*
Protein Slurry				A	A					
Pulp Stock				A	A					A
PVA Emulsions				A	A					
PVC Slurry				A	A					
Pyridine			A	A	A	N	C	N	A	A
Quenching Oil			A	A	A	A	N	A	A	A
Raffinate			A	A	A	A			A	A
Rapeseed Oil			A	A	A	C	A	A	A	A
Red Oil (Oleic Acid)			A	A	A	N	N	C	A	A
Rich Oil			A	A	A	A	N	A	A	A
Rosin	100		A	A	A	A			A	A
Saccharine				A	A					A
Salad Oil				A	A					
Sal Ammoniac (Ammonium Chloride)			A	A	A	A	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Salt Cake			A	A	A	A	A	A	A	A
Salt Cake, Aqueous			A	A	A	A	A	A	A	A
Salt Water			C	A	A	A	A	A	A	A
Saltpeter (Potassium Nitrate)			A	A	A	A	A	A	A	A
Sea Water			A	A	A	A	A	A	A	A
Sewage			C	A	A	A	A	A	A	A
Shellac			A	A	A					A
Silicon Fluids				A	A					
Silicone Oils and Greases			A	A	A	A	A	A	A	A
Silicone Tetrachloride				A	A					C*
Silver Nitrate		10	A	A	A	C	A	A	A	A
Skydrol 500			A	A	A	N	A	N	A	A
Skydrol 7000			A	A	A	N	A	C	A	A
Slop, Brewery				A	A					A
Slop, Distillers				A	A					A
Soap, Liquors			A	A	A	A	A	A	A	A
Soap, Solutions			A	A	A	A	A	A	A	A
Soda Ash (Sodium Carbonate)	cold		A	A	A	A	A	A	A	A
Soda Niter, Aqueous (Sodium Nitrate)			A	A	A	C	A	C	A	A
Soda, Caustic (Sodium Hydroxide)			A	A	A	C	A	C	A	A
Sodium Acetate, Anhydrous			A	A	A	C	A	N	A	A
Sodium Aluminate			A	A	A	A		A	A	A
Sodium Aluminate Lime				A	A					
Sodium Acid Sulfate				A	A					
Sodium Bicarbonate, Aqueous (Baking Soda)			A	A	A	A	A	A	A	A
Sodium Bichromate (Sodium Dichromate)				C	A					A
Sodium Bisulfate			A	A	A	A	A	A	A	A
Sodium Bisulfite			A	A	A	A	A	A	A	A
Sodium Borate (Borax)			A	A	A	C	A	A	A	A
Sodium Bromide				A	A					A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Sodium Carbonate, Aqueous (Soda Ash)			A	A	A	A	A	A	A	A
Sodium Chloride Sol (Common Salt)			N	A	A	A	A	A	A	A
Sodium Chlorate				A	A					A
Sodium Chromate				C	A					A
Sodium Cyanamide			A	A	A				A	A
Sodium Cyanide, Aqueous			A	A	A	A	A	A	A	A
Sodium Dichromate (Sodium Bichromate)				C	A					
Sodium Dithionate				A	A					
Sodium Fluoride				A	A					A
Sodium Hexametaphosphate (Calgon®)				A	A					
Sodium Hydrosulfite			A	A	A	C	A	A	A	A
Sodium Hydroxide	< 248	all	A	A	A	C	A	C	A	A
Sodium Hydroxide, Aqueous	< 122	< 50	A	A	A	C	A	C	A	A
Sodium Hypochlorite		20		A	A	C	C	A	A	A
Sodium Metaphosphate			C	C	A	A	A	A	A	A
Sodium Metasilicate			A	A	A	A	A	A	A	A
Sodium Nitrate, Aqueous (Soda Niter)			A	A	A	C	A	C	A	A
Sodium Nitrite				A	A					
Sodium Perborate			A	A	A	C	A	A	A	A
Sodium Peroxide Sol			A	A	A	C	A	A	A	A
Sodium Phosphate, Mono., Aqueous			A	A	A	A	A	A	A	A
Sodium Phosphate, Dibasic, Aqueous			A	C	A	A	A	A	A	A
Sodium Phosphate, Tribasic, Aqueous			A	A	A	A	A	A	A	A
Sodium Phosphate, Meta, Aqueous			A	A	A	A	A	A	A	A
Sodium Plumbite, Aqueous			A	A	A			A	A	A
Sodium Silicate, Aqueous (Water Glass)			A	A	A	A	A	A	A	A
Sodium Sulfate, Aqueous (Glauber's Salt)			A	A	A	N	C	A	A	A
Sodium Sulfide			A	A	A	A	A	A	A	A
Sodium Sulfite, Aqueous			A	A	A	A	A	A	A	A
Sodium Tetraborate (Borax Sol)			A	A	A	C	A	A	A	A

Key: A=Acceptable, C=Use with Caution, N=Not Recommended, ()=Unknown, *differences may exist between Kalrez compounds.

SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Sodium Thiocyanate				A	A					A
Sodium Thiosulfate			A	A	A	C	A	A	A	A
Soft Drinks				A	A					
Solvasol 1, 2 & 3			A	A	A	A	N	A	A	A
Solvasol 73,74			A	A	A	C	N	A	A	A
Sorbitol			A	A	A				A	A
Soyabean Oil			A	A	A	A	N	A	A	A
Stannic Chloride				A	A	A	A	A		A
Stannous Fluoride				A	A					A
Starch			A	A	A	A	A	A	A	A
Steam	> 248		A	A	A	N	A	N	A	A
Steep Liquors				A	A					
Stoddard Solvent			A	A	A	A	N	A	A	A
Strontium Nitrate, Aqueous				A	A					A
Styrene (Monomer) (Vinylbenzene)			A	A	A	N	N	C	A	A*
Styrene & Di- Nitrochlorobenzene				A	A					
Sugar, Aqueous			A	A	A	A	A	A	A	A
Sulfahydrate				A	A					
Sulfate Liquors, Acid			A	A	A					A
Sulfate Liquors, Base			A	A	A					A
Sulfur in Water				A	A					A
Sulfur Chloride, Aqueous	cold		A	A	A	N	N	A	A	A
Sulfur Dioxide, Dry			A	A	A	N	A	A	A	A
Sulfur Dioxide, Wet			N	A	N	N	A	N	A	A
Sulfur Dioxide & Water			N	A	A	N	A	A	A	A
Sulfur, Molten			A	A	A	N	N	N	A	A
Sulfur Trioxide, Dry			A	A	A	N	C	A	A	A
Sulfur Trioxide, Wet			A	C	A	N	C	A	A	A
Sulfate of Lime				A	A					A
Sulfide of Hydrogen				A	A					A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Sulfide of Sodium	hot			A	A					A
Sulfide of Sodium	cold			A	A					A
Sulfite Pulp (Paper Pulp)				A	A					A
Sulpholignis Salts		conc		A	A					
Sulpholignis Salts		dilute		A	A					
Sulphonated Fatty Alcohol			A	A	A	A		A	A	A
Sulphonated Vegetables Oils			A	A	A	A		A	A	A
Sulphuric Chlorohydrin			N	A	A	N	N	N	A	A
Sylvite (Potassium Chloride)			A	A	A	A	A	A	A	A
Syrup (Sucrose Soin.)			A	A	A	A	A	A	A	A
Tall Oil	203		C	A	A	C			A	A
Tallow			A	A	A	A	C	A	A	A
Tanning Liquors			A	A	A	A	A	A	A	A
Tar & Ammonia w/ Water			A	A	A	C	N	A	A	A
Tar, Pine			A	A	A	C	A	N	A	A
Tar, Bituminous			A	A	A	C	N	A	A	A
Tar, Hot				A	A					
TCA (Tri-Chloroacetic Acid)				A	A	C	C	N		A*
Teepol®				A	A					
Tetrabromoethane				A	A	N	N	A		A
Tetrachloroethane			A	A	A	N	N	A	A	A
Tetrachloroethylene			A	A	A	N	N	A	A	A
Tetra Ethyl Lead			A	A	A	C	N	A	A	A
Tetrahydro Benzene (Cyclohexene)			A	A	A	C	N	A	A	A
Tetrahydrofuran			A	A	A	N	C		A	A
Tetramine C				A	A					
Tetraphenyl			A	A	A				A	A
Therminol # 1, 2 & 3			A	A	A			A	A	A
Thinner for Cellulose Lacquer				A	A					
Thinner for Oil Paint				A	A					

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Thiol				A	A				A	A
Titanium Tetrachloride			A	A	A	C	N	A	A	C*
Toluene (Toluol) (Methylbenzene)			A	A	A	N	N	A	A	A
Tomato Pulp			A	A	A	A		A	A	A
Tooth Paste				A	A					
Toxaphene				A	A				A	A
Transformer Oil				A	A	A	N	A		A
Trichlorhydrin				A	A					
Trichlorobenzene			A	A	A				A	A
Trichloroethane, Dry			A	A	A	N	N	A	A	A
Trichloroethane, Wet				A	A	N	N	A	A	A
Trichloroethylene, Dry			A	A	A	N	N	A	A	A
Trichloroethylene, Wet			A	A	A	N	N	A	A	A
Trichloronitromethane			A	A	A				A	A
Tricresyl Phosphate			A	A	A	N	A	C	A	A
Triethanolamine (TEA)				A	A	C	A	N		A*
Triethylamine			A	A	A	A		A	A	A*
Trifluorovinylchloride			A	A	A				A	A
Trisodium Phosphate			A	A	A	A		A	A	A
Tung Oil (Chinawood Oil)			A	A	A	A	N	A	A	A
Turpentine			A	A	A	A	N	A	A	A
Ucon Oil®				A	A					A
UDMH (Dimethyl Hydrazine)			A	A	A	C	A	N	A	A
Urea, Anhydrous (Carbamide)	all	100	A	A	A	N		A	A	A
Urea, Wet (Carbamide)	all	all	A	A	A	N		A	A	A
Urea & Phenolic Resins				A	A				A	A
Urine			A	A	A	A		A	A	A
Varnish, Aromatic			A	A	A	N	N	A	A	A
Varnish, Non- Aromatic			A	A	A	C	N	A	A	A
Vegetable Juices			A	A	A	A		A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Vegetable Oils			A	A	A	A	N	A	A	A
Vetrocoke Solution, Wet			A	A	A			A	A	A
Vinegar			A	A	A	C	A	A	A	A
Vinyl Acetate				A	A					A
Vinyl Chloride (Chloroethene, Chloroetylene)			A	A	A			A	A	A
Vinylidine Chloride			A	A	A				A	A
Vinyl Pyridine			A	A	A				A	A
Vitamine C (Ascorbic Acid)				A	A					A
Vitriole, White			A	C	A	A	A	A	A	A
Water, Boiler Feed			A	A	A	A	A	A	A	A
Water, Brackish			A	A	A	N	N	A	A	A
Water, Chilled Air Washing				A	A					
Water, Clean Untreated			A	A	A	A	A	A	A	A
Water, Cooling Tower			A	A	A	A	A	A	A	A
Water, Condenser Service				A	A					
Water, Condensate			A	A	A	A	A	A	A	A
Water, Deionized				A	A					A*
Water, Demineralized				A	A					
Water, Detergent				A	A					
Water, Distilled			A	A	A	A	A	A	A	A
Waterflood Service			A	A	A	A		A	A	A
Water, Grit Carrying				A	A					
Water, Fresh			A	A	A	A	A	A	A	A
Water, Heavy			A	A	A	A	A	A	A	A
Water, Hot	< 135		A	A	A	A	A	A	A	A*
Water, Mine			A	A	A	N	N	A	A	A
Water, River			A	A	A	A	A	A	A	A
Water, Salt & Sea, Solution			C	A	A	A	A	A	A	A
Water, Sandy				A	A					
Water, Soapy	<212		A	A	A	A	A	A	A	A

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SEAL SELECTION

Product	Temp. (°F)	Conc. (%)	316L	Carbon Resin Impregnated	Self-Sintered SiC	Buna N	EPDM	SFY (Fluoroelastomer)	PTFE	Kalrez®
Water w/ sol Oil			A	A	A	A	N	A	A	A
Water Glass (Sodium Silicate)			A	A	A	A	A	A	A	A
Waxes				A	A					
Whale Oil				A	A					
Whey				A	A					
Whiskey			A	A	A	A	A	A	A	A
White Liquor			A	A	A	C	C	A	A	A
White Water, Paper Mill			A	A	A	C	C	A	A	A
White Spirit				A	A					
Wine			A	A	A	A	A	A	A	A
Wood Pulp (Stock)				A	A				A	A
Wood Vinegar			A	A	A	N	C	N	A	A
Wort (Beer)			A	A	A	A	A	A	A	A
Xenon				A	A					A
Xylene (Dimethylbenzene)			A	A	A	N	N	A	A	A
Xylol				A	A					A
Xylene, Meta-				A	A					
Xylene, Ortho-				A	A					
Xylene, Para-				A	A					
Yeast				A	A				A	A
Yogurt				A	A					
Zeolite Treated Water			A	A	A	A	A	A	A	A
Zink Acetate				A	A	C	A	N		A
Zink Ammonium Chloride				A	A					A
Zink Chloride, Dry			N	A	A	A	A	A	A	A
Zink Chloride, Wet			N	A	A	A	A	A	A	A
Zink Cyanide			A	A	A	A		A	A	A
Zink Hydrosulfite				A	A					A
Zink Nitrate			A	A	A			A	A	A
Zink Oxide				A	A					A
Zink Phosphate				A	A				A	A
Zink Sulfate			A	A	A	A	A	A	A	A

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TROUBLESHOOTING

INTRODUCTION

Mechanical seals are precision designed and manufactured products, yet one of the most common causes of pump failure is due to the malfunction of its mechanical seal.

By design, mechanical seals are friction contact devices, and can be subjected to a very wide range and often hostile operating environments.

Seals fail for a variety of reasons, from poor installation to incorrect operation of the pump in the field.

Here are a few reasons why mechanical seals fail:

A) Pump

- pump is run dry
- vibration or cavitation
- misalignment or pipe strain
- excessive temperature, pressure, or speed

B) Mechanical Seal

- Incorrect installation (setup length, damage to faces, etc.)
- wrong selection of materials for duty
- insufficient or no auxiliary services to mechanical seal
- excessive temperature, pressure, or speed

In this Troubleshooting section, we attempt to help you find the primary cause of why the mechanical seal has failed. We discuss how to use the evidence of failed seals to establish what was, or still is, happening inside the seal chamber area.

When troubleshooting a seal, use the complete seal and not just the parts that seem to be important. For successful analysis, both rotating and stationary seal must be collected together with the involved elastomers and springs.

When parts of the seal are separated after removal from the pump, they should be kept together and tagged. Seal faces must also be protected from damage, as this is usually the area that provides the most clues.

Even though the troubleshooting may be of little help for the pump that contained the seal, quite often this type of troubleshooting turns up common problems.

TROUBLESHOOTING

TROUBLESHOOTING CHART

PROBLEM	PROBABLE CAUSE	REMEDY
Narrow wear track	Seal has been overpressurized and has bowed away from the pressure. Causes the seal to seal only on a portion of the face width.	Seal must be changed to a higher pressure, more rugged design.
No wear track	Both seal faces are rotating with each other.	Ensure that the drive mechanism or anti rotation devices are working correctly.
No wear track - shiny spots on face	Caused by too much pressure, or improper clamping of the stationary face. Indicates that the seal was probably leaking from start-up. Leakage causes the o-ring to hang up and the seal can no longer clean itself.	Seal must be changed to a higher pressure, more rugged design. Ensure that the stationary face is clamped properly.
Chipped edges on either or both faces	Caused by a large separation in faces and consequent breaking when they slam back into each other. Most often associated with Flashing, which is most common in hot water systems or in fluids that may have water condense in them. When water changes from liquid to gas, its volume expands thousands of times, causing a large separation in the faces. Can also be caused by severe cavitation of the pump. (Usually, small vibrations, misalignment and the like can not cause the breakage because they do not separate the faces enough.)	Use a single flush or double seal to keep the faces running on a cooling fluid film preventing fialure. Ensure the pump is operating at the correct pressure and speed. Ensure the spring tension is not excessive due to incorrect fitting of the seal.
Widened wear track	An indication of misalignment of the pump usually caused by bad bearings, shaft whip, shaft deflection, a bent shaft or sever pipe strain.	Ensure the described causes are eliminated. Ensure the pump is operating at the correct pressure and speed.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
Pitting, blistering, corrosion of the carbon faces	The carbon used in the CL Series Mechanical Seals is selected for corrosive applications, and should not be subject to these problems. However, these problems occur when the wrong carbon is being used, or when retrofitted by someone other than the original manufacturer. Most seal carbons use an impregnated face and this is not obtainable when a carbon is machined from tube stock.	Corrosive attack of carbon can be stopped by selecting carbons that are relatively binder free. In the few fluids which attack a pure carbon or carbon graphite such as nitric acid, oleum, chlorosulphonic acid, and some exotic highly oxidizing acids, the alternative is to use a PTFE or filled PTFE face. Faces made from PTFE are a poor substitute for carbon, but are appropriate for the few fluids where pure carbon is not compatible.
Broken seal faces	Some seal faces are subject to heat shock or cold shock. This most often occurs when the material is heated unevenly and then subject to a rapid change in temperature. In many industries, pumps are cleaned by hosing them down, or incorporating a CIP cycle. If the stream of water hits a face (such as tungsten carbide) that is running hot, it will cause it to fracture. Broken seal faces can also be caused by seal faces sticking together during a longer stip (e.g. over night), or when processing a product with tacky poperties (e.g., sugar solutions). High turning moments at start up due to the faces stuck together can cause the rotary face to fail.	Ensure the seal never runs dry within the procss involved. If the process involves stages twith lack of product a single flush or a double seal arrangement should be choosen to prevent dry running. Apply a single flush or double seal to prevent sticking of the seal faces.
Worn position in the rotary seal.	Usually means the flush line or product recirculation line has been directed at the carbon face causing erosion.	If a flush line is used in the pump configuration, it should be directed tangentially to the carbon face.
Wear at the pin or notch.	Seal designs all use some way to transmit torque from the shaft to the rotary face. Wear on the pin or notch often happens when the seal is assembled and the pin is not lined up with the notch in the carbon seal.	Assemble the seals correctly. Refer to the *CL Series Centrifugal Pump Service and Installation Manual (CLSM)* or the *CL Series Centrifugal Pump Maintenance Video (CLMV).*

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
Deep wear in the hard face	This often accompanies externally mounted seals in misaligned pumps, and seals in severe abrasive service. It is caused by face separation letting large particles between the faces. These particles then embed in the carbon face and grind the hard face. This can occur in crystallizing products, also, where high face heat causes some products to change to abrasive crystals. This problem is often compounded by the reuse of the carbon face because it shows little wear.	Use hard faces such as Silicon Carbide, and flush the crystals or solids away with an external low pressure flush. Double seals with a pressurized sealant can also be used, but it is normally an expensive option for this particular application.
Discoloration of seal parts	Caused by high friction between the seal faces. Further evidence in o-ring hardening and setting may support this. The most probable cause is dry running, flashing, or very poor face lubrication. The seal faces will also show signs of excessive wear and possible heat distress in the form of thermal cracking.	Ensure the seal never runs dry within the process. If the process involes stages with lack of product, use a single flush or double seal. Ensure the tension is not excessive due to incorrect fitting of the seal.
Worn drive tabs or slots	This is caused by "slip stick". If the two faces stick together, the tab drive will load up with a high stress. This is then transferred back to the face causing it to accelerate and then stick again. Instead of a smooth rotary motion, the face is being beaten around in its circular path. Caused by a lack of lubrication on the faces, which can be caused by a variety of problems: • Incorrect fitting of the seal • tacky or sticky pumped fluids. • the fluid being sealed has poor lubricating properties • pump cavitation • on vertical pumps, air trapped in the pump housing.	Fit the seals correctly. Contact Tri-Clover for assistance. Use a double seal arrangement to keep the faces running on a lubricating fluid film preventing a failure due to the product's poor lubricating properties.
Rubbing	• Flushing lines coming into the seal chamber housing and extending into the seal chamber itself. • Gasket slip into the seal cavity. • Rotary or stationary seal which does not pilot and come in contact with the rotating shaft. • Build up of scale in the seal cavity. • Seal area not concetric with the shaft.	Ensure the described causes are eleminated.

TROUBLESHOOTING

PROBLEM	PROBABLE CAUSE	REMEDY
Spring breakage	Usually caused by chemical attack at the same time the device is being stressed. Stress corrosion cracking is commonly seen in seals when stainless steel springs are used in certain fluids. When the fluid being sealed contains chlorine, bromine, iodine, fluorine, and ions or compounds of these elements, they often will attack the chrome oxide layer that protects most grades of stainless steel. While the oxide layer is being attacked, the flexing will open up small cracks. If the oxide particles wedge into these cracks, a sudden failure can occur. Fatigue failure occurs when a portion of the spring is extended too much or flexed in torsion. When the seal is mounted externally, the spring is not actually in the pumped media, and can only be attacked if the primary seal fails. In the standard configuration, CL Series seals are always mounted externally.	Ensure the seal is kept clean from foreign solutions. If failure occurs, contact Tri-Clover for assistance.
Swollen, sticky, or disintegrating elastomer	This is a sign of chemical incompatibility.	Use a different material. The Seal Selection section shows how different materials stand up to different materials.
Hardening, charring, cracking, or a burned appearance of the elastomer. Changed shape of the elastomer or o-rings, etc.	These are all signs of excessive heat. Usually, the source of the heat is the face or a metal to metal contact of two parts. Excessive face heat is caused by lack of lubrication and subsequent high friction. It could also be a sign that the pump has run dry.	Ensure the seal never runs dry within the process involved. If the process involves stages with lack of product, a single flush or a double seal arrangement should be choosen to prevent dry running. Use a double seal arrangement to keep the faces running on a lubricating film, preventing a failure due to the product's poor lubricating properties. Look for signs of metal to metal contact.

PARTS LIST

ORDERING INFORMATION

The exploded view and parts key facilitate ordering repair parts for CL Series seals from Tri-Clover. All seal parts for the CL pump are keyed to the parts list.

DG - EXTERNAL BALANCED SEAL

Key#	DESCRIPTION	QTY
5	O-ring	1
15	Rotating Seal, including cup	2
16	Spring	1
17	Drive collar	1

FG - WATER COOLED SINGLE SEAL

Key#	DESCRIPTION	QTY
5	O-ring, Seal	2
15	Rotating Seal, including cup	2
16	Spring	1
18	Drive Collar, Stainless Steel	1
19	Pin, Drive Collar	1
20	O-ring, Stuffing Box	1
21	Single Flush Lip Seal	1
22	Stuffing Box	1
23	Screw, Stuffing Box	2
24	Flush Pipe	2

EG - WATER COOLED BALANCED DOULBE SEAL

Key#	DESCRIPTION	QTY
5	O-ring, Seal	2
15	Rotating Seal, including cup	2
16	Spring	1
20	O-ring, Stuffing Box	1
23	Screw, Stuffing Box	2
24	Flush Pipe	2
25	Spacing Ring	1
26	Stationary Seal, Rear	1
27	O-ring, Stationary Seal	1
28	Stuffing Box	1

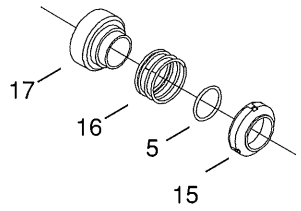
YG -JOHN CRANE DOUBLE 8 SEAL

Key#	DESCRIPTION	QTY
20	O-ring, Stuffing Box	1
26	Stationary Seal, Rear	1
27	O-ring, Stationary Seal	1
47	Stuffing Box	1
48	John Crane Double 8 Seal	1

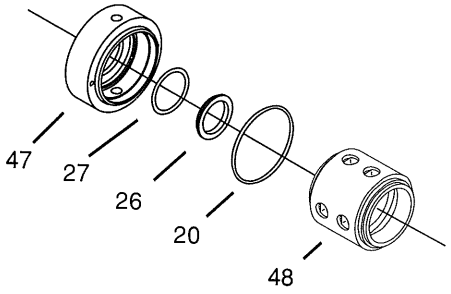
PARTS LIST

ORDERING INFORMATION

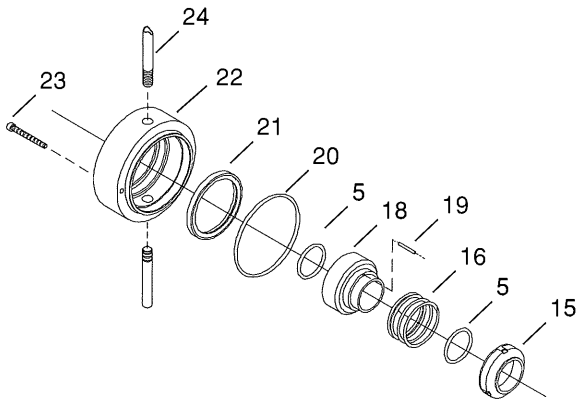
TYPE DG - EXTERNAL BALANCED SEAL



JOHN CRANE DOUBLE 8 SEAL



TYPE FG - WATER COOLED SINGLE SHAFT SEAL



TYPE EG - WATER COOLED BALANCED DOUBLE SHAFT SEAL