

Chemical Resistant Seal and Gasket Materials

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Materials - Short List

1. Kalrez and equivalents
2. Viton and equivalents
3. Polyethylene
4. Polypropylene

Forms - Short List

1. Small Square thin sheets
2. Compression molded parts

Vendors - Short List

Fluoroelastomers:

1. Green-Tweed
2. Siverson Design

Polyethylene - Polypropylene

1. McMaster-Carr
2. Laird
3. US Plastics

Greene-Tweed Materials



TYPICAL PROPERTIES

Reference Document No. TP-534

Material Name: CHEMRAZ® 534	Rubber Classification (ASTM D1418): FFKM	Service Temperature Range: -30°C to 220°C (-22°F to 428°F)	Color: WHITE
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DESCRIPTION	TYPICAL
Original Properties	
Specific Gravity (ASTM D297)	2.12
Hardness, Shore A, Points (ASTM D2240), Buttons	70
Tensile Strength, psi (ASTM D1414)	1460
Elongation, % (ASTM D1414)	190
Modulus @ 100% Elongation, psi (ASTM D1414)	680
Modulus @ 50% Elongation, psi (ASTM D1414)	300
Compression Set @ 25% Deflection	
70 Hrs. @ 400°F, In Air, % Of Original Deflection (ASTM D395)	25

Note

Unless otherwise noted, all tests performed on dash 214 O-Rings.

Greene-Tweed Materials



TYPICAL PROPERTIES

Reference Document No. TP-537

Material Name:	Rubber Classification	Service Temperature Range:	Color:
CHEMRAZ [®] 537	(ASTM D1418): FFKM	-30°C to 220°C (-22°F to 428°F)	WHITE

DESCRIPTION	TYPICAL
Original Properties	
Specific Gravity (ASTM D297)	2.22
Hardness, Shore A, Points (ASTM D2240), Buttons	80
Tensile Strength, psi (ASTM D1414)	1600
Elongation, % (ASTM D1414)	165
Modulus @ 100% Elongation, psi (ASTM D1414)	1050
Modulus @ 50% Elongation, psi (ASTM D1414)	540
Compression Set @ 25% Deflection	
70 Hrs. @ 400°F, In Air, % Of Original Deflection (ASTM D395)	25

Note

Unless otherwise noted, all tests performed on dash 214 O-Rings.

Greene-Tweed Materials

TYPICAL PROPERTIES

Reference Document No. TP-565

Material Name: CHEMRAZ® 565	Rubber Classification (ASTM D1418): FFKM	Service Temperature Range: -30°C to 220°C (-22°F to 428°F)	Color: BLACK
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DESCRIPTION	TYPICAL	
Original Properties		
Specific Gravity (D297)	1.93	
Hardness, Shore A, Points (D2240), Buttons	75	
Tensile Strength, psi (D1414)	1750	
Elongation, % (D1414)	140	
Modulus @ 100% Elongation, psi (D1414)	1150	
Modulus @ 50% Elongation, psi (D1414)	450	
Fluid Aging		
70 Hrs. @ 347°F, In Stauffer 7700	Hardness Change, Points (D471)	+2
	Tensile Change, % (D471)	-2
	Elongation Change, % (D471)	-2.8
	Volume Change, % (D471)	+1
70 Hrs. @ Room Temperature, In ASTM Reference Fuel B	Hardness Change, Points (D471)	+1
	Tensile Change, % (D471)	-16
	Elongation Change, % (D471)	-11
	Volume Change, % (D471)	+1.9
70 Hrs. @ 250°F, In Distilled Water	Hardness Change, Points (D471)	-4
	Tensile Change, % (D471)	-11
	Elongation Change, % (D471)	-3.5
	Volume Change, % (D471)	+1.45
70 Hrs. @ 250°F, In Steam	Hardness Change, Points (D471)	-4
	Tensile Change, % (D471)	-8
	Elongation Change, % (D471)	-8
	Volume Change, % (D471)	+1.2
Compression Set @ 25% Deflection		
70 Hrs. @ 400°F, In Air, % Of Original Deflection (D395)	25	
1000 Hrs. @ 300°F, In Air, % Of Original Deflection (D395)	41	
1000 Hrs. @ 300°F, In Air (4 More Hr. PC @ 300°F), % Of Original Deflection (D395)	26	

Greene-Tweed Materials

TYPICAL PROPERTIES

Reference Document No. TP-618

Material Name: CHEMRAZ® 618	Rubber Classification (ASTM D1418): FFKM	Service Temperature Range: -18°C to 324°C (-0°F to 615°F)	Color: BLACK
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DESCRIPTION	AMS 7257C REQUIREMENT	TYPICAL CHEMRAZ 618
Original Properties		
Specific Gravity (D297)	As Determined	1.99
Hardness, Shore A, Points (D2240)	70 - 80	75
Tensile Strength, psi (D1414)	1500 Min.	1925
Elongation, % (D1414)	120 Min.	130
Modulus @ 100% Elongation, psi (D1414)	-	1275
Modulus @ 50% Elongation, psi (D1414)	-	370
TR 10/50, Deg. F (D1329)	+41 Max.	+18
Air Aging		
70 Hrs. @ 554°F (D1414):	% Change Tensile	-20 max.
	% Change Elongation	-5 max.
	Durometer Chg., points	-5 to +5
	% Weight Loss	-5 max.
Fluid Aging		
70 Hrs. @ 347°F In AMS 3021:	% Change Tensile	-10 max.
	% Change Elongation	-15 max.
	Durometer Chg., points	-5 to +5
	% Volume Swell	0 to +5
70 Hrs. @ 255°F ± 5°F In AS1241 Type IV:	% Change Tensile	-40 max.
	% Change Elongation	-15 max.
	Durometer Chg., points	-15 to 0
	% Volume Swell	0 to +15
70 Hrs. @ 77°F In ASTM REF Fuel B:	% Change Tensile	-20 max.
	% Change Elongation	-15 max.
	Durometer Chg., points	-5 to +5
	% Volume Swell	0 to +5
% Compression Set		
70 Hrs. @ 446°F In Air	40 max.	16

Greene-Tweed Materials

1. Chemraz 4079
2. Fluoromer 900

Compound 4079--- A low compression set compound for general purpose use in O-rings, diaphragms, seals and other parts used in the process and aircraft industries. It is a carbon black filled compound with excellent chemical resistance, good mechanical properties and outstanding hot air aging properties. It exhibits low swell in organic and inorganic acids and aldehydes and has good response to temperature cycling effects. A maximum operating temperature of 316°C (600°F) is recommended, with short excursions to higher temperatures possible. This compound is not recommended for use in hot water/steam applications or in contact with certain hot aliphatic amines, ethylene oxide and propylene oxide.

Kalrez Compounds

KALREZ®, a Dupont product that is not a true elastomer so you will experience some compression set depending upon the compound you select. You have a few choices of compounds:

Compound 4079, A "low compression set" compound (about 25% compression at 400°F) (205°C). Can be used to 600°F (316°C) Not recommended for hot water or steam applications, or in contact with certain hot aliphatic amines, ethylene oxide and propylene oxide.

Compound 1050, Slightly harder than 4079. Can be used to 500°F (260°C) in non-oxidizing environments. Not recommended for pure water or steam at higher temperatures. This compound is scheduled to be phased out of production.

Compound 2035, To 425°F (218°C) It is the compound recommended for Ethylene Oxide and Propylene Oxide service. It also exhibits low swell in organic and inorganic acids, esters, ketones, and aldehydes.

Compound 1018, To 550°F (288°C). It has better hot water/ steam resistance than all other compounds except 3018. Not recommended for use in organic or inorganic acids at high temperature or for rapid temperature cycling applications.

Compound 3018, To 600°F (315°C). It has the best hot water/steam resistance and the best high-pressure extrusion resistance. It is too hard for most mechanical seal applications at temperatures below 400°F (205°C).

Chemraz Compounds

Compound Name	Handling, Cleaning, Packaging, Designator Options	Compound Type	Compound Color	Service Temp Range (C)	Specific Gravity	Hardness (Shore A)	Compression Set (%)†	Tensile Strength psi (kPa)	Elongation (%)	Modulus 50% Elongation psi (kPa)	Modulus 100% Elongation psi (kPa)
Chemraz 513	SC SS	Perfluoro	White	-30 to 210	2.22	80	25	1660 (11032)	165	540 (3723)	1050 (7239)
Chemraz 520	SC SS	Perfluoro	White	-30 to 240	2.10	90	35	1950 (13445)	110	990 (6826)	1780 (12273)
Chemraz 550	SD	Perfluoro	Black	-30 to 210	1.93	75	25	1750 (12066)	140	450 (3103)	1150 (7929)
Chemraz 570	SD	Perfluoro	White	-30 to 210	1.98	70	35	1300 (8963)	145	350 (2413)	780 (5378)
Chemraz 571	SD	Perfluoro	White	-30 to 210	1.99	80	35	1550 (10687)	130	625 (4309)	1240 (8549)
Chemraz 592	SS	Perfluoro	White	-30 to 240	2.07	85	36	2100 (14479)	120	700 (4826)	1770 (12204)
Chemraz 653	SD	Perfluoro	Black	-15 to 325	1.99	80	14 26**	1830 (12618)	135	360 (2482)	1090 (7516)
Chemraz E38	SS	Perfluoro	White	-20 to 260	1.99	80	21	2200 (15169)	150	410 (2827)	1100 (7585)
Chemraz HT300	SC	Perfluoro	White	-20 to 300	2.14	85	17	2100 (14480)	175	600 (4137)	1100 (7585)
Chemraz 661	SS	Perfluoro	White	-20 to 240	2.11	80	17	2620 (18065)	140	400 (2758)	1200 (8274)
Fluoro-elastomer 742	SP	Fluorocarbon	Black	-30 to 250	1.82	75	20	2050 (14134)	182	600 (4137)	1026 (7074)
Fluoro-elastomer 931	SP	Fluorocarbon	Black	-30 to 250	1.81	90	27	2245 (15479)	107	936 (6453)	1950 (13445)
Fluoraz 888	SP	FEPM Fluoro elastomer	Tan	0 to 230	1.56	70	48	3320 (22892)	325	190 (1310)	455 (3137)

Chemraz

CHEMRAZ is distributed by Greene, Tweed & Company, telephone (714) 875 3301. It is similar to KALREZ and can be used to 400°F (205°C).

FLUORAZ - is another product distributed by Greene Tweed & Company, telephone (714) 875 3301. It can be used to 400°F (205°C). Field experience indicates that in operation it appears to be very similar to AFLAS.

AFLAS is distributed through the 3M company, telephone (612) 733 5353. It can be used to 400°F (205°C)

Aegis

Aegis

Perfluoroelastomers (PF)

Description: Excellent resistance to all chemicals. Excellent outgassing performance in vacuum environments.

Limitations: Avoid low-molecular-weight, fully halogenated fluids and molten alkali metals. Strong oxidizing acids may cause some swelling. Poor compression set may not be suitable for some applications. Helium permeability is slightly higher than fluoroelastomer compounds. Specific AEGIS compounds provide better low-temperature performance and amine resistance.

Chemistry: Copolymer of tetrafluoroethylene and perfluorovinyl ether.

Trade Names: AEGIS, Chemraz, Parofluor

ASTM D1418 Designation: FFKM

ASTM D2000/SAE J200 Type, Class: JK, HK

Temperature Range: -20 to 300C (-4 to 572F)

Aegis Compounds

AEGIS Compound: SC1001

International Seal - Freudenberg-NOK compound AEGIS SC1001 is a 78-durometer, black, low-compression set, high-strength perfluoroelastomer. The operating temperature range for SC1001 is from -10°C to 230°C (-14°F to 446°F). Typical application environments for SC1001 seals are aggressive acids, bases and solvents. SC1001 is also suited for many non-oxidizing dry process chemistries. SC1001 can be used in place of compound 4079 (below 230°C), 6375 (below 230°C), and 1050LF. Used in wet chemical applications below 230C.

AEGIS Compound: SC1070

International Seal - Freudenberg-NOK compound AEGIS SC1070 is a 72-durometer, black, high temperature perfluoroelastomer. The operating temperature range for SC1070 is from -10°C to 300°C (-14°F to 572°F). Typical application environments for SC1070 seals are aggressive acids, bases and solvents. SC1070 can be used in place of compound 4079. Used in high heat, dry applications below 300C.

AEGIS Compound: SC1005

International Seal - Freudenberg-NOK compound AEGIS SC1005 is an 89-durometer, black, low-compression set, high-strength perfluoroelastomer. The operating temperature range for SC1005 is from -10°C to 230°C (-14°F to 446°F). Typical application environments for SC1005 seals are aggressive acids, bases and solvents. SC1005 is formulated to provide very good extrusion resistance for seals operating in high-pressure environments.

AEGIS Compound: SC1071

International Seal-NOK compound AEGIS SC1071 is a 72-durometer, ivory, high temperature perfluoroelastomer. The operating temperature range for SC1071 is from 10°C to 300°C (-14°F to 572°F). Typical application environments for SC1071 seals are aggressive dry process chemistries, including reactive plasmas.

AEGIS Compound: SC1011

International Seal - Freudenburg-NOK compound AEGIS SC1011 is A 80 -durometer, white low-compression set, highs trength perfluoroelastomer. The operating temperature range for SC1011 is from -10C to 230C (-14F to 446F). Typical application environments for SC1011 seals are aggressive dry process chemistries, including reactive plasmas.

AEGIS Compound: SC1090

International Seal - Freudenberg-NOK compound AEGIS SC1090 is a 61-durometer, translucent, clean perfluoroelastomer. The operating temperature range for SC1090 is from -10C to 260C (-14F to 500F). Typical application environments for SC1090 seals are aggressive dry process chemistries, including reactive plasmas, as well as aggressive acids, bases and solvents.

Simriz Compounds

Simriz® Cpd#	Color	Hardness Shore A	Upper Service Temperature	Tensile Mpa (Psi)	Elongati on %	Modulus @ 100% MPa (psi)	Comp Set 70Hr @ 200°C	Tempera ture Retractio n 10%
SZ481	Black	71	230°C (446°F)	17.1 (2,480)	260	3.7 (535)	27	-14 °C
SZ484	Black	76	230°C (446°F)	22.1 (3205)	165	8.0 (1160)	34	6 °C
SZ485*	Black	76	230°C (446°F)	18.5 (2680)	195	5.7 (825)	25	5 °C
SZ486	White	78	230°C (446°F)	18.0 (2610)	190	8.5 (1230)	25	5 °C
SZ487	Black	79	310°C (615°F)	18.7 (2710)	170	8.6 (1245)	26	0 °C
SZ488	Ivory	73	300°C (572°F)	17.0 (2,465)	190	5.7 (825)	27	0 °C
SZ489	Clear	69	260°C (500°F)	13.5 (1960)	235	2.7 (390)	20	0 °C
SZ134	Black	89	230°C (446°F)	21.5 (3117)	160	16.6 (2407)	25	-4 °C

Simriz Compounds

Simriz® Compound: SZ481

SZ481 is a 70-durometer, black, low-compression set, high-strength perfluoroelastomer. The operating temperature range is from -10°C to 230°C (-14°F to 446°F). Typical application environments are aggressive acids, bases and solvents. Z1001 is also suited for many non-oxidizing dry process chemistries. Z1001 can be used in place of Kalrez® compound 6375 when temperature are below 230°C.

Simriz® Compound: SZ484

SZ484 is a FDA compliant, 75-durometer, black, low-compression set, high-strength perfluoroelastomer. The operating temperature range is from -10°C to 230°C (-14°F to 446°F). Typical application environments are aggressive acids and bases.

Simriz® Compound: SZ485* (Standard compound, most readily available and cost effective)

SZ485 is a 75-durometer, black, low-compression set, high-strength perfluoroelastomer. The operating temperature range is from -10°C to 230°C (-14°F to 446°F). Typical application environments are aggressive acids, bases, solvents, and steam. Z1005 is also suited for many non-oxidizing dry process chemistries. Z1005 can be used in place of Kalrez® compound 6375 when temperature are below 230°C.

Simriz® Compound: SZ486

SZ486 is A 80 -durometer, white low-compression set, high strength perfluoroelastomer. The operating temperature range is from -10C to 230C (-14F to 446F). Typical application environments for Z1006 seals are aggressive dry process chemistries, including reactive plasmas.

Simriz® Compound: SZ487

SZ487 is a 75-durometer, black, high temperature perfluoroelastomer. The operating temperature range is from -10°C to 310°C (-14°F to 615°F). Typical application environments are aggressive acids, bases and solvents. Z1007 can be used in place of Kalrez® compound 4079. Used in dry, high heat below 310C.

Simriz Compounds

Simriz® Compound: SZ487

SZ487 is a 75-durometer, black, high temperature perfluoroelastomer. The operating temperature range is from -10°C to 310°C (-14°F to 615°F). Typical application environments are aggressive acids, bases and solvents. Z1007 can be used in place of Kalrez® compound 4079. Used in dry, high heat below 310C.

Simriz® Compound: SZ488

SZ488 is a 70-durometer, ivory, high temperature perfluoroelastomer. The operating temperature range is from -10°C to 300°C (-14°F to 572°F). Typical application environments for Z1008 seals are aggressive dry process chemistries, including reactive plasmas.

Simriz® Compound: SZ489

SZ489 is a 65-durometer, clear, **clean** perfluoroelastomer. The operating temperature range is from -10C to 260C (-14F to 500F). Typical application environments for Z1009 seals are aggressive dry process chemistries, including reactive plasmas, as well as aggressive acids, bases and solvents.

Description: Excellent resistance to almost all chemicals. Excellent outgassing performance in vacuum environments.

Limitations: Avoid low-molecular-weight, fully halogenated fluids and molten alkali metals. Especially strong oxidizing acids may cause some swelling. Helium permeability is slightly higher than fluoroelastomer compounds. Specific Simriz® compounds provide better low-temperature performance and amine resistance.

Chemistry: Copolymer of tetrafluoroethylene and perfluorovinyl ether.

Trade Names: Simriz®, [Kalrez®](#), [Chemraz®](#), [Parofluor®](#)

Viton - *Hexafluoro-propylene-vinyl-idene fluoride*

Fluoroelastomers (Viton)

Description: Excellent resistance to petroleum products and solvents. Very good high-temperature performance. Fluorocarbon elastomers make up the most widely used seals in the semiconductor industry.

Limitations: Avoid polar solvents, amines, anhydrous ammonia, SKYDROL, hydrazine and hot acids.

Chemistry: Copolymer of vinylidene fluoride and hexafluoropropylene, although many more exotic versions exist for improved chemical resistance or low temperature performance.

Trade Names: VITON, FLUOREL, TECHNOFLON, DAI-EL

ASTM D1418 Designation: FKM

ASTM D2000/SAE J200 Type, Class: HK

Temperature Range: -40 to 200C (-40 to 392F)

Typical Uses: Crystal Growth, Epitaxial Silicon, LPCVD/Oxidation, Coater/Developer, CVD, Dry Etch, Wet Etch, Cleaning, Resist Stripping, Ion Implant, PVD

Super Viton

Super Viton
Highly Fluorinated Fluoroelastomers (VITON ETP)

Description: Excellent resistance to most chemicals. The performance of these products is greater than traditional fluoroelastomers.

Limitations: Contamination performance is somewhat less than AEGIS™ Perfluoros. Avoid service in strong bases or amines.

Chemistry: These compounds may be terpolymers of fully fluorinated monomers, a cure-site monomer or ethylene.

Trade Names: CV75, Chemtemp, Hifluor

ASTM D1418 Designation: None

ASTM D2000/SAE J200 Type, Class: HK

Temperature Range: -20 to 200C (-4 to 392F)

Viton Compounds

VITON® (A)

Description: Excellent resistance to petroleum products and solvents. Very good high-temperature performance. Fluorocarbon elastomers make up the most widely used seals in the semiconductor industry.

Limitations: Avoid polar solvents, amines, anhydrous ammonia, SKYDROL, hydrazine and hot acids.

Chemistry: Copolymer of vinylidene fluoride and hexafluoropropylene, although many more exotic versions exist for improved chemical resistance or low temperature performance.

Trade Names: VITON®, FLUOREL®, TECHNOFLON®, DAI-EL®

ASTM D1418 Designation: FKM (FPM in Europe) **ASTM D2000/SAE J200 Type, Class:** HK

Temperature Range: -40° to 200°C (-40° to 392°F)

Typical Uses: Crystal Growth, Epitaxial Silicon, LPCVD/Oxidation, Coater/Developer, CVD, Dry Etch, Wet Etch, Cleaning, Resist Stripping, Ion Implant, PVD

Compound#	Color	Hardness Shore A	Tensile Mpa (Psi)	Elongation %	22Hr C/S @ 200C	Low Temp	High Temp
V1000	Black	75	12.1 (1750)	210	10	-25°C (13°F)	200°C (392°F)

Viton Compounds

VITON® ETP Highly Fluorinated Fluoroelastomers (VITON® ETP)

Description: Excellent resistance to most chemicals. The greater performance than traditional Viton® fluoroelastomers. Cost-effective replacement for perfluoroelastomers like Kalrez®, Chemraz®, or Simriz® when temperatures are below 400°F.

Limitations: Contamination performance is slightly less than Perfluoroelastomers.

Chemistry: These compounds may be terpolymers of fully fluorinated monomers, a cure-site monomer or ethylene.

Trade Names: CV75, Chemtemp®, Hifluor®

ASTM D1418 Designation: None

ASTM D2000/SAE J200 Type, Class: HK

Temperature Range: -20° to 200°C (-4° to 392°F)

Typical Uses: Wet Etch, Dry Etch, CVD, Resist Stripping, Coater Developer

Compound#	Color	Hardness Shore A	Tensile Mpa (Psi)	Elongation %	70Hr C/S @ 200C	Low Temp	High Temp
V1020	Black	78	17.9 (2,590)	145	17	-20°C(-4°F)	200°C(392°F)

Aflas Compounds

Description: Excellent resistance to acids, bases, water and amines. Widely used in oil fields.

Limitations: Avoid polar solvents and aromatic fuels. Compression set performance may be too high for some applications.

Chemistry: Copolymer of tetrafluoroethylene and propylene.

Trade Names: AFLAS ® , FLUORAZ ®

Temperature Range: -10° to 200°C (14° to 400°F)

A unique fluoroelastomer based on a copolymer of tetrafluoroethylene (TFE) and propylene (P) was developed by Asahi Glass (Japan) and sold under the AFLAS trade name. TFE/P polymers exhibit improved chemical resistance to base and amine chemical environments compared to traditional FKM polymers.

Typical Uses: Oil Fields, Coater/Developer, Resist Stripping, CMP, Cleaning

AFLAS Chemical Compatibility

Chemicals	Materials			
	Kalrez® 4079 20°C	EP, EPDM 20°C	Viton® 20°C	Chemraz® 505 20°C
Inorganic				
ACIDS				
Hydrochloric (conc)	OK	NO	OK	OK
Sulfuric (conc)	OK	NO	OK	OK
Hydrofluoric (40%)	OK	NO	OK	OK
Aqua regia	OK	NO	-	OK
ALCOHOLS				
Benzyl	OK	OK	OK	OK
Ethyl	OK	OK	OK	OK
Isopropanol	OK	OK	OK	OK
Methyl	OK	OK	NO	OK

Elastomeric Material Symbols, Families and Trade Names

SYMBOL	COMMON NAME	COMPOUND TYPE
FFKM	Kalrez™, Chemraz™, Parofluor™	Perfluoroelastomer
TFE/P	Aflas™	Fluorinated copolymer
FKM	Viton™	Fluorocarbon
FVMQ	Fluorosilicone	Fluorosilicone
VMQ	Silicone	Silicone
EPR		Ethylene propylene
AU/AE	Polyurethane	Polyurethane
NBR	Buna	Nitrile

Elastomeric Material Overview

Elastomer (Common Names)	General Description	Advantages	Limitations
*Natural Rubber *Gum Rubber *Polyisoprene	An elastomer made from rubber tree latex.	High elongation & resilience. High tensile strength. Excellent abrasion resistance and good tear resistance. Low compression set. Good flexing qualities at low temperature	Deteriorates when exposed to oils, fuels, solvents & hydraulic fluids. Poor resistance to sunlight, ozone. Not recommended for outdoor applications. Poor high temperature resistance.
*Synthetic Natural *Synthetic Polyisoprene	The synthetic version of natural rubber. No rubber tree latex.	Very similar to natural rubber. Free of allergenic proteins of natural rubber (latex free).	Same limitations as natural rubber.
*Neoprene *Chloroprene *Polychloroprene	A popular elastomer considered by many as a "general purpose" rubber. Often misused as a generic term for the word "rubber".	Good resistance to moderate exposure to ozone, UV, weather as well as oils, greases & solvents.	Poor resistance to strong acids, solvents, esters, Ketones, chlorinated, aromatic and nitro hydrocarbons. See note # 3