Parofluor ULTRA™ Series Perfluorinated Elastomer Materials

Parofluor ULTRA series materials incorporate the ultimate elastomer polymer technology to offer maximum resistance to a broad range of process chemistries. These materials are formulated to retain their physical properties at extremely high temperatures and reduce system contamination (see figures 1-3).

For additional information please visit www.parofluor.com

Figure 1

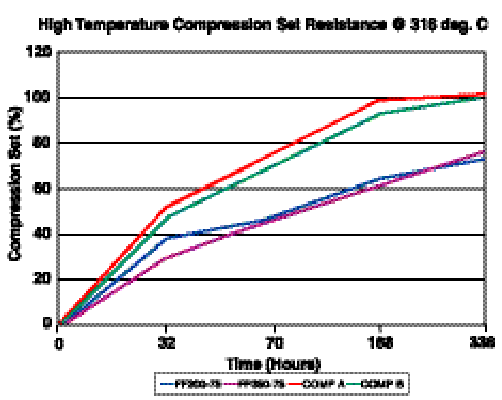


Figure 2

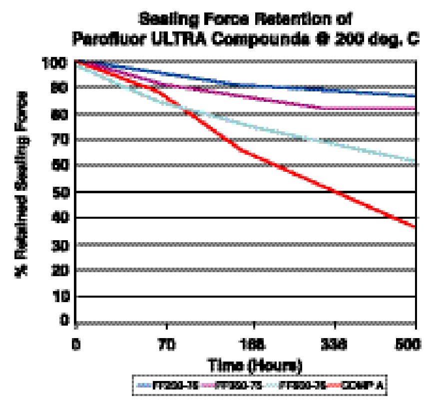
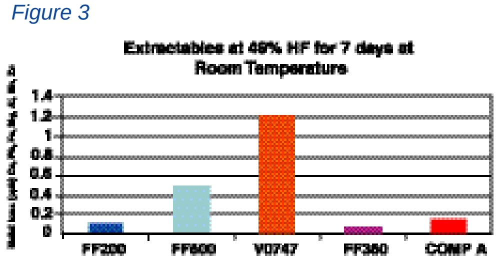


Figure 3



DESIGN ASSISTANCE

Parker Seal offers a dedicated applications engineering staff, finite element analysis (FEA) assisted design, and many other services to assist in the specification of the right Parofluor seal material.
For more information, call 1-859-269-2351.

Total System Solutions: Parker's Seal Group offers a complete line of O-rings, custom molded shapes, composite (rubber/metal and rubber/plastic) seals, PTFE and thermoplastic seals, bumpers, dust covers, diaphragms, isolators, washers and thermoset injection molded boots and bellows for a wide variety of applications. Parker's "total systems sealing" approach can help customers reduce costs and improve efficiency.

Unless otherwise noted, all test values are obtained from a limited number of samples, and should not be used for establishing specific limitations.

07/02-5C-CE

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Perfluorinated Elastomer Media Compatibility Tables for Semiconductor Service

Parofluor™ is a unique, advanced perfluorinated elastomer (FFKM) family developed and produced exclusively by Parker Seals. Perfluorinated elastomers provide performance beyond all other available elastomer families.

Parofluor ULTRA™ series materials are high performance perfluorinated elastomers designed specifically for use in harsh operating environments where superior thermal stability, chemical resistance and ultra high-purity are required.

Parofluor ULTRA™ Materials Offering

Parker Compound	Color	Nominal Hardness (Shore A)	Temperature Range	Features
FF200-75	Black	75	-15°C to 320°C 5°F to 608°F	High temperature, low compression set, chemical resistance
FF202-90	Black	90	-15°C to 320°C 5°F to 608°F	Extrusion resistant, high temperature, low compression set, chemical resistance
FF350-75	White	75	-15°C to 316°C 5°F to 600°F	High purity, high temperature
FF352-75	White	75	-15°C to 316°C 5°F to 600°F	General purpose, high temperature
FF354-65	White	65	-15°C to 316°C 5° F to 600°F	Low closure force material, high temperature
FF500-75	Black	75	-15°C to 260°C 5°F to 525°F	Best chemical resistance

Parofluor™ Materials Offering

Parker Compound	Color	Nominal Hardness (Shore A)	Temperature Range
VI266-65	White	65	-15°C to 300°C 5°F to 572°F
V8545-75	Black	75	-15°C to 300°C 5°F to 572°F
V8562-75	White	75	-15°C to 300°C 5°F to 572°F
V8588-90	Black	90	-15°C to 280°C 5°F to 536°F
V8581-90	White	90	-15°C to 300°C 5°F to 572°F

COMPOUND COMPATIBILITY RATING

1 Satisfactory
2 Fair (normally okay for static seal)
3 Doubtful (sometimes okay for static seal)
4 Unsatisfactory
X Insufficient data

Compatibility rating charts, pages 2-4

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CHEMICAL	FORMULA	Parofluor ULTRA	Parofluor	FKM
Acetic acid 30%	CH_3COOH	1	1	X
Acetic acid, Glacial	CH_3COOH	1	1	2
Acetone	CH_3COCH_3	1	1	4
Ammonia	NH_3	1	1	4
Ammonium fluoride	NH_4F	1	1	1
Ammonium hydroxide	NH_4OH	1	1	4
Ammonium persulfate	$(NH_4)_2S_2O_8$	1	1	4
Aqua Regia	HNO_3:HCl(1:3)	1	1	2
Argon	Ar	1	1	1
Arsenic trioxide	As_2O_3	1	1	4
Arsine	AsH_3	1	1	X
Boron tribromide	BBr_3	1	1	X
Boron trichloride	BCl_3	1	1	X
Bromine	Br_2	1	1	1
Bromide trifluoride	BrF_3	1	1	4
Bromotrifluoroethylene (BFE)	$BrFC:CF_2$	1	1	X
Buffered Oxide Etchants (BOE)	NH_4:HF	1	1	X
Butyl (n-) acetate	$CH_3COO(CH_2)_4$	1	1	4
Carbon dioxide	CO_2	1	1	1
Carbon tetrachloride	CCl_4	1	1	1
Chlorine	Cl_2	1	1	X
Chlorine trifluoride	ClF_3	1	1	4
Chloroform	$CHCl_3$	1	1	1
Chromic acid (50%)	H_2CrO_4	1	1	1
Cyclohexanone	$C_6H_{10}O$	1	1	4
Deionized water (UPDI)	H_2O	1	1	2
Diborane	B_2H_6	1	1	X
Diethylene glycol monomethyl ether (DGMME)	$CH_3O(CH_2)_2O(CH_2)_2OH$	1	1	4
Dimethyl acetamide (DMAC)	$CH_3CON(CH_3)_2$	1	1	3
Dimethyl ether	CH_3OCH_3	1	1	2
Dimethyl sulfoxide (DMSO)	$(CH_3)_2SO$	1	1	3
Dimethylamine (DMA)	$(CH_3)_2NH$	1	1	4
Ethyl acetate	$CH_3COOC_2H_5$	1	1	4
Ethyl lactate (EL)	$CH_3CHOHCOOC_2H_5$	1	1	3
Ethylene	$H_2C:CH_2$	1	1	2
Ethylene glycol	$(CH_2OH)_2$	1	1	1
Ethylene glycol monoethyl ether acetate(EGMEEA)	$CH_3COO(CH_2)_2OC_2H_5$	1	1	4
F-11 (CFC) (Trichlorofluoromethane)	$CFCl_3$	1	1	2
F-12 (CFC) (Dichlorodifluoromethane)	CF_2Cl_2	1	1	3
F-13 (CFC) (Chlorotrifluoromethane)	CF_3Cl	1	1	1

1 Satisfactory 2 Fair (normally okay for static seal) 3 Doubtful (sometimes okay for static seal) 4 Unsatisfactory X Insufficient data

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CHEMICAL	FORMULA	Parofluor ULTRA	Parofluor	FKM
F-13B1 (FC)(Bromotrifluoromethane)	$CBrF_3$	1	1	1
F-14 (FC) (Tetrafluoromethane)	CF_4	1	1	1
F-22 (HCFC) (Chlorodifluoromethane)	$CHClF_2$	1	1	4
F-23 (HFC) (Fluoroform)	CHF_3	1	1	X
F-113 (CFC) (Trichlorotrifluoroethane)	CCl_2FCClF_2	1	1	2
F-115 (CFC) (Chloropentafluoroethane)	$CClF_2CF_3$	1	1	2
F-116 (FC) (Hexafluoroethane)	C_2F_6	1	1	2
F-123 (HCFC) (Dichlorotrifluoroethane)	CF_3CHCl_2	1	1	X
F-124 (CFC) (Chlorotetrafluoroethane)	C_2CF_4Cl	1	1	X
F-125 (HFC) (Pentafluoroethane)	C_2HF_5	1	1	X
F-134a (HFC) (Tetrafluoroethane)	CF_3CH_2F	1	1	X
F-141b (HCFC) (Dichlorofluoroethane)	$CFCl_2CH_3$	1	1	X
F-142b (HCFC) (Difluoeochloroethane)	CF_2ClCH_3	1	1	2
F-152a (HCFC) (Difluoroethane)	CH_3CHF_2	1	1	X
Fluorine (gas)	F	1	1	4
Germane	GeH_4	1	1	X
Helium	He	1	1	1
Hexamethyldisilizane (HMDS)	$(CH_3)_3SiNHSi(CH_3)_3$	1	1	X
Hydrochloric acid (37%)	HCl	1	1	1
Hydrofluoric acid (40%)	HF	1	1	
Hydrogen	H_2	1	1	1
Hydrogen bromide	HBr	1	1	X
Hydrogen chloride	HCl	1	1	X
Hydrogen fluoride	HF	1	1	X
Hydrogen peroxide	H_2O_2	1	1	1
Hydrogen selenide	H_2Se	1	1	X
Hydrogen sulfide	H_2S	1	1	4
Iodine pentafluoride	IF_5	1	1	4
Isobutane	$(CH_3)_2CHCH_3$	1	1	1
Isopropyl alcohol (IPA)	$(CH_3)_2CHOH$	1	1	1
MEA (Ethanolamine)	$HO(CH_2)_2NH_2$	1	1	4
MEK (Methyl ethyl ketone)	$CH_3COCH_2CH_3$	1	1	4
Methane	CH_4	1	1	1
Methanethiol	CH_3SH	1	1	4
Methyl alcohol	CH_3OH	1	1	4
Methyl bromide	CH_3Br	1	1	1
Methyl chloride	CH_3Cl	1	1	1
Methylamine	CH_3NH_2	1	1	3
Methlene chloride	CH_2Cl_2	1	1	2
MIBK (Methyl isobutyl ketone)	$(CH_3)_2CHCH_2COCH_3$	1	1	4

1 Satisfactory 2 Fair (normally okay for static seal) 3 Doubtful (sometimes okay for static seal) 4 Unsatisfactory X Insufficient data

Parker Seals

QS 9000/ISO 9001/AS 9000
Certified

Semiconductor Media Compatibility

CHEMICAL	FORMULA	Parofluor Ultra	Parofluor	FKM
Nitric acid (0-50%)	HNO_3	1	1	1
Nitrogen	N_2	1	1	1
Nitrogen trifluoride	NF_3	1	1	X
Nitrous oxide	N_2O	1	1	1
NMP (Methyl(n-)pyrrolidone(2-))	$CH_3NCH_2CH_2CH_2CO$	1	1	X
Octafluoropropane	C_3F_8	1	1	2
Oxygen	O_2	1	1	1
Ozonated deionized water	$O_3{:}H_2O$	1	1	3
Ozone	O_3	1	1	1
Phosgene	$COCl_2$	1	1	X
Phosphine	PH_3	1	1	X
Phosphoric acid (20%)	H_3PO_4	1	1	X
Phosphorous oxychloride	$POCl_3$	1	1	X
Piranha fluid	$H_2SO_4{:}H_2O_2$	1	1	X
Potassium hydroxide	KOH	1	1	4
Silane	SiH_4	1	1	X
Silicon tetrachloride	$SiCL_4$	1	1	X
Silicon tetrafluoride	SiF_4	1	1	X
Sodium hydroxide	NaOH	1	1	2
Standard Clean 1 (SC-1)	$NaOH{:}H_2O_2$	1	1	
Standard Clean 2 (SC-2)	$HCl{:}H_2O$	1	1	
Stoddard solvent	-	1	1	1
Sulfur hexafluoride	SF_6	1	1	3
Sulfur tetrafluoride	SF_4	1	1	X
Sulfuric acid (conc.)	H_2SO_4	1	1	1
TEOS (Tetraethylorthosilicate)	$(C_2H_5)_4SiO_4$	1	1	X
Tetrahydrofuran (THF)	$CH_2CH_2CH_2CH_2O$	1	1	4
Tetramethyl ammonium hydroxide (TMAH)	$(CH_3)_4NOH$	1	1	3
Toluene	$C_6H_5CH_3$	1	1	1
Trichloroacetic acid (TCA)	CCl_3COOH	1	1	3
Trichloroethylene (TCE)	$CHCl{:}CCl_2$	1	1	1
Trichlorosilane	$SiHCl_3$	1	1	1
Trimethylamine (TMA)	$(CH_3)_3N$	1	1	3
Trimethyl borate (TMB)	$(CH_3O)_3B$	1	1	1
Trimethyl phosphite (TMP)	$(CH_3O)_3P$	1	1	2
Vinyl chloride (VC)	$CH_2{:}CHCl$	1	1	1
Vinyl fluoride	$CH_2{:}CHF$	1	1	1
Xenon	Xe	1	1	1
Xylene	$C_6H_4(CH_3)_2$	1	1	1

1 Satisfactory 2 Fair (normally okay for static seal) 3 Doubtful (sometimes okay for static seal) 4 Unsatisfactory X Insufficient data

General Properties of Parofluor ULTRA™ Materials

Parker Compound: FF200-75

Black, ultra high temperature, 75 Shore A Parofluor ULTRA™, Perfluorinated Elastomer *-15°C to 320°C (5°F to 608°F)*

Property	Typical Results
Original Properties, ASTM D1414	
Shore A Hardness	79
Tensile Strength, MPa	12.0
Elongation, %	124
Modulus at 100% Elongation, MPa	7.8
Compression Set, 70 hours at 200°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	12
Compression Set, 70 hours at 316°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	45
Low Temperature Retraction, ASTM D1329	
TR-10 in degrees C	-2
Volume Change, 70 hours at room temperature, ASTM D471	
Acetone, % Volume Change	0.4
Methyl Ethyl Ketone, % Volume Change	0.2
Methanol, % Volume Change	0.2
Benzene, % Volume Change	0.3
Toluene, % Volume Change	0.3
Dichloromethane, % Volume Change	0.6
Chloroform, % Volume Change	0.6
Ethyl Acetate, % Volume Change	0.4
MTBE, % Volume Change	0.2
Glacial Acetic Acid, % Volume Change	0.4
Conc.Phosphoric Acid, % Volume Change	0.0
50/50 by Volume, MEK/Methanol % Volume Change	0.7
Tetrahydrofuran (THF), % Volume Change	0.4
Styrene Monomer, % Volume Change	0.0
Methyl Methacrylate Monomer, % Vol.Change	0.5

Parker Compound: FF202-90

Black, ultra high temperature, 90 Shore A Parofluor ULTRA™, Perfluorinated Elastomer *-15°C to 320°C (5°F to 608°F)*

Property	Typical Results
Original Properties, ASTM D1414	
Shore A Hardness	91
Tensile Strength, MPa	20.5
Elongation, %	110
Modulus at 100% Elongation, MPa	15.1
Compression Set, 70 hours at 200°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	25
Low Temperature Retraction, ASTM D1329	
TR-10 in degrees C	-2
Volume Change, 70 hours at room temperature, ASTM D471	
Acetone, % Volume Change	0.5
Methyl Ethyl Ketone, % Volume Change	0.3
Methanol, % Volume Change	0.4
Benzene, % Volume Change	0.4
Toluene, % Volume Change	0.4
Dichloromethane, % Volume Change	0.7
Chloroform, % Volume Change	0.8
Ethyl Acetate, % Volume Change	0.4
MTBE, % Volume Change	0.2
Glacial Acetic Acid, % Volume Change	0.4
Conc.Phosphoric Acid, % Volume Change	0.2
50/50 by Volume, MEK/Methanol % Volume Change	0.9
Tetrahydrofuran (THF), % Volume Change	0.5
Styrene Monomer, % Volume Change	0.1
Methyl Methacrylate Monomer, % Vol.Change	0.6

General Properties of Parofluor ULTRA™ Materials

Parker Compound: FF350-75

White, high purity, high temperature, 75 Shore A Parofluor ULTRA™, Perfluorinated Elastomer *-15°C to 316°C (5°F to 600°F)*

Property	Typical Results
Original Properties, ASTM D1414	
Shore A Hardness	74
Tensile Strength, MPa	16.3
Elongation, %	125
Modulus at 100% Elongation, MPa	9.4
Compression Set, 70 hours at 200°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	13
Compression Set, 70 hours at 260°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	26
Low Temperature Retraction, ASTM D1329	
TR-10 in degrees C	-1

Volume Change, 70 hours at room temperature, ASTM D471

Acetone, % Volume Change	0.3	MTBE, % Volume Change	0.3
Methyl Ethyl Ketone, % Volume Change	0.2	Glacial Acetic Acid,% Volume Change	0.1
Methanol, % Volume Change	0.2	Conc.Phosphoric Acid, % Volume Change	0.1
Benzene, % Volume Change	0.3	50/50 by Volume, MEK/Methanol	
Toluene, % Volume Change	0.3	% Volume Change	0.6
Dichloromethane, % Volume Change	0.5	Tetrahydrofuran (THF), % Volume Change	0.4
Chloroform, % Volume Change	0.5	Styrene Monomer, % Volume Change	0.2
Ethyl Acetate,, % Volume Change	0.4	Methyl Methacrylate Monomer, % Vol.Change	0.3

Parker Compound: FF352-75

White, clean, high temperature, 75 Shore A Parofluor ULTRA™, Perfluorinated Elastomer *-15°C to 316°C (5°F to 600°F)*

Property	Typical Results
Original Properties, ASTM D1414	
Shore A Hardness	76.0
Tensile Strength, MPa	16.9
Elongation, %	142.0
Modulus at 100% Elongation, MPa	9.2
Compression Set, 70 hours at 200°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	16
Compression Set, 70 hours at 260°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	28
Low Temperature Retraction, ASTM D1329	
TR-10 in degrees C	-1

Volume Change, 70 hours at room temperature, ASTM D471

Acetone, % Volume Change	0.2	MTBE, % Volume Change	0.2
Methyl Ethyl Ketone, % Volume Change	0.1	Glacial Acetic Acid,% Volume Change	0.0
Methanol, % Volume Change	0.1	Conc. Phosphoric Acid, % Volume Change	0.1
Benzene, % Volume Change	0.2	50/50 by Volume, MEK/Methanol	
Toluene, % Volume Change	0.2	% Volume Change	0.5
Dichloromethane, % Volume Change	0.3	Tetrahydrofuran (THF), % Volume Change	0.4
Chloroform, % Volume Change	0.4	Styrene Monomer, % Volume Change	0.2
Ethyl Acetate,, % Volume Change	0.3	Methyl Methacrylate Monomer, % Vol.Change	0.3

General Properties of Parofluor ULTRA™ Materials

Parker Compound: FF354-65

Low closure force, white, high temp., 65 Shore A Parofluor ULTRA™, Perfluorinated Elastomer *-15°C to 316°C (5°F to 600°F)*

Property	Typical Results
Original Properties, ASTM D1414	
Shore A Hardness	65
Tensile Strength, MPa	8.0
Elongation, %	277
Modulus at 100% Elongation, MPa	1.8
Compression Set, 70 hours at 200°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	28
Compression Set, 70 hours at 260°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	41
Low Temperature Retraction, ASTM D1329	
TR-10 in degrees C	-1

Volume Change, 70 hours at room temperature, ASTM D471

Acetone, % Volume Change	0.2	MTBE, % Volume Change	0.1
Methyl Ethyl Ketone, % Volume Change	0.2	Glacial Acetic Acid, % Volume Change	0.1
Methanol, % Volume Change	0.1	Conc.Phosphoric Acid, % Volume Change	0.1
Benzene, % Volume Change	0.2	50/50 by Volume, MEK/Methanol	
Toluene, % Volume Change	0.1	% Volume Change	0.7
Dichloromethane, % Volume Change	0.3	Tetrahydrofuran (THF), % Volume Change	0.4
Chloroform, % Volume Change	0.5	Styrene Monomer, % Volume Change	0.3
Ethyl Acetate, % Volume Change	0.3	Methyl Methacrylate Monomer, % Vol.Change	0.2

Parker Compound: FF500-75

Black, best chemical resistance, 75 Shore A Parofluor ULTRA™, Perfluorinated Elastomer *-15°C to 276°C (5°F to 525°F)*

Property	Typical Results
Original Properties, ASTM D1414	
Shore A Hardness	80
Tensile Strength, MPa	14.1
Elongation, %	135
Modulus at 100% Elongation, MPa	8.7
Compression Set, 70 hours at 230°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	23
Compression Set, 70 hours at 200°C, ASTM D395 Method B, 2-214 Size O-Rings	
% Permanent Set	19
Low Temperature Retraction, ASTM D1329	
TR-10 in degrees C	-1

Volume Change, 70 hours at room temperature, ASTM D471

Acetone, % Volume Change	0.1	MTBE, % Volume Change	0.5
Methyl Ethyl Ketone, % Volume Change	0.2	Glacial Acetic Acid, % Volume Change	0.3
Methanol, % Volume Change	0.2	Conc.Phosphoric Acid, % Volume Change	0.1
Benzene, % Volume Change	0.3	50/50 by Volume, MEK/Methanol	
Toluene, % Volume Change	0.3	% Volume Change	0.7
Dichloromethane, % Volume Change	0.9	Tetrahydrofuran (THF), % Volume Change	0.6
Chloroform, % Volume Change	0.6	Styrene Monomer, % Volume Change	0.3
Ethyl Acetate, % Volume Change	0.4	Methyl Methacrylate Monomer, % Vol.Change	0.3