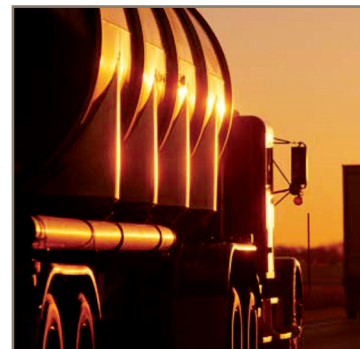


aerospace
climate control
electromechanical
filtration
fluid & gas handling
hydraulics
pneumatics
process control
sealing & shielding



High & Low Pressure Gas Filters

Filtration Solutions
For Alternative Fuel Applications



ENGINEERING YOUR SUCCESS.

PARKER: ON VEHICLE

Collaborate with Parker for CNG solutions that fuel competitive advantage.

From the refueling receptacle to the engine compartment, Parker offers the CNG components that make a noticeable difference in performance, plus the expertise to put it all together for you. Our global experience in the design of fuel systems for medium- and heavy-duty vehicles is well respected in the industry. And customers have local access to Parker channels throughout the world.

VALVES AND RECEPTACLES

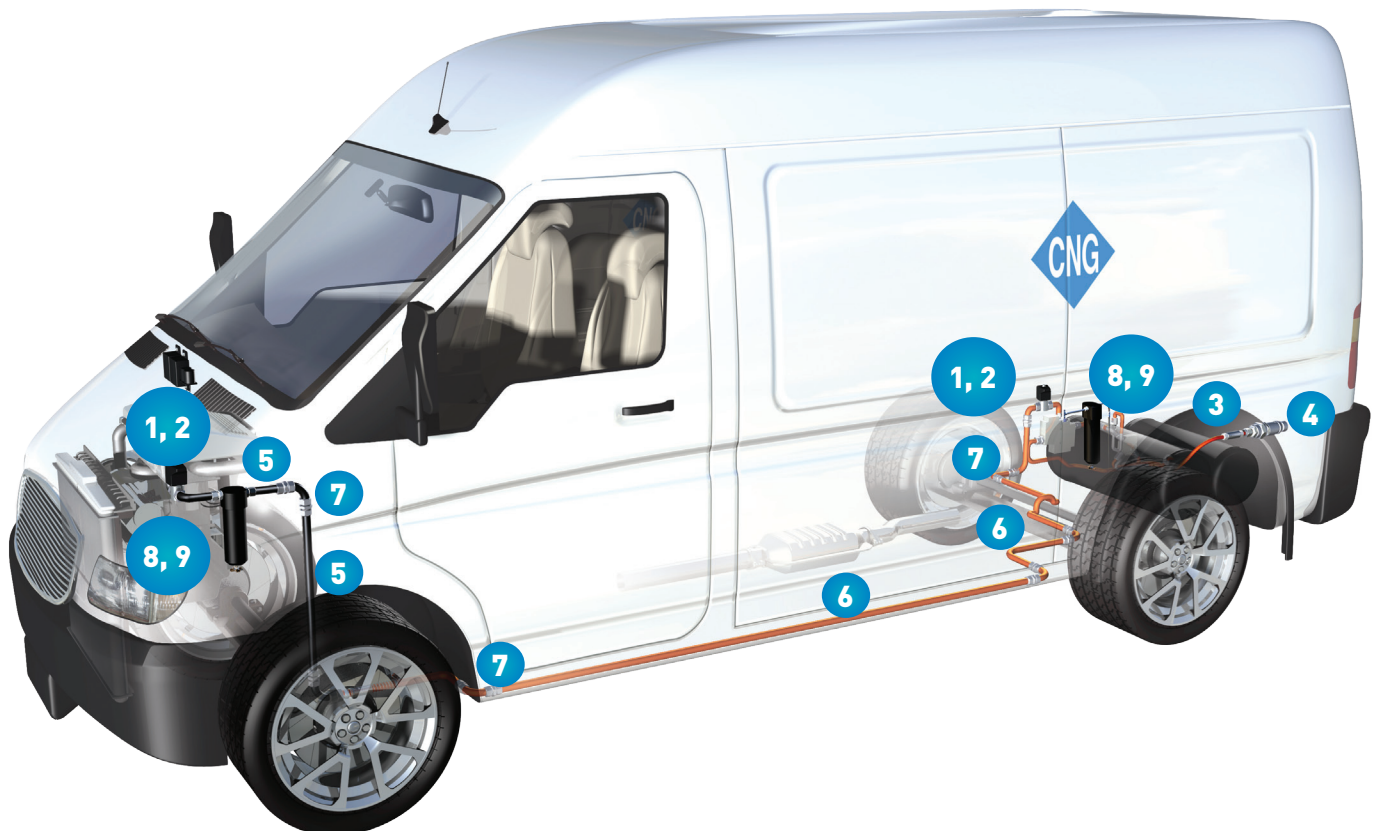
- 1 High-pressure CNG valves
- 2 Low-pressure CNG valves
- 3 Check valves
- 4 Receptacles

FUEL CONVEYANCE

- 5 Low-pressure CNG hose
- 6 High-pressure CNG hose
- 7 Seal-Lok™ O-Ring Face Seal fittings

FILTRATION

- 8 High-pressure filters
- 9 Low-pressure filters



Onboard CNG Vehicles

Alternative Vehicles need high pressure filtration

Compressed Natural Gas, or CNG, is a leading alternative to traditional fuel for the automotive industry. CNG is used in passenger vehicles, pickup trucks, in transit and on school buses. It can be less expensive than gasoline, and is more environmentally friendly – it reduces the amount of carbon monoxide, carbon dioxide and hydrocarbon vehicle exhaust emissions.

Natural gas is gathered from a pipeline and travels to a connecting compressor station. The gas is elevated to pressures ranging from 2000 PSIG up to 5000 PSIG and the resultant CNG is stored in large tanks. The CNG then makes its way to a gas dispenser where it is ready for use in natural gas vehicles.

Contaminants can enter into the gas at any stage of this processing. Filters are critical at each stage to

ensure clean gas as a final product. Contamination that collects during handling, water that condenses in tanks and compressors that leak oil into the fuel stream are all problems that could shorten the life of expensive equipment, create unnecessary downtime and increase maintenance costs.

From pipeline to engine, Racor filters provide the critical filtration required for most alternative fuel systems.



The Application:

Efficient operation of a CNG vehicle requires protection of the fuel system to prevent premature failing of the fuel injectors and precision components. The gas is dispensed from the filling station to the vehicle fuel tank, finally entering the fuel injection system.

The Solution:

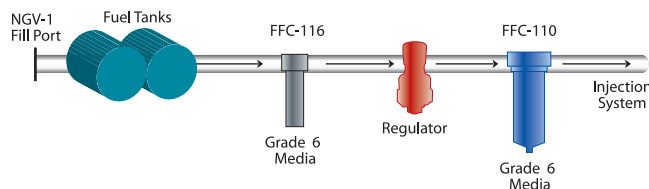
Filtration is the key to guarding against damaging contaminants that could ruin a fuel system. Installing a coalescer upstream of the high pressure regulator extends the system's life and reduces maintenance costs. A low pressure filter can also be used downstream of the regulator to protect other fuel injection system components.



The Problem:

Contaminants such as lube oil carryover from compressors, condensed liquids in fuel tanks and solids buildup during gas handling contributes to:

- System downtime
- Component repair and failure
- Increased maintenance costs



FFC Series



FFC-110

FFC-110L

FFC-112

FFC-113

FFC-116

The Racor FFC Series filter assemblies are designed and tested for superior performance in Compressed Natural Gas (CNG) fuel. Compressed Natural Gas has contamination problems similar to what plagues diesel fuel and gasoline; particulate contamination collects during handling, water condenses in tanks, and compressors leak oil into the fuel stream.

The precision components necessary for the efficient operation of an alternative fuel system demand superior filtration. Racor anticipated the need for ultra-fine filtration at the

pressures required by compressed natural gas. The answer is the industry's first, most complete and most efficient line of alternative fuel filters/coalescers.

FFC series filters are designed to protect critical engine components in CNG powered vehicles. Contaminants can be introduced into a vehicle's fuel tank when being fueled or may come from compressors and/or storage facilities. A grade 6 coalescing filter is specifically designed to remove oil, water, and solid contamination from compressed natural gas.

The patented coalescing filter removes 99.97% of all aerosols in the 0.3 to 0.6 micron range.

These fuel filter/coalescer elements are produced by a patented process of arranging micro-glass fibers into a tubular form. During operation, fuel is forced through the coalescing media from the inside of a cartridge through a tubular wall to the outside, where large droplets fall to the bottom of the housing. Oily water emulsion accumulates until drained while dirt particles remain trapped and collect on surfaces of fibers.

Media types, grades & efficiencies

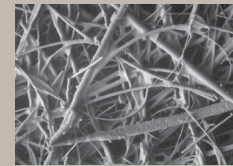
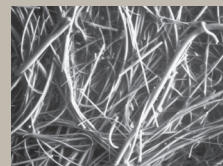
Coalescing:

Coalescing elements are specially designed for the removal of liquid contaminants from gaseous flows. These media types flow from the inside of the element to the outside. Coalesced liquid (water and oil) collects in the bowl where it is drained, while clean air or gas exits the housing through the outlet port. Particulate contaminants are captured and held in the media.

Grade 6

Grade 10

Media Grades:



Grade 6 filter elements are used when "total removal of liquid aerosols and suspended fines" is required. Because of its overall performance characteristics, this grade is most often recommended below 500 PSIG.

Grade 10 filters are used as prefilters for grade 6 to remove gross amounts of aerosols or tenacious aerosols which are difficult to drain. This grade is often used as a 'coarse' coalescer.



Type C, For use with:

- FFC-110 (800 PSIG)
- FFC-110L (800 PSIG)
- FFC-112 (3600 PSIG)
- FFC-112 SAE (3600 PSIG)
- FFC-113 (3600 PSIG)

Composed of an epoxy saturated, borosilicate glass microfiber tube in intimate interlocking contact with a rigid retainer. Surrounded by a coarse fiber drain layer, retained by a synthetic fabric safety layer. Some models are available with molded elastomeric end seals (CU), or with metal end caps and fluorocarbon gaskets.

FFC Series



Specifications	FFC-110	FFC-110L-10	FFC-112	FFC-113	FFC-116
Fuels Used	CNG	CNG	CNG	CNG	CNG
Filter Type	Coalescer	Coalescer	Coalescer	Coalescer	Coalescer
Maximum Pressure	800 PSI (5,500 kPa)	800 PSI (5,500 kPa)	3,600 PSI (24,800 kPa)	3,600 PSI (24,800 kPa)	5,000 PSI (34,400 kPa)
Max Flow Rate	25 SCFM (708 lpm)	50 SCFM (1,416 lpm)	15 SCFM (425 lpm)	50 SCFM (1,416 lpm)	8.4 SCFM (238 lpm)
Port Size	¼" NPT	½" NPT	¼" NPT	½" NPT	¼" NPT
Length	7.9 in. (18.3 cm)	10.4 in. (26.4 cm)	4.8 in. (12.2 cm)	8.0 in. (20.3 cm)	4.0 in. (10.1 cm)
Diameter	3.1 in. (7.9 cm)	3.1 in. (7.9 cm)	2.3 in. (5.8 cm)	3.0 in. (7.6 cm)	1.75 in. (4.4 cm)
Weight	1.5 lbs (0.7 kgs)	1.8 lbs (0.8 kgs)	1.5 lbs (0.7 kgs)	5.5 lbs (2.5 kgs)	1.75 lbs (0.8 kgs)
Clean Pressure Drop	1.0 PSI (6.9 kPa)	1.0 PSI (6.9 kPa)	3.0 PSI (20.7 kPa)	1.7 PSI (11.7 kPa)	1.25 PSI (8.6 kPa)
Sump Capacity	5.0 oz. (148 cc's)	7.0 oz. (207 cc's)	0.5 oz. (15 cc's)	5.0 oz. (148 cc's)	0.25 oz. (7.4 cc's)
Temperature	-40° / +221° F (-40° / +105° C)				

- Notes:**
1. For accurate flow rates and pressures, consult your engine manual, engine manufactures agent, or the vehicle manufacturer.
 2. Some specifications are the result of tests conducted at the optimum flow rate.
 3. Allow 3.0 in. (7.6 cm) of clearance below assembly for draining and maintenance of element.
 4. Filter element kit, includes element and replacement seals.



Low Pressure Filters

FFC-110



Many CNG powered commuter vehicles, such as shuttle buses, taxis or vans, rely on FFC-110 filters to protect contaminants in the fuel tank from entering the engine.

FFC-110 is often used onboard CNG (compressed natural gas) powered vehicles to prevent contaminants in the fuel tank from getting into the engine, protecting critical engine components, like fuel injectors. Its small size allows for versatile installation and easy servicing. Each housing is powder painted for long-term corrosion protection.

These coalescers are ideal for operating environments up to 800 PSIG. Coalescing efficiencies of 95% (grade 10) or 99.97% (grade 6) can be chosen to match the filter to the application. Both the FFC-110 and FFC-110L have an 1/8" NPT drain port with a brass petcock manual drain.

Specifications: ECE 110R Approved

Model Number	Port Size (NPT)	Max. Pressure	Max. Temp.	Materials of Construction			Seals	Sump Capacity	Weight	Dimensions	
				Head	Internals	Bowl				Length	Width
FFC-110	1/4"	800 PSIG (55 bar)	221°F (105°C)	Chromated Aluminum	Stainless Steel	Chromated Aluminum	Fluorocarbon	5.1 oz. (150 ml)	1.5 lbs. (.68 kgs)	7.8" (198.1mm)	3.1" (78.7mm)
FFC-110L	1/2"	800 PSIG (55 bar)	221°F (105°C)	Chromated Aluminum	Stainless Steel	Chromated Aluminum	Fluorocarbon	4.7 oz. (140 ml)	1.8 lbs. (.82 kgs)	10.2" (259.1mm)	3.1" (78.7mm)

Flow Rates (SCFM):

Filter Housing Model	Media Grade	100 PSIG	250 PSIG	500 PSIG
FFC-110	6	15	35	67
	10	25	58	112
FFC-110L	6	30	69	135
	10	50	115	224

How to Order:

							Bowl	Element Grade
F	F	C	-	1	1	0	Leave blank for standard	-
							L (Long)	06 10

Example:
FFC-110-06

Replacement Element Kits Available:

Filter Housing Model	Media Grade 6	Media Grade 10
FFC-110	CLS110-06	CLS110-10
FFC-110L	CLS110L-06	CLS110L-10

Note: Element kits include replacement element and the replacement seals.

Height
2.5 in.
(6.4 cm)

Diameter
1.5 in.
(3.8 cm)



CLS110

Height
5.0 in.
(12.7 cm)

Diameter
1.5 in.
(3.8 cm)



CLS110L

High Pressure Filters



FFC-112

CNG powered vehicles such as airport shuttles and taxis use FFC-112 filters, which are installed on these vehicles. They protect critical engine components from contaminants present in CNG fuel.

CNG powered engine components such as fuel injectors and pressure reducing valves require contaminant free air. Submicronic solid or lubricant aerosols may carry over during CNG compression. Contaminants can also be generated in the storage and distribution of the natural gas, and may eventually enter the

vehicle's storage tank. Both 1/4" NPT and 9/16" SAE connections are available on this 3600 PSIG rated assembly. The machined aluminum housing is anodized to enhance durability. It's robust yet small, lightweight size allows for versatile installation and easy servicing.

Specifications: ECE 110R Approved

Model Number	Port Size	Max. Pressure	Max. Temp.	Materials of Construction			Seals	Sump Capacity	Weight	Dimensions	
				Head	Internals	Bowl				Length	Width
FFC-112	1/4" NPT	3600 PSIG (248 bar)	221°F (105°C)	Anodized Aluminum	Acetal Plastic	Anodized Aluminum	Fluorocarbon	0.5 oz. (14.8 ml)	1.5 lbs. (.68 kgs)	4.75" (120.65mm)	2.25" (57.15mm)
FFC-112-SAE	9/16" SAE	3600 PSIG (248 bar)	221°F (105°C)	Anodized Aluminum	Acetal Plastic	Anodized Aluminum	Fluorocarbon	0.5 oz. (14.8 ml)	1.5 lbs. (.68 kgs)	4.75" (120.65mm)	2.25" (57.15mm)

Flow Rates (SCFM):

Filter Housing Model	Media Grade	100 PSIG	250 PSIG	500 PSIG	750 PSIG	1000 PSIG	1500 PSIG	2000 PSIG	2500 PSIG	3000 PSIG	3600 PSIG
FFC-112/FFC-112-SAE	6	10	23	45	67	88	132	176	219	263	315
	10	15	35	67	100	133	198	263	329	394	473

How to Order:

							Port	Element Grade
F	F	C	-	1	1	2	Leave blank for NPT	-
							SAE	06 10

Examples: FFC-112-06
or FFC-112-SAE-10

Replacement Element Kits Available:

Filter Housing Model	Media Grade 6	Media Grade 10
FFC-112	CLS112-06	CLS112-10
FFC-112-SAE		

Note: Element kits include replacement element and the replacement seals

Height
3.0 in.
(7.6 cm)

Diameter
0.8 in.
(2.0 cm)



CLS112

High Pressure Filters

FFC-113



Many large CNG powered vehicles, such as buses used in city transit systems rely on FFC-113 filters, which are installed onboard the vehicle itself. They protect critical engine components from contaminants present in alternative fuel gas systems.

FFC-113 is a popular filter choice onboard alternative fuel vehicles. Tiny solid and liquid contaminants can foul critical engine components, diminishing engine performance. These contaminants are typically generated during the compression, storage, and dispensing of alternative fuel gases like CNG. The FFC-113 removes sub-micronic contaminants with removal efficiencies from 95% to 99.97% ensuring long service intervals

for components like fuel injectors.

Its robust 303 stainless steel construction and 3600 PSIG design pressure and relatively light weight combine to provide a unit that will withstand the harsh operating environments found on heavy duty vehicles like buses and trucks. It is supplied with 1/2" NPT connections and is designed for flows exceeding 50 SCFM at 3600 PSIG.

Specifications: ECE 110R Approved

Model Number	Port Size	Max. Pressure	Max. Temp.	Materials of Construction			Seals	Sump Capacity	Weight	Dimensions	
				Head	Internals	Bowl				Length	Width
FFC-113	1/2" NPT	3600 PSIG (248 bar)	221°F (105°C)	303 Stainless Steel	303 Stainless Steel	303 Stainless Steel	Fluorocarbon	5.0 oz. (147.9 ml)	5.5 lbs. (2.5 kgs.)	8.06" (204.7mm)	2.97" (75.44mm)
FFC-113-SAE	3/4" SAE	3600 PSIG (248 bar)	221°F (105°C)	303 Stainless Steel	303 Stainless Steel	303 Stainless Steel	Fluorocarbon	5.0 oz. (147.9 ml)	5.5 lbs. (2.5 kgs.)	8.06" (204.7mm)	2.97" (75.44mm)

Flow Rates (SCFM):

Filter Housing Model	Media Grade	100 PSIG	250 PSIG	500 PSIG	750 PSIG	1000 PSIG	1500 PSIG	2000 PSIG	2500 PSIG	3000 PSIG	3600 PSIG
FFC-113	6	25	58	112	167	221	330	439	548	657	788
	10	50	115	224	333	442	660	878	1096	1314	1576

How to Order:

							Element Grade
F	F	C	-	1	1	3	06
							10

Example: FFC-113-06

Replacement Elements Available:

Filter Housing Model	Media Grade 6
FFC-113	CLS47133-01

Height
5.9 in.
(12.7 cm)

Diameter
1.5 in.
(3.8 cm)



CLS47133-01

Note: Element kits include replacement element and the replacement seals

High Pressure Filters

FFC-116



Many CNG powered commuter vehicles, such as shuttle buses, taxis or vans, rely on FFC-116 filter to protect contaminants from fouling fuel injector systems. Both solid and liquid contaminants can enter the system from various sources.

This stainless steel filter is commonly used to filter oil, water and particulate from lower flow CNG systems and onboard CNG vehicles. Its small size allows for installation versatility and ease of servicing. The 316 stainless steel construction resists corrosion. Its 5000 PSIG design enables it to be used on the high pressure side of a CNG

system, protecting both the regulator and the fuel injectors. The sump capacity is 0.25 oz. (7.4 cc) for fluid contaminants, which can be drained through a plugged 1/4" NPT drain port.

Specifications: ECE 110R Approved

Model Number	Port Size	Max. Pressure	Max. Temp.	Materials of Construction			Seals	Sump Capacity	Weight	Dimensions	
				Head	Internals	Bowl				Length	Width
FFC-116N	1/4" NPT	5000 PSIG (345 bar)	350°F (177°C)	316 Stainless Steel	316 Stainless Steel	316 Stainless Steel	Fluorocarbon	0.25 oz. (7.4 ml)	1.16 lbs. (0.53 kgs.)	4.0" (101.6 mm)	1.75" (44.5 mm)

Flow Rates (SCFM):

Filter Housing Model	Media Grade	100 PSIG	1000 PSIG	1500 PSIG	2000 PSIG	2500 PSIG	3000 PSIG	3500 PSIG	4000 PSIG	4500 PSIG	5000 PSIG
FFC-116N	10	10	90	132	176	219	263	306	350	394	438

How to Order:

F	F	C	-	1	1	6	N
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Example: FFC-116N

Replacement Elements Available:

Filter Housing Model	Media Grade 10
FFC-116N	CLS116-10

Note: Element kits include replacement element and the replacement seals

Height
2.3 in.
(5.8 cm)

Diameter
0.8 in.
(2.0 cm)



O-ring
Included
With
Element Kit

CLS116-10

Biodiesel Filtration Solutions from Racor



Biodiesel is a diesel fuel produced by the chemical refining of vegetable oils into “fatty acid methyl esters”, or FAME. Glycerin is removed in the refining process, lowering the oil viscosity to match diesel fuel. Pure biodiesel is most often added to diesel fuel in a 2%, 5%, or 20% blend — referred to as B2, B5, or B20 respectively.

Other renewable “biofuels” available are raw oils or recycled greases that have not been transformed into biodiesel. These products require extra heat, filtration, and extensive vehicle modifications to burn in only older pre-high pressure injection diesel engines.

Challenges and Solutions

Racor fuel filters and heaters are uniquely suited for filtering and conditioning biodiesel and biofuels for use in diesel engines.

Biodiesel tends to dissolve the natural fuel “tar” deposits coating the inside of diesel tanks, piping, and hoses. The dissolved deposits are carried to fuel filters, causing shortened fuel filter life. Most biodiesels have a low “interfacial tension”. This means that water easily disperses and dissolves in the fuel. Low interfacial tension greatly reduces water separation efficiency for all types of water separators and coalescers. Removal of water from a fuel system is necessary for proper engine performance.

Racor recommends using the largest filter practical for the application. A larger filter adds more filtration media surface area, which lowers the flow velocity going to each square inch of the media. This extends filter life and increases water removal efficiency. When specifying a new biodiesel fuel system, de-rate fuel filter flow by 50% and install on the vacuum side of any pumps, where possible.

Pure biodiesel has high cloud and pour points, necessitating the use of electric and/or coolant heaters in cold weather. Lower percentage blends (B20) act more like standard diesel fuel, but some lower fuel blends have been known to cause problems.

Racor recommends using at least 200 watts of thermostatically controlled electric heating in the head and/or filter bowl to help avoid biofuel waxing and gelling. Pour point suppressants and biocides are necessary for reliable operation. A coolant heat exchanger is required to heat the fuel in extreme cold weather conditions.

Biodiesel is known to attack certain synthetic rubber compounds, making them swell and soften, or the opposite, shrink and harden. Racor uses very high quality synthetic rubber compounds that perform equally well in biodiesel as in standard diesel.

Seals subject to biodiesel exposure are generally replaced at the same time as the replacement filter. Racor uses all materials compatible with up to 20% biodiesel blend. Above 20% may require material changes to dynamic seals that are not normally replaced at element change-outs.

Racor Engineering Leadership









Racor has participated in several biodiesel filtration field tests with major OEMs. Racor is actively participating in industry wide research and development on biodiesel fuel filtration and water separation challenges. Development of technology to support the use of all biofuels is on-going at Racor Division.

Biodiesel and Biofuel Filtration Specification Considerations

- 1. Large primary and secondary filters at 50% of their rated flow.**
- 2. High quality, corrosion resistant materials in construction.**
- 3. High quality, synthetic rubber compounds for seals and hoses.**
- 4. Applicable coolant, return fuel and electric heating.**
- 5. Fuel source with high efficiency fuel dispensing.**



Fuel Filtration Systems Recommended for Biodiesel/Biofuels

Fuel Dispensing	Electric Heated Primary Filtration ²	Coolant or Return Fuel Heated Primary Filtration ³	Coolant/Electric Heaters ⁴
FBO Series ²	6120R1230	GreenMAX Series	320HTR4
			
RVFS Series	1000FH31230	390RC1210	14278
			

Notes: 1. Marine rated versions are available—consult factory.

2. Available with additional electric heat.

3. Also available—Thermoline Heaters, 300 and 500 watt, 12 and 24 volt.

See bulletins 7529, 7749, RSL0020, and RSL0145 for additional information on these products.

Worldwide Filtration Manufacturing Locations

North America

Compressed Air Treatment

Gas Separation & Filtration Division

Airtek/Finite/domnick hunter/Zander
Lancaster, NY
716 686 6400
www.parker.com/faf

Balston
Haverhill, MA
978 858 0505
www.parker.com/balston

Engine Filtration

Racor

Modesto, CA
209 521 7860
www.parker.com/racor

Holly Springs, MS
662 252 2656
www.parker.com/racor

Hydraulic Filtration

Hydraulic & Fuel Filtration

Metamora, OH
419 644 4311
www.parker.com/hydraulicfilter

Laval, QC Canada
450 629 9594
www.parkerfarr.com

Velcon
Colorado Springs, CO
719 531 5855
www.velcon.com

Process Filtration

domnick hunter Process Filtration SciLog

Oxnard, CA
805 604 3400
www.parker.com/processfiltration

Water Purification

Village Marine, Sea Recovery, Horizon Reverse Osmosis

Carson, CA
310 637 3400
www.parker.com/watermakers

Europe

Compressed Air Treatment

domnick hunter Filtration & Separation

Gateshead, England
+44 (0) 191 402 9000
www.parker.com/dhfn

Parker Gas Separations

Etten-Leur, Netherlands
+31 76 508 5300
www.parker.com/dhfn

Hiross Zander

Essen, Germany
+49 2054 9340
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Engine Filtration & Water Purification

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+49 (0)711 7071 290-10

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Hydraulic Filter

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+31 26 3760376
www.parker.com/hfde

Urjala, Finland
+358 20 753 2500

Condition Monitoring Parker Kittiwake

West Sussex, England
+44 (0) 1903 731 470
www.kittiwake.com

Process Filtration

domnick hunter Process Filtration Parker Twin Filter BV

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+44 (0) 191 410 5121
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