

900FH and 1000FH Turbine Series Fuel Filter/Water Separators

Installation, Operation, and Service Information

RACOR[®]

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Overview

The 900FH and 1000FH Turbine Series filter assemblies protect precision engine components from dirt, rust, algae, asphaltines, varnishes, and especially water, which is prevalent in engine fuels. They remove contaminants from fuel using the following legendary three stage process:

Stage 1 - Separation

As fuel enters the assembly, it moves through the centrifuge and spins off large solids and water droplets, which are heavier than fuel, and fall to the bottom of the collection bowl.

Stage 2 - Coalescing

Small water droplets bead-up on the surface of the conical baffle and cartridge element. When heavy enough, they too fall to the bottom of the collection bowl.

Stage 3 - Filtration

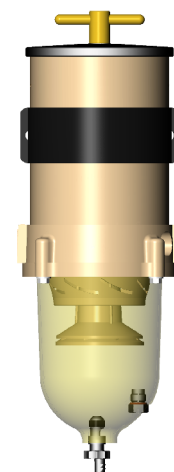
Proprietary Aquabloc II cartridge elements repel water and remove contaminants from fuel down to 2 micron. Aquabloc II cartridge elements are waterproof and effective longer than water absorbing elements.

Turbine Series filter assemblies are designed to be installed on the vacuum side of the fuel transfer pump for best efficiency (see the Installation Diagram on page three). Adjustable one-piece clamp-type mounting brackets, with grade 5 fasteners, are included for ensured durability. The 900FH uses one mounting bracket and the 1000FH uses two. The see-thru contaminant collection bowl allows the operator to check for water and solid contamination at a glance.

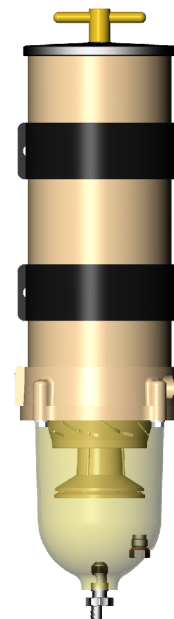
Getting Started

The following customer supplied materials should be on hand before beginning installation.

- Shop Towels
- Diesel Fuel (about 1 gallon)
- Thread Sealant (no thread tapes)
- Parker Super O-lube (or equivalent)
- Fuel Hose (see Fuel Hose chart on page 4)
- Mounting Hardware (3/8" or M10 fasteners)
- Inlet/Outlet Fittings (see Fitting chart on page 4)

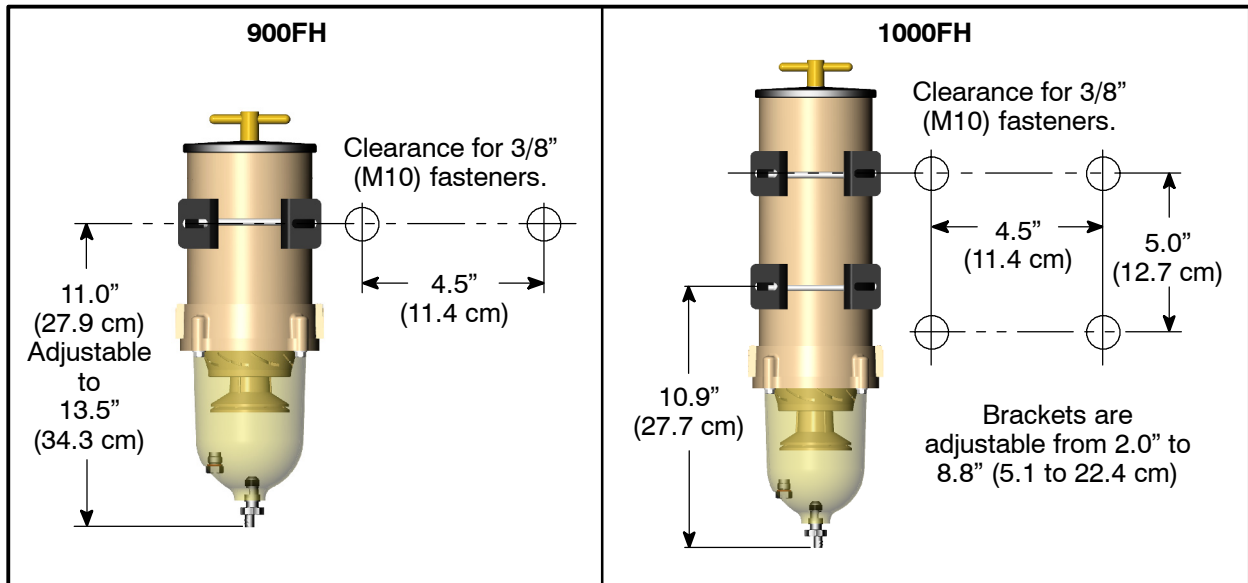


900FH

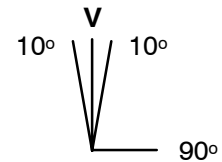


1000FH

Mounting Information (no scale)



Note - mount the filter assembly as close to vertical (**V**) as possible. Do not exceed 10° from vertical or the assembly may not function properly.



Installation Instructions

When positioning the filter assembly:

- FH filter assemblies should be installed on the vacuum side of the fuel transfer pump for optimum water separating efficiency. See 'Installation Diagram' on the next page.
- Keep fuel line restrictions to a minimum. Locate the FH filter assembly between the horizontal planes of the bottom of the fuel tank and the inlet of the fuel pump, if possible. If the FH filter assembly is installed in an application where the fuel tank is higher than the filter, a shut-off valve must be installed between the tank and the FH filter assembly INLET. This will be used when servicing the replacement element.

Before installing the filter assembly:

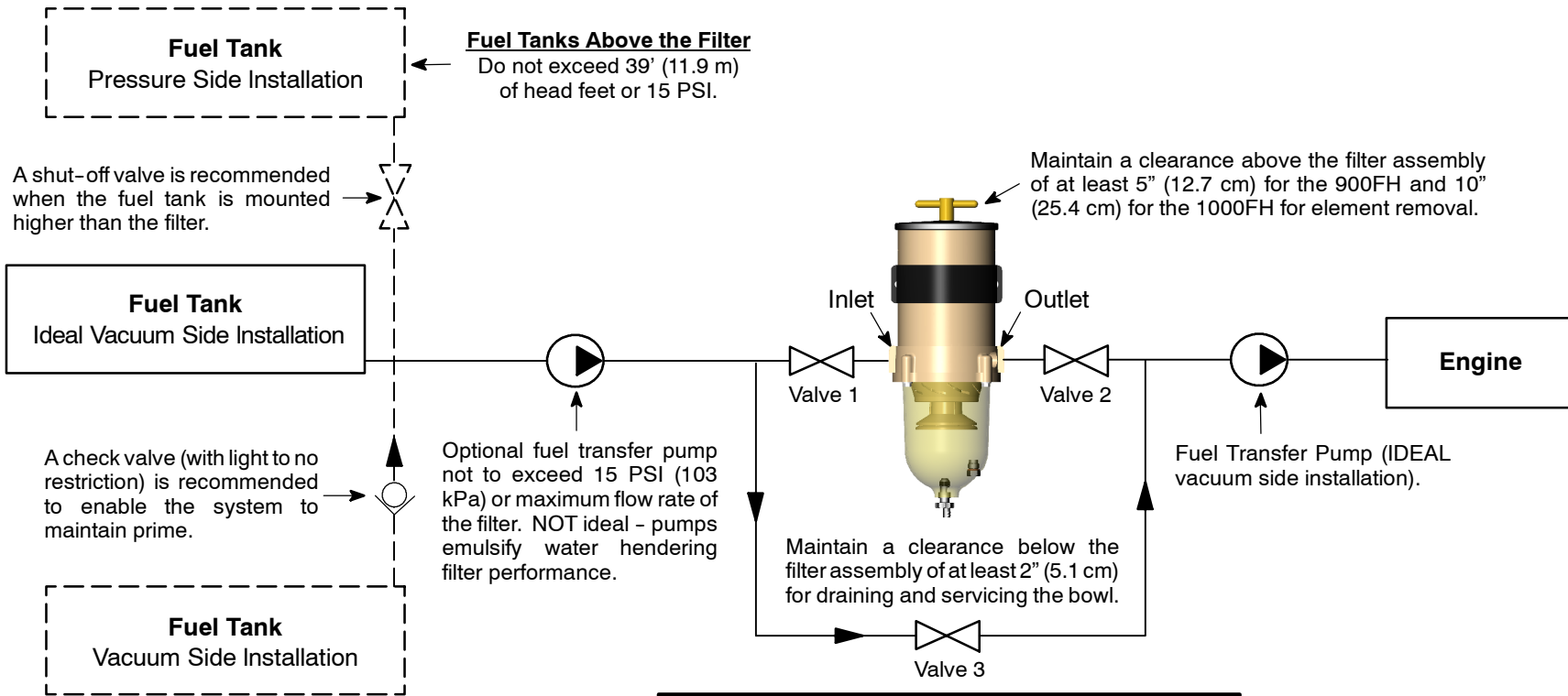
- Obtain good ventilation and lighting.
- Maintain a safe working environment.
- The engine must be off for installation.
- DO NOT smoke or allow open flames near the installation.

Installing the filter assembly:

- Completely remove any vacuum side filters in the fuel line between the fuel tank and the fuel pump. This is where the FH filter assembly will mount. Leaving these filters in place will add to the fuel line restriction. Filter heads cast into the engine or that are non-removable or hard piped should be serviced with a new element and left in place.
- Keep fuel flow restriction values to a minimum. Always use the maximum size fuel hose possible. Do not make sharp bends with flexible fuel hose as kinks may occur. Avoid the use of two 45° elbow fittings where one 90° elbow will work.
- When routing hose, avoid surfaces that will move, have sharp edges, or will get hot (such as exhaust piping).

900FH and 1000FH Installation Diagram

A Vacuum Side Installation is Recommended


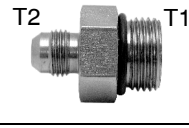
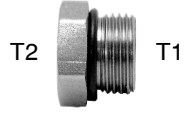

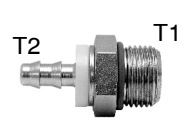


Optional Bypass Installation and Operation

The optional bypass installation allows the user to service the filter without shutting down the engine.

Valves	1	2	3
<u>Unit On-line:</u>	Open	Open	Closed
<u>Unit Off-line:</u>	Closed	Closed	Open

Racor Plated Steel Fittings

Part Number	Description	T1 (SAE J1926)	T2	Tube or Hose Size	Picture (No Scale)
9010-10-8 9010-10-10	SAE O-ring (T1) to JIC 37° Male Flare (T2) Elbow	7/8"-14 UNF 7/8"-14 UNF	3/4"-16 UNF 7/8"-14 UNF	8 10	
9020-10-8 9020-10-10	SAE O-ring (T1) to JIC 37° Male Flare (T2) Straight	7/8"-14 UNF 7/8"-14 UNF	3/4"-16 UNF 7/8"-14 UNF	8 10	
911-O10-F8 911-O10-F12	SAE O-ring (T1) to Female NPT (T2) Straight	7/8"-14 UNF 7/8"-14 UNF	1/2"-14 NPT 3/4"-14 NPT	8 12	
913-O10-H8 913-O10-H10 913-O10-H12	SAE O-ring (T1) to Hose Barb (T2) Elbow	7/8"-14 UNF 7/8"-14 UNF 7/8"-14 UNF	1/2" Hose Barb 5/8" Hose Barb 3/4" Hose Barb	8 10 12	
911-O10-H8 911-O10-H10 911-O10-H12	SAE O-ring (T1) to Hose Barb (T2) Straight	7/8"-14 UNF 7/8"-14 UNF 7/8"-14 UNF	1/2" Hose Barb 5/8" Hose Barb 3/4" Hose Barb	8 10 12	

Note: T1 is the side of the fitting that will attach to the FH filter housing. Additional fitting options may be available from a Parker dealer. Call 1-800-C-PARKER (1-800-272-7537) for the dealer nearest you.

Racor Fuel Hose

Racor fuel hose is fire resistant and meets SAE J1527 Type A class and SAE J1942 standards. This hose delivers test proven performance in a wide operating temperature range, constant working pressure in popular sizes, long-lasting reinforced construction, kink and cut resistance, and compatibility with a variety of standard fittings.



Part Number	Hose ID	Working Pressure	Burst Pressure	Min. Bend Radius
CGH-10	1/2" (12.5 mm)	500 PSI (3.5 MPa)	2000 PSI (14 MPa)	2 1/4" (55 mm)
CGH-12	5/8" (16 mm)	500 PSI (3.5 MPa)	2000 PSI (14 MPa)	2 3/4" (70 mm)
CGH-16	7/8" (22 mm)	500 PSI (3.5 MPa)	2000 PSI (14 MPa)	3 1/2" (90 mm)

Note - additional sizes are available - call Racor at 1-800-344-3286.

Additional Features

- High-tensile steel wire braid.
- No-Skive - does not require the removal of outer cover to install.
- USCG-rated for gasoline, diesel, lube oil and hydraulic systems.
- Working temperature of -4°F to +212°F (-20°C to +100°C).

Priming Instructions

1. Remove the T-handle and lid from the top of the filter assembly.
2. Fill the filter assembly with clean fuel.
3. Lubricate lid gasket and T-handle O-ring with clean fuel or motor oil.
4. Replace the lid and T-handle and tighten snugly by hand only – **do not use tools**.
5. If applicable, refer to the equipment Operator's Service Manual to complete the fuel priming procedure.
6. Start engine and check for fuel system leaks.
7. Correct as necessary with engine off and pressure relieved from filter assembly.

Service Instructions

Draining Water:

Frequency of water draining is determined by the contamination level of the fuel. Inspect or drain the collection bowl of water daily or as necessary. The collection bowl must be drained before contaminants reach the top of the turbine or when the Water Detection Module (optional) indicates it's time to 'drain water'.

Vacuum Applications / Installations:

1. Close the inlet valve (or valve #1) and open the self-venting drain on the bottom of the bowl.
2. Close the drain after all the water and contaminants have been evacuated – DO NOT leave the drain open too long as it will eventually completely drain the entire filter assembly of water AND fuel.
3. Follow 'Priming Instructions'.

Pressure Applications / Installations:

1. Open the self-venting drain on the bottom of the bowl to evacuate water and contaminants with a suitable collection container in place. Head pressure will push any water and contaminants out of the drain while keeping the filter primed.
2. Close the drain after all the water and contaminants have been evacuated – DO NOT leave the drain open too long as it will eventually completely drain the entire filter assembly of water AND fuel, and possibly drain the entire tank.

Element Replacement:

Frequency of element replacement is determined by the contamination level of the fuel. Replace the elements every 10,000 miles, every 500 hours, every other oil change, when the vacuum gauge (optional) reads between 6 to 10 inches of mercury (inHg), if power loss is noticed, or annually, whichever comes first. *Note - always carry extra replacement elements as one tankful of excessively dirty fuel can plug a filter.*

Use only genuine Racor Aquabloc II replacement elements.

All Applications:

1. Bypass filter assembly with bypass valves, if applicable.
2. Remove the T-handle and lid.
3. Remove the element by holding the bail handles and slowly pulling upward with a twisting motion. Dispose of properly.
4. Replace old lid gasket and T-handle O-ring with new seals (supplied with new element). Lubricate both seals with motor oil or diesel fuel before installation.
5. Refer to 'Priming Instructions', otherwise, fill the unit with clean fuel, then replace the lid and T-handle and tighten snugly by hand only – do not use tools.

Note – above ground tanks or transfer pump applications may use head pressure to prime the filter assembly.

Installing Optional Water Detection Components

Note – Racor electrical options are for use with diesel applications only.

Water Sensor




FH filter assemblies can be ordered with a water sensor installed at the factory. The following instructions are for FH filter assemblies that do NOT have a water sensor already installed. All water sensors must be used with a special Racor electronic detection module to function properly. Due to the variety of detection modules available, they are sold separately and installation instructions are supplied with each kit. See chart below for part numbers and descriptions.

1. Drain the FH filter assembly completely.
2. Take out the water sensor plug on the side of the bowl and discard properly.
3. Lubricate the water sensor O-ring with Parker Super O-lube or equivalent.
4. Thread the water sensor into the probe port on the side of the bowl. Tighten snugly.
5. Attach the Racor detection module to the wire leads of the water sensor. Specific instructions for this step are included with each detection module.
6. Prime the FH filter assembly by filling with fuel.
7. Start engine and check for leaks. Correct as necessary.

Water Detection Modules

Racor water detection modules are available in a wide selection for various installation requirements. Under dash, in-dash and remote mount, these solid-state units may be used with any Racor water sensor. They are manufactured using the highest quality materials and are all 100% electronically tested.

An electronic detection module analyzes electrical resistance at the water sensor and determines if water is present. If so, the detection module operates to indicate water, based on its features listed below. All units reset automatically after water is removed (unless specified). Below are some of our more popular modules, others are available.

Part Number	Description	Voltage	Picture
RK 12870	Under-dash mount. Light and audio. Illuminates and sounds when water is detected. Plastic enclosure measures 1.4" square by 1.25" deep. Power draw is 1 milliamp.	12 vdc	
RK 12871	Same as above.	24 vdc	
RK 20726	In-dash mount. Light and audio. Red 'DRAIN' lamp illuminates continuously and horn sounds momentarily when water is detected. Initial power-up self diagnosis feature and circuit protection included. Plastic 2" gauge. Power draw is 3 milliamps for 12 vdc and 13 milliamps for 24 vdc.	12 or 24 vdc	
RK 20725	Under-dash mount. Light only. Green 'ON' lamp illuminates with power and red 'DRAIN' lamp illuminates when water is detected. Initial power-up self diagnosis feature and circuit protection included. Plastic enclosure measures 2.75" by 1.0" by 1.5". Power draw is 10 milliamps.	12 vdc	
RK 20725-24	Same as above.	24 vdc	

Installing An Optional Fuel Heater

Note - Racor electrical options are for use with diesel applications **only**.

The in-filter heater is a cold weather starting aid with an internal automatic thermostat that turns the heater **ON** when the fuel temperature drops below 50°F (10°C) and turns **OFF** when the fuel reaches 80°F (27°C). Heat is supplied in the FH filter assembly just below the replacement element to melt wax crystals and allow fuel to pass through the element for quick, easy starting. The 300 watt heater is available in 12 or 24 vdc and is operated by turning the ignition switch ON for a minimum of five minutes prior to starting the engine.

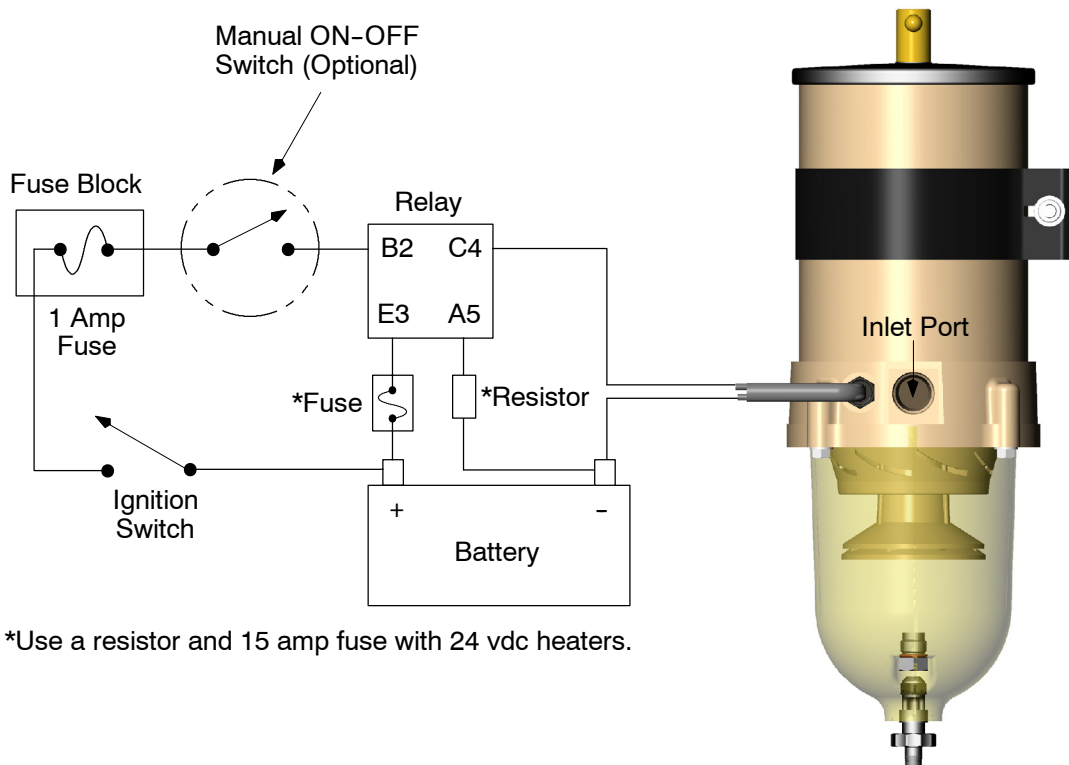
FH filter assemblies can be ordered with a heater installed at the factory. If you are adding a heater to a filter assembly that does not already have one, refer to the installation instructions that come with the heater. Follow the directions below to hook up the heater wire leads to your engine.

Customer Supplied Items:

1. Heater power demand is 25 amps for 12 vdc and 13 amps for 24 vdc. Due to the power demand, an additional relay is recommended for the safest method of installation. Racor offers two relay kits available from your Racor distributor. Part numbers are **RK 11861** (for 12 vdc) and **RK 11862** (for 24 vdc). These kits include an in-line fuse holder (and fuse) and the RK 11862 kit also includes a resistor. Use the 25 amp fuse with a 12 vdc system and the 15 amp fuse (and resistor) with a 24 vdc system.
2. An ON-OFF toggle switch may be used to control power to the heater relay. This allows the operator to cut power to the heater relay during summer use.
3. All wires should be 14 AWG (American Wire Gauge) minimum.

Installation:

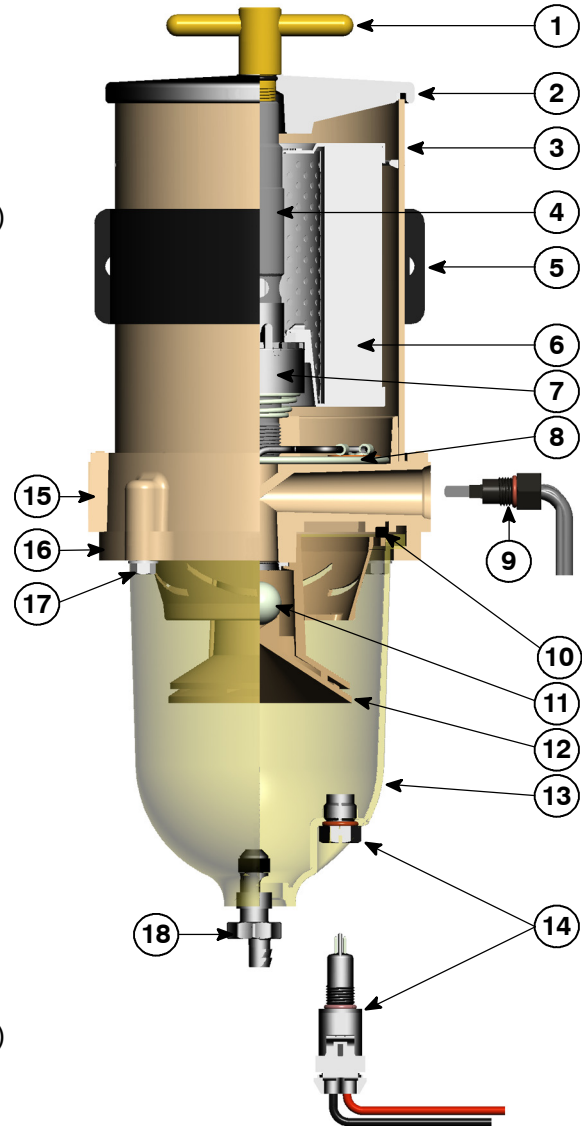
1. Either heater wire may be used for Hot (+) or Ground (-).
2. Wire / terminal connections should be soldered and crimped.
3. Run wires in protected locations. Avoid hot surfaces and places that could pinch or rub on the wires.



*Use a resistor and 15 amp fuse with 24 vdc heaters.

Replacement Parts

<u>Part Number</u>	<u>Description</u>
1 RK 11-1945 11350	T-handle and O-ring Kit T-handle O-ring
2 RK 11-1927-01 11007	Lid and Lid Gasket Kit Square Cut Gasket (Lid and Bowl)
3 RK 19002-03 RK 11021-03	900FH - Outer Cylinder 1000FH - Outer Cylinder
4 RK 11-1931 RK 11-1930	900FH - Return Tube 1000FH - Return Tube
5 RK 11815-103	Body Clamp Bracket
6 900FH: 2040SM-OR 2040TM-OR 2040PM-OR	2 Micron Element w/ Seals 10 Micron Element w/ Seals 30 Micron Element w/ Seals
1000FH: 2020SM-OR 2020TM-OR 2020PM-OR	2 Micron Element w/ Seals 10 Micron Element w/ Seals 30 Micron Element w/ Seals
7 RK 11-1953	Valve, Spring & O-ring Kit
8 RK 11-1800-01 RK 11-1800-02	12 vdc Heater w/ Body Feed-thru 24 vdc Heater w/ Body Feed-thru
9 RK 21067 RK 11-1679	Body Feed-thru Assy (for heater) Body Feed-thru Plug (not shown)
10 11007	Square Cut Gasket (Lid and Bowl)
11 RK 11028B	Checkball and Seal
12 RK 11-1939	Turbine Centrifuge / Conical Baffle
13 RK 11-1938	See-thru Bowl w/ Drain & Plug
14 RK 32204 RK 22838	Water Sensor Water Sensor Plug
15 RK 11-1776	Body, 7/8"-14
16 RK 11037A	Bowl Ring, 5" Diameter
17 RK 11542	Capscrew Kit (4)
18 RK 30476	Self-venting Drain
<u>Additional Parts</u>	
RK 11-1952	FH Assembly Seal Kit
RK 31605	Parker Super O-lube
(various)	Racor Additives (see chart on next page)



Additive	Part Number	Size	Treatment	Benefits
Diesel Biocide	ADT 2116	16 oz. Bottle	1,280 Gallons	<ul style="list-style-type: none"> • Concentrated formula • Kills bacteria and fungi • Prevents corrosion
	ADT 2201	1 Gallon Bottle	10,240 Gallons	
Diesel Conditioner Plus+	ADT 1116	16 oz. Bottle	320 Gallons	<ul style="list-style-type: none"> • Enhances engine performance • Stabilizes the fuel • Quieter engine operation
	ADT 1201	1 Gallon Bottle	2,560 Gallons	
Diesel Winter Plus+	ADT 4116	16 oz. Bottle	128 Gallons	<ul style="list-style-type: none"> • Inhibits waxing, icing and gelling • Protects down to -30°F (-34°C) • Enhances engine performance
	ADT 4201	1 Gallon Bottle	1,024 Gallons	

Specifications

Basic Models	900FH	1000FH
Maximum Flow Rate	90 GPH (341 LPH)	180 GPH (681 LPH)
Port Size (SAE J1926)	7/8"-14 UNF	7/8"-14 UNF
Replacement Elements: 2 micron 10 micron 30 micron	2040SM-OR 2040TM-OR 2040PM-OR	2020SM-OR 2020TM-OR 2020PM-OR
Minimum Service Clearance Above assembly Below assembly	5 in. (127 mm) 2 in. (51 mm)	10 in. (254 mm) 2 in. (51 mm)
Height	17.0 in. (432 mm)	22.0 in. (559 mm)
Depth	6.0 in. (152 mm)	6.0 in. (152 mm)
Width	7.0 in. (178 mm)	7.0 in. (178 mm)
Weight (dry)	6.0 lb (2.7 kg)	10.0 lb (4.5 kg)
Clean Element Pressure Drop	0.30 PSI (2.07 kPa)	0.43 PSI (2.97 kPa)
Maximum Allowable Pressure ¹	15 PSI (103 kPa)	15 PSI (103 kPa)
Water In Bowl Capacity	305 ml	305 ml
Available Options: ² Water Sensor Heater	Yes Yes	Yes Yes
Operating Temperature	-40° to +255°F / -40° to +121°C	

Special Notes

¹ Pressure installations are applicable up to the maximum PSI shown. Vacuum installations are recommended.

² Not for use on gasoline applications.

Troubleshooting

Note – Correct external fuel leaks immediately! These conditions will result in reduced engine performance such as: hard starting, stalling, reduced power and other associated problems.

New filter installations must be filled with fuel and the fuel system must be adequately primed following the **engine manufacturer's recommendations**, if applicable. Existing installation difficulties are usually associated with improper priming procedures or damage to the unit or fuel system. The result is either internal air suction or external fuel leakage. Diagnosis should be in the following steps:

1. Check the fuel tank level and make sure any fuel delivery valves are in the open position, as applicable.
2. Ensure the T-handle, bowl fasteners and fuel fittings are tight. Also verify that the bowl drain is closed.
3. If the Racor element is new, check potential restriction at the fuel tank draw tube. An in-tank strainer may be plugged.
4. Review some of the workings of the units below to possibly uncover other solutions.

Correct Application – It is very important that the FH filter assembly is not 'under specified' for the application. The maximum fuel flow rating of the FH filter assembly must not be exceeded. Doing so will reduce efficiency and de-gas (pull air from) the fuel.

Filter Elements – Replacement elements are available in 2, 10 and 30 micron ratings. Filtration needs are based on application, fuel quality, maintenance schedules and operating climates. A simple rule to remember is – the finer the filtration, the more frequent the filter change. *Always carry extra replacement elements with your equipment as one tankful of excessively contaminated fuel can plug an element.* When clogged to the maximum capacity, elements will have a brown to black color or tar like contaminants may be present – this is normal. An appearance of a multi-colored slime (which may have a foul odor) is an indication of microbiological contamination. This condition must be treated immediately. Severe conditions must be corrected by a repair facility.

Note – Never operate the filter assembly without the element in place – the element safety valve will not expose the outlet hole on the fuel return tube if the element is removed. Instead, punch the emergency tab on the top of the element and leave in place. Puncturing the emergency tab will bypass all filtration and send unfiltered fuel to your engine. Service the element as soon as possible to avoid harmful contaminants flowing downstream to the engine.

Water Sensors – This feature alerts the operator of a high-water condition. The bowl is then drained of water at the earliest convenience. Note – a Racor water detection module is needed to work with the in-bowl sensor. The unit should activate when the water reaches the sensor tips (and when they measure between 47,000 and 100,000 ohms of resistance, depending on the detection module used). If not, the tips may be fouled with a coating. Remove the sensor and clean the tips with a cloth. Run a jumper wire between the tips with the ignition ON to test the system. Difficulties usually lie in the wire connections, power source, or an independent ground.

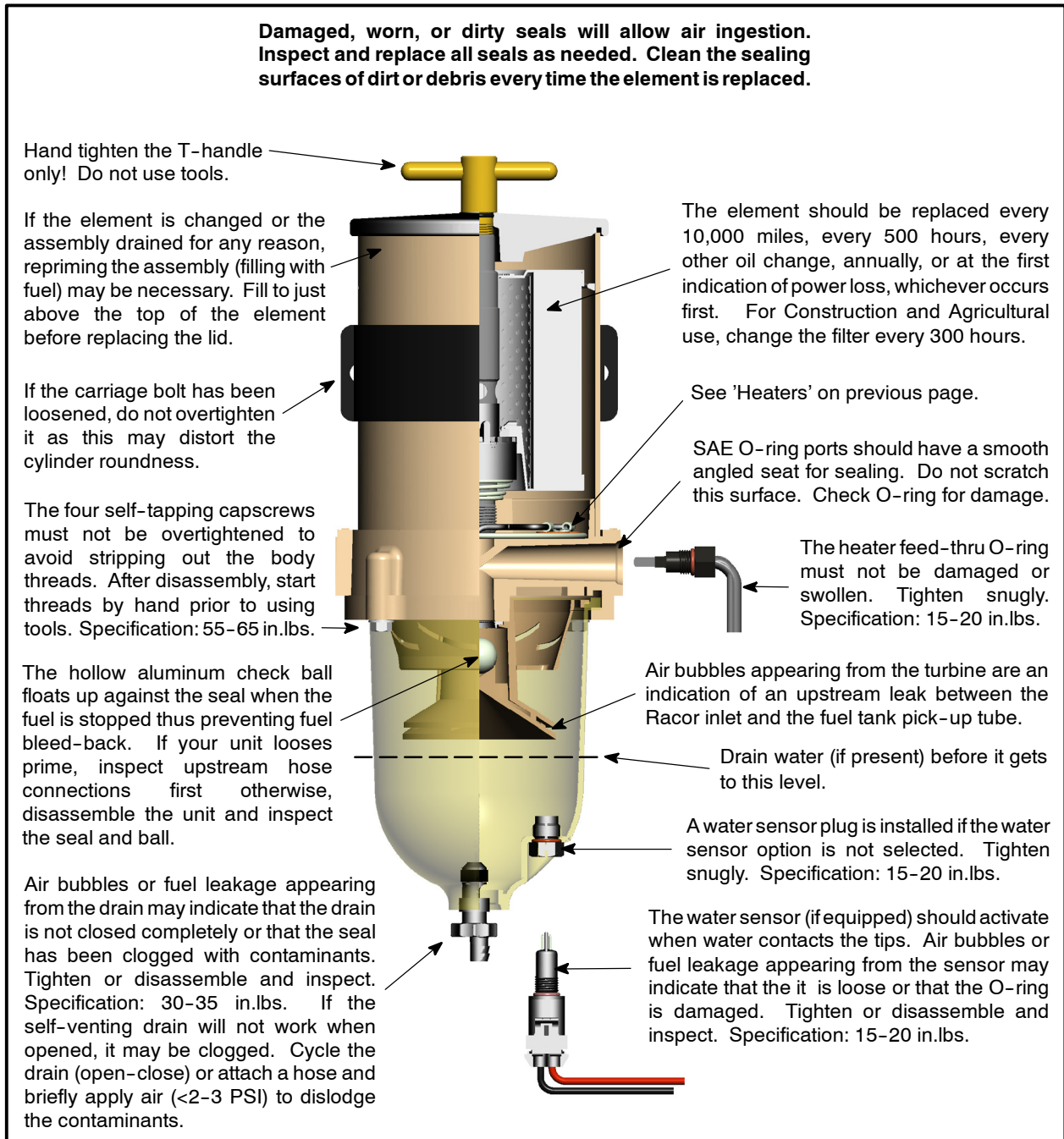
Heaters – In-filter heaters are starting aids only, but may be left on during cold operations. The 300 watt heater is an extremely reliable option, but **MUST** be powered via a relay switch due to the initial amperage surge at start-up: 25 amps at 12 vdc and 12.5 amps at 24 vdc. They do not activate unless the fuel is below 50°F (10°C) and automatically deactivate at 80°F (28°C).

Heater Testing – The heater can only be tested when the thermostat is closed (fuel temperature is below 50°F or 10°C). With a voltmeter attached to external wiring, and engine off, power should drop when heater is switched on. (Option – remove the heater and place it in a freezer until the temperature is under 50°F (10°C). Remove the heater and repeat the above test).

Troubleshooting

All Racor FH filter assemblies are 100% tested to ensure a leak-proof, quality product. Note - Correct external fuel leaks immediately! In the event difficulties are experienced with your filter assembly or a problem appears to prevent the engine from running smoothly, follow the quick-help illustration below or refer to the procedures on the previous page. **Note** - Apply Parker Super O-lube (part number RK 31605) or equivalent to all seals at major attachment points to maintain integrity, seal elasticity, to fill small voids and provide protection from degradation.

Perform the following checks with the engine OFF (and applicable valves closed). For replacement parts, refer to the Replacement Parts section of this manual.



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