



# FUEL SYSTEM

## Section 3A - Fuel Pump

### Table of Contents

---

Specifications .....	3A-2	Checking Fuel Pump Lift (Vacuum) .....	3A-7
Fuel Pump Pressure @ W.O.T. ....	3A-2	Vacuum Test Troubleshooting .....	3A-7
Fuel Pump Pressure @ Idle .....	3A-2	Testing Fuel Pump .....	3A-8
Special Tools .....	3A-2	Fuel Pump Removal/Disassembly .....	3A-9
Fuel Pump Assembly .....	3A-4	Cleaning/Inspection .....	3A-10
Fuel Pump Description/Operation .....	3A-6	Reassembly/Installation .....	3A-10
Checking for Restricted Fuel Flow Caused by		Fuel Lift Pump .....	3A-13
Anti-siphon Valves .....	3A-6	Fuel Lift Pump Troubleshooting .....	3A-14

---

**3  
A**



## Specifications

### Fuel Pump Pressure @ W.O.T.

Maximum – 10 psi (68.5 kPa)  
Normal – 8-10 psi (41.0 – 54.8 kPa)  
Minimum – 3 psi (20.5 kPa)

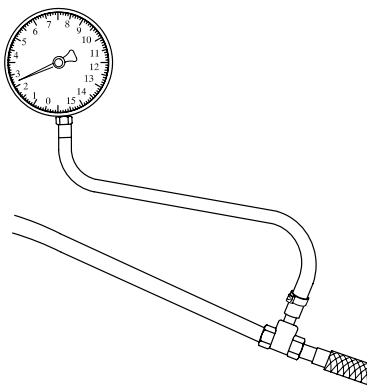
### Fuel Pump Pressure @ Idle

Normal – 2-3 psi (13.7 – 20.5 kPa)  
Minimum – 1 psi (6.8 kPa)

**NOTE:** Electric fuel pump pressure, if used in conjunction with engine mechanical fuel pump, must be limited to no more than 4 psi (27.4 kPa).

## Special Tools

1. Fuel Pressure Gauge (0–15 psi) (Obtain Locally)



57721

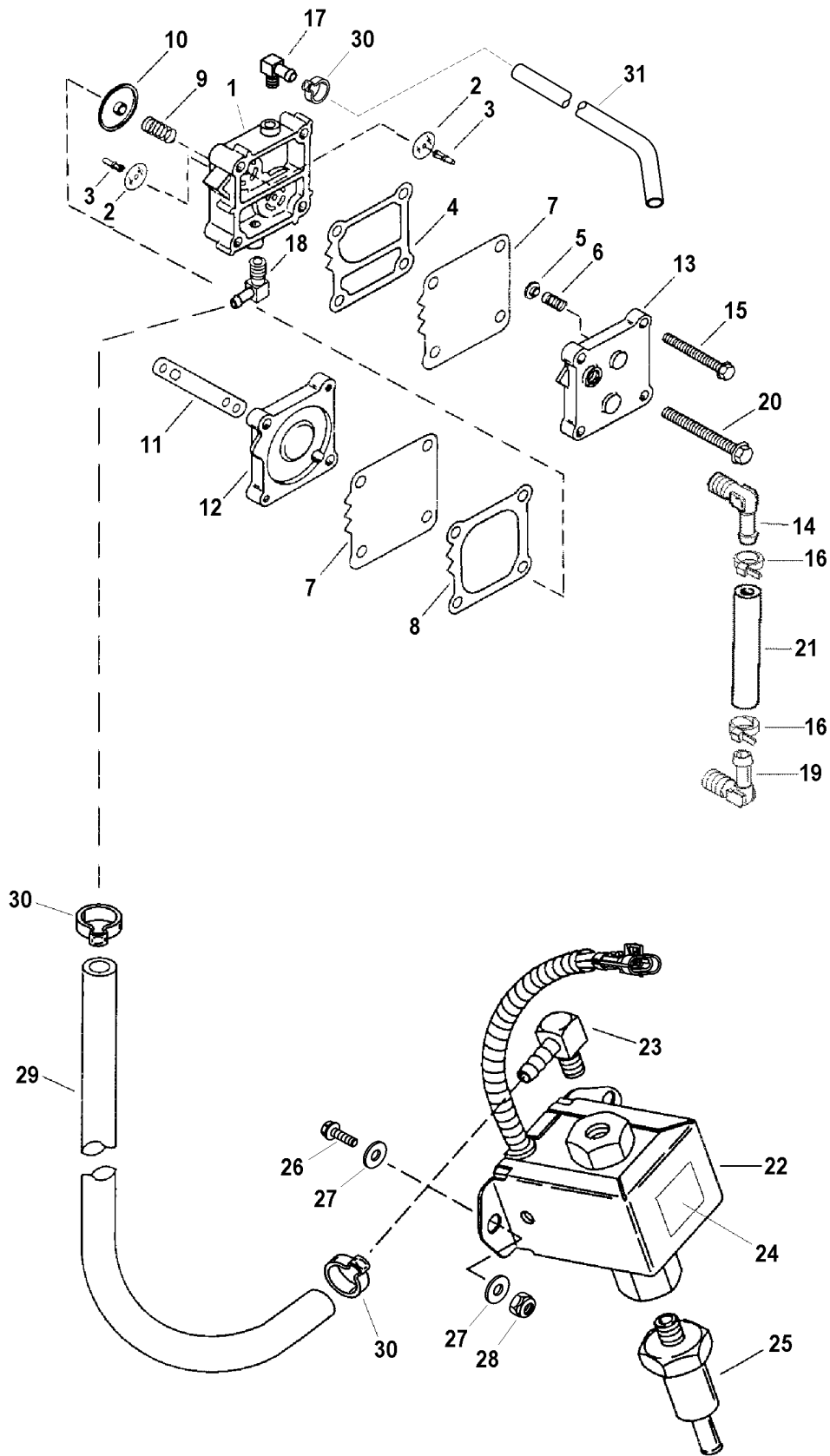
2. Vacuum Gauge (0 – 10 inches of vacuum mercury). Obtain Locally



## Notes:



# Fuel Pump Assembly





# Fuel Pump Assembly

REF. NO.	QTY.	DESCRIPTION	TORQUE		
			lb-in	lb-ft	Nm.
1	1	FUEL PUMP ASSEMBLY			
2	2	DISK – Check Valve			
3	2	RETAINER			
4	1	GASKET – Boost			
5	1	CAP – Spring End			
6	1	SPRING			
7	2	DIAPHRAGM			
8	1	GASKET-PULSE			
9	1	SPRING			
10	1	CAP – Spring End			
11	1	GASKET – Base			
12	1	BASE – Fuel Pump			
13	1	PLATE – Fuel Pump			
14	1	ELBOW (0.125-27) (0.250 ID) (Nylon)	Do Not Overtighten		
15	2	SCREW–FUEL PUMP (M5 x 40) (Fuel Pump)	55		6.
16	2	STA STRAP (8 in) (20.3 cm)			
17	1	FITTING (0.125-27 Brass) (90 Degree)	110		12.5
18	1	FITTING (0.125-27 Brass) (90 Degree)	110		12.5
19	2	ELBOW (0.125-27) (0.250 ID) (Nylon)	Do Not Overtighten		
20	2	SCREW (M6 x 50) (Fuel Pump to Crankcase)	55		6
21	1	TUBING [0.312 ID x 6.00 in(7.9 mm ID x 15.3 cm)]			
22	1	PUMP ASSEMBLY – Electric			
23	1	FITTING (Elbow)	105		12
24	1	DECAL – Info (SAE J1171 Marine)			
25	1	FILTER – Fuel	105		12
26	2	SCREW (M5 x 13)			
27	4	WASHER			
28	2	NUT (M5)	70		8
29	1	HOSE [8 in (20.3 cm)]			
30	3	CLAMP (18.3)			
31	1	HOSE [5 in (12.7 cm)]			



## Fuel Pump Description/Operation

The fuel pump is a crankcase-pressure-operated, diaphragm-type pump. Crankcase pulsating pressure (created by the up-and-down movement of piston) is transferred to fuel pump by way of a passage (hole) between crankcase and fuel pump.

When piston is in an upward motion, a vacuum is created in the crankcase, thus pulling in on the fuel pump diaphragm. The inlet check valve (in fuel pump) is opened and fuel (from fuel tank) is drawn into fuel pump.

Downward motion of the piston forces the air mixture out of the crankcase into the cylinder. This motion also forces out on the fuel pump diaphragm, which, in turn, closes the inlet check valve (to keep fuel from returning to fuel tank) and opens the outlet check valve, thus forcing fuel to the VST(EFI models) or carburetors.

## Checking for Restricted Fuel Flow Caused by Anti-Siphon Valves

While anti-siphon valves may be helpful from a safety stand-point, they clog with debris, they may be too small, or they may have too heavy a spring. Summarizing, the pressure drop across these valves can, and often does, create operational problems and/or power-head damage by restricting fuel to the fuel pump and VST. Some symptoms of restricted (lean) fuel flow, which could be caused by use of an anti-siphon valve, are:

- 1 - Loss of fuel pump pressure
- 2 - Loss of power
- 3 - High speed surging
- 4 - Preignition/detonation (piston dome erosion)
- 5 - Outboard cuts out or hesitates upon acceleration
- 6 - Outboard runs rough
- 7 - Outboard quits and cannot be restarted
- 8 - Outboard will not start
- 9 - Vapor lock

Since any type of anti-siphon device must be located between the outboard fuel inlet and fuel tank outlet, a simple method of checking [if such a device (or bad fuel) is a problem source] is to operate the outboard with a separate fuel supply which is known to be good, such as a remote fuel tank.

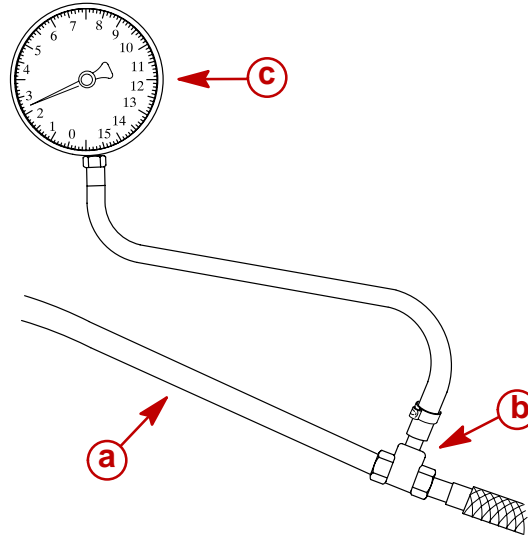
If, after using a separate fuel supply, it is found that the anti-siphon valve is the cause of the problem, there are 2 solutions to the problem; either 1) replace the anti-siphon valve with one that has lighter spring tension or 2) replace it with a solenoid-operated fuel shut off valve.



## Checking Fuel Pump Lift (Vacuum)

The square fuel pump is designed to lift fuel (vertically) about 60 in. (1524 mm) if there are no other restrictions in the system using a fuel hose that is 5/16 in. (7.9 mm) minimum diameter. As restrictions are added, such as filters, fittings, valves etc., the amount of fuel pump lift decreases.

Fuel pump vacuum and air bubbles in the fuel supply can be checked with a vacuum gauge, a t-fitting and a clear piece of fuel hose. Connect the clear hose between the inlet fitting on the pulse driven fuel pump and the vacuum gauge t-fitting; keeping the t-fitting as close as possible to the pump. Connect the fuel line from the fuel tank to the remaining connection on the t-fitting.



- a - Clear Hose
- b - T-fitting
- c - Vacuum Gauge

57721

### Vacuum Test Troubleshooting

Before proceeding with the system vacuum test, confirm that the pulse fuel pump is capable of supplying the required vacuum. To do this, start the engine, pinch off/restrict the fuel supply hose between the vacuum gauge and fuel tank. The vacuum gauge should rise to or exceed the maximum normal reading of 2.5 inches vacuum (mercury). If it fails to reach this minimum number, the pump needs servicing or there is a lack of crankcase pressure to operate the pump.

Normal Reading	Below 2.5 in. of vacuum (mercury)
Reading above 2.5 in. of vacuum (mercury)	Restriction within the fuel system – <ul style="list-style-type: none"> <li>• Restricted anti-siphon valve</li> <li>• Restriction within the primer bulb</li> <li>• Kinked or collapsed fuel hose</li> <li>• Plugged water separating fuel filter (in the boat)</li> <li>• Restriction in fuel line thru-hull fitting</li> <li>• Restriction in fuel tank switching valves</li> <li>• Plugged fuel tank pick-up screen</li> </ul>



## Testing Fuel Pump

<b>Problem: Air Bubbles in Fuel Line</b>	
Low fuel in tank.	Fill tank with fuel.
Loose fuel line connection.	Check and tighten all connectors.
Fuel pump fitting loose.	Tighten fitting.
A hole or cut in fuel line.	Check condition of all fuel lines and replace
Fuel Pump anchor screw(s) loose.	Tighten all screws evenly and securely.
Fuel Pump filter cover anchor screw loose.	Tighten screws securely.
Fuel pump filter gasket worn out.	Replace gasket.
Fuel pump gasket(s) worn out.	Rebuild fuel pump.
Fuel vaporizing	Fuel with high reed vapor pressure (winter grade fuel) may vaporize (form bubbles) when used in hot/warm weather. Use fuel with a lower reed vapor pressure (summer grade fuel) <a href="http://motorka.org">http://motorka.org</a>
<b>Problem: Lack of Fuel Pump Pressure</b>	
An anti-siphon valve.	See "Checking for Restricted Fuel Flow" preceding.
Air in fuel line.	See "Air Bubbles in Fuel Line", above.
A dirty or clogged fuel filter.	Clean or replace fuel filter.
The fuel pickup in fuel tank is clogged or dirty.	Clean or replace pickup.
Worn out fuel pump diaphragm.	Rebuild fuel pump.
Worn out check valve(s) in fuel pump.	Rebuild fuel pump.
A leaky check valve gasket.	Rebuild fuel pump.
Pulse hole(s) plugged.	Remove fuel pump and clean out holes.
Hole in pulse hose.	Replace pulse hose.
Loose pulse hose.	Tighten connection(s).
Fuel hose internal diameter too small.	Use 5/16 I.D. fuel hose.
Primer bulb check valve not opening.	Replace primer bulb.
Excessive fuel lift required.	Fuel lift exceeds 2.5 in. of vacuum (mercury)

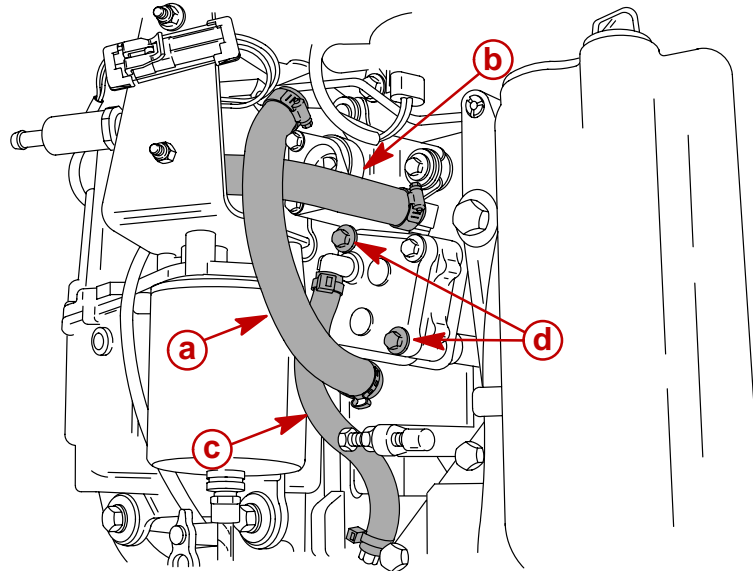




## Fuel Pump Removal/Disassembly

**IMPORTANT: Fuel pump diaphragm and gaskets should not be re-used once fuel pump is disassembled.**

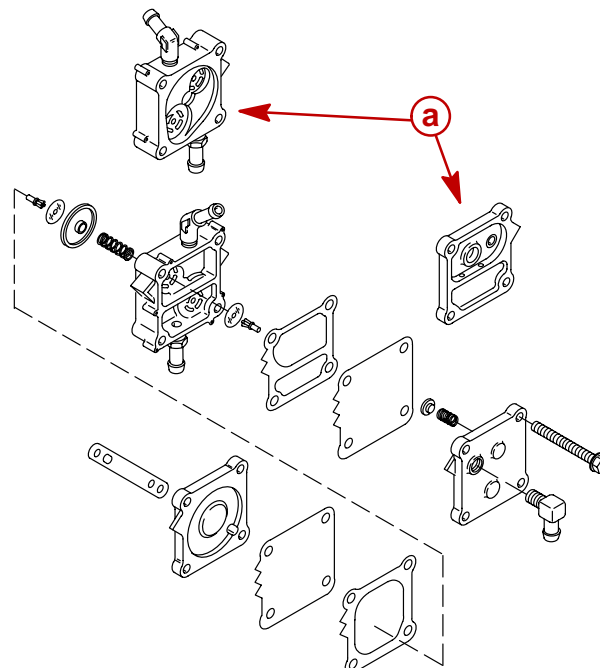
1. Disconnect fuel hoses from fuel pump.
2. Disconnect pulse hose.
3. Remove two mounting screws.
4. Remove fuel pump from engine.



59243

- a** - Fuel Inlet
- b** - Fuel hose from fuel pump to Fuel/Water Separator
- c** - Pulse hose
- d** - Mounting screws

5. Disassemble fuel pump.



58876

- a** - Reverse View of Pump Body



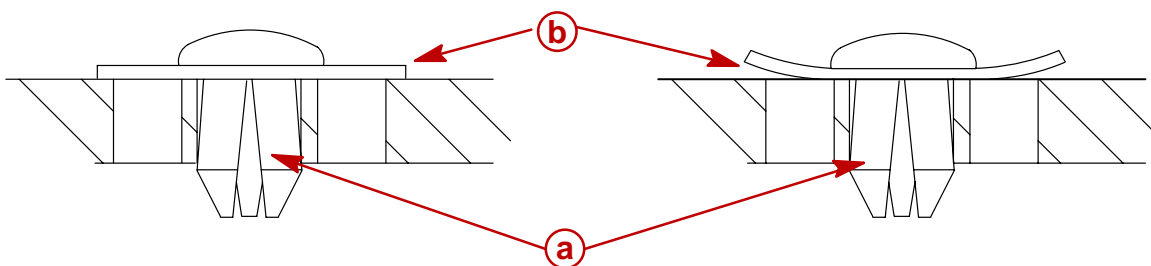
## Cleaning/Inspection

1. Clean fuel pump housing, check valves, pulse chamber and pump base in solvent and dry all but check valves with compressed air.
2. Inspect each check valve for splits or chips.
3. Inspect boost springs for weakness or breakage.
4. Inspect fuel pump housing, pulse chamber and base for cracks or rough gasket surface and replace if any are found.
5. Inspect fitting on fuel pump housing for loosening or any signs of fuel or air leaks. Replace or tighten fitting if a leak is found.

## Reassembly/Installation

### ASSEMBLY

**NOTE:** The new repair kits contain check valves made of a plastic material, impervious to damage from additives. When repairing the fuel pump discard old rubber and small plastic check valve disks, and install one new plastic disk under each retainer. Caution must be taken not to push the check valve retainer to tightly against the check valve, this may cause valve to deform.



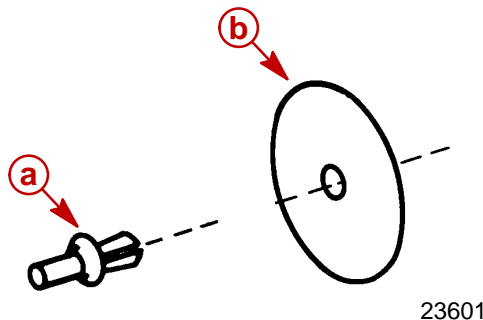
**CORRECT**

**INCORRECT**

57861

- a** - Check Valve Retainer
- b** - Check Valve (Plastic)

1. Insert retainer through plastic check valve.

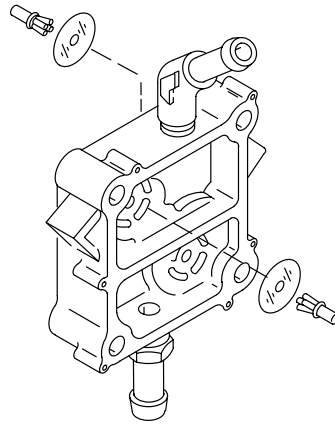


- a** - Retainer
- b** - Plastic Check Valve

23601

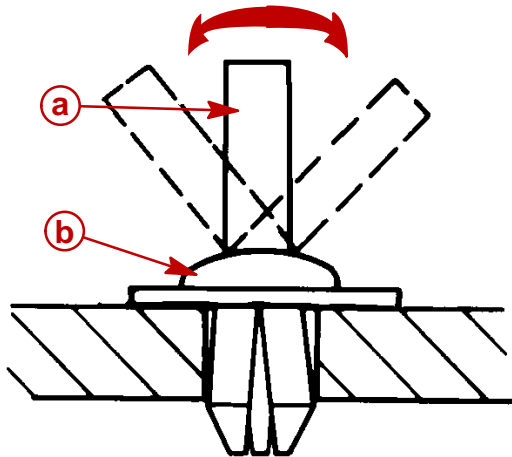


2. Install check valves and retainers into fuel pump body.



58887

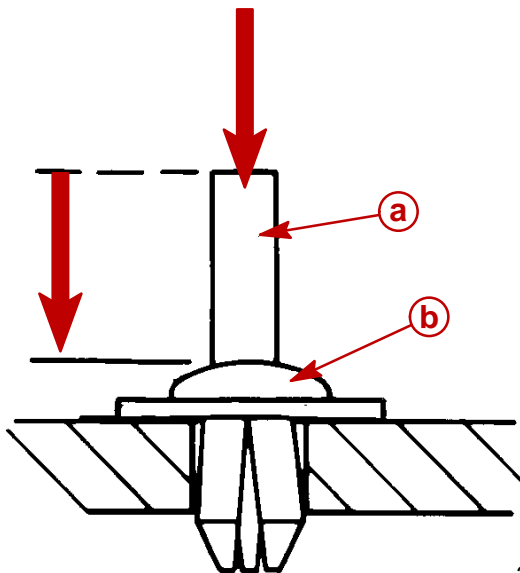
3. With retainer installed in pump body, break retainer rod from retainer by bending side-ways.



23601

- a - Rod
- b - Retainer Cap

4. Reinstall rod into retainer cap and, use a small hammer or hammer and punch to tap rod down into retainer until flush with top of retainer.

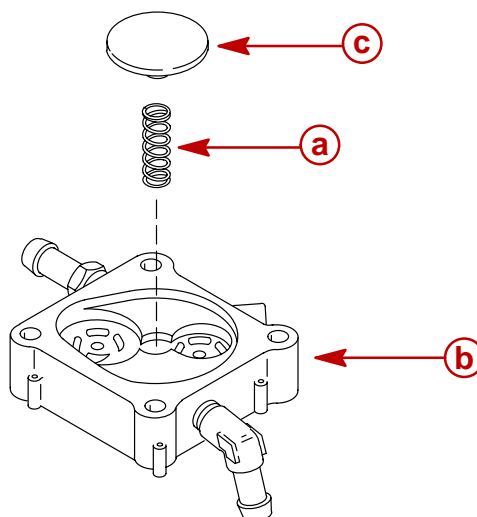


23601

- a - Rod
- b - Retainer Cap



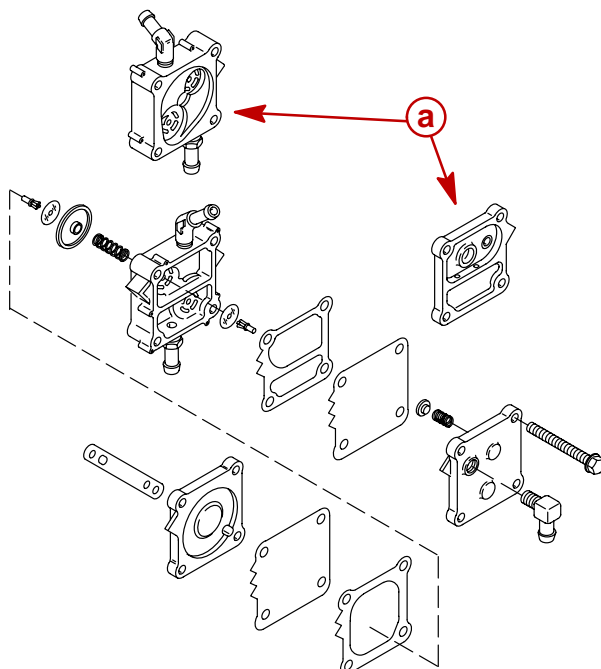
5. Place boost spring into pump body and place cap onto boost spring.



50161

- a - Boost Spring
- b - Pump Body
- c - Cap

6. Assemble remainder of components as shown and install retaining screws through to align.



58876

- a - Reverse View of Pump Body

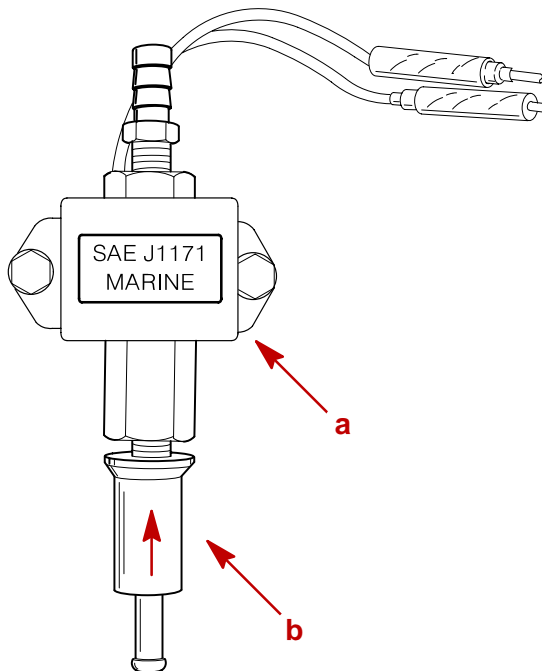
## INSTALLATION

1. Install pump onto engine. Torque to 55 lb. in. (6 N·m).
2. Install hoses onto proper fittings and secure with sta-straps.
3. Run engine and check for leaks.



## Fuel Lift Pump

The fuel lift pump is an electric fuel pump used to supply fuel from the boat fuel tank to the engine driven pulse fuel pump. Electrical power is supplied to the fuel lift pump from the slave solenoid. A 3 amp fuse is used to protect the electrical circuit.



- a** - Fuel Lift Pump [Torque Nuts to 70 lb. in. (8 Nm)]
- b** - Fuel Filter [Torque filter to 105 lb. in. (12 Nm)]



## Fuel Lift Pump Troubleshooting

The purpose of this test is to determine if the fuel lift pump is operating correctly.

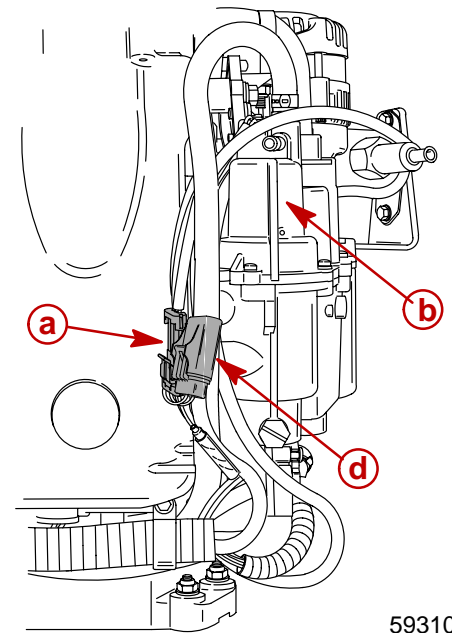
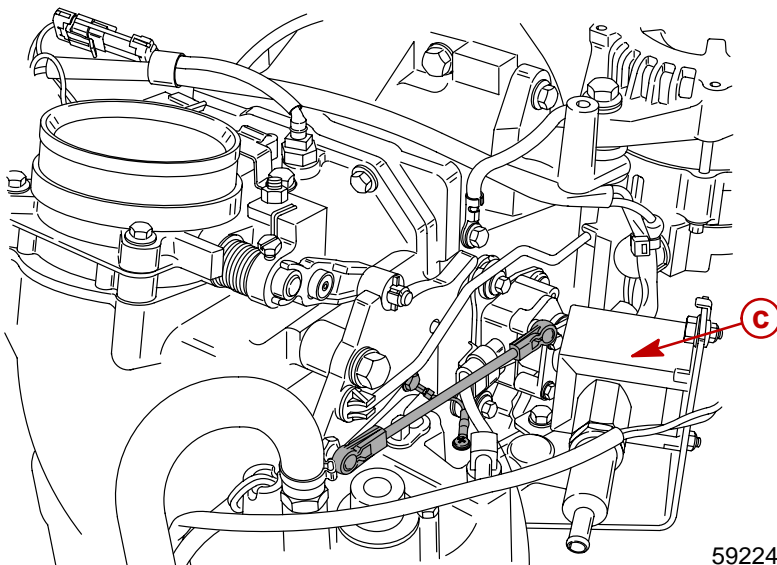
1. Place emergency stop switch in "OFF" position.
2. Disconnect the high pressure fuel pump electrical connector.

**IMPORTANT: If the high pressure fuel pump is not disconnected the activation of the lift pump can be confused with the activation of the high pressure fuel pump.**

3. Place your fingers on the lift pump and have someone turn the key switch to the "ON" position. Or, unplug the remote control harness, plug in a remote key switch harness and turn the key switch to the "ON" position.
4. If the lift pump is operating correctly it will run for 5 seconds after the key switch is turned on. Listen for an audible clicking and feel with your fingers if the pump is activating. If uncertain, turn the key to the "OFF" position and then the "ON" position to reactivate.

### RESULTS:

1. If the lift pump does not activate inspect the 3 amp fuse. Replace if necessary.
2. If the fuse is ok check for battery voltage at the lift pump electrical connection. If battery voltage is low check for loose, dirty or damaged wiring connections.
3. If battery voltage is present and lift pump does not activate, replace lift pump.
4. If voltage to the lift pump is correct and the pump is activating but not pumping fuel check the following:
  - Inspect for loose fuel connections (pump is drawing air)
  - Pinched fuel hose
  - Stuck anti-siphon valve
  - Clogged lift pump filter or clogged fuel filter in the boat fuel tank



- a** - High Pressure Fuel Pump Connector
- b** - High Pressure Electric Fuel Pump (inside VST)
- c** - Lift Pump
- d** - 3 Amp Fuse