



FUEL SYSTEM

Section 3C – Oil Injection

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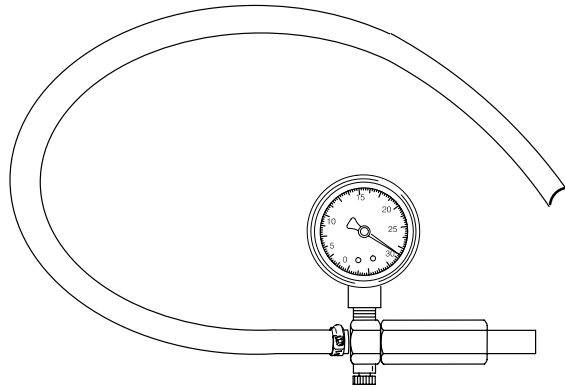
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Special Tools

1. Gearcase Leakage Tester (FT-8950)



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Oil System Operation

Oil in this engine is not mixed with the fuel before entering the combustion chamber. Oil is stored inside the remote oil tank in the boat. Crankcase pressure forces oil from the remote oil tank into the engine oil reservoir. The engine oil reservoir feeds oil to the oil pump. The oil pump is ECM driven and controls oil distribution to the crankcase and air compressor. The oil pump has seven oil discharge ports. Six of the oil discharge ports inject oil into the crankcase through hoses, one hose for each cylinder. The last oil discharge port discharges oil into the air compressor for lubrication. Unused oil from the air compressor returns to the plenum and is ingested through the crankcase for Model Year 2000. On Model Year 2001 engines, unused oil from the air compressor is returned to the top main bearing.

The ECM is programmed to automatically increase the oil supply to the engine during the initial engine break-in period. The oil ratio is doubled during the first 120 minutes of operation whenever engine speed exceeds 2500 RPM and is under load; below 2500 RPM the oil pump provides oil at the normal ratio. After the engine break-in period, the oil ratio will return to normal – 300 - 400:1 at idle to 60:1 at WOT.

NOTE: On some light boat applications after the break-in is completed and the engine is being run at cruising speed – between 4000 and 5000 RPM – the fuel to oil ratio may be as high as 40:1. This results from a reduced throttle opening with a corresponding reduction in fuel consumption.

Oil Pump Output

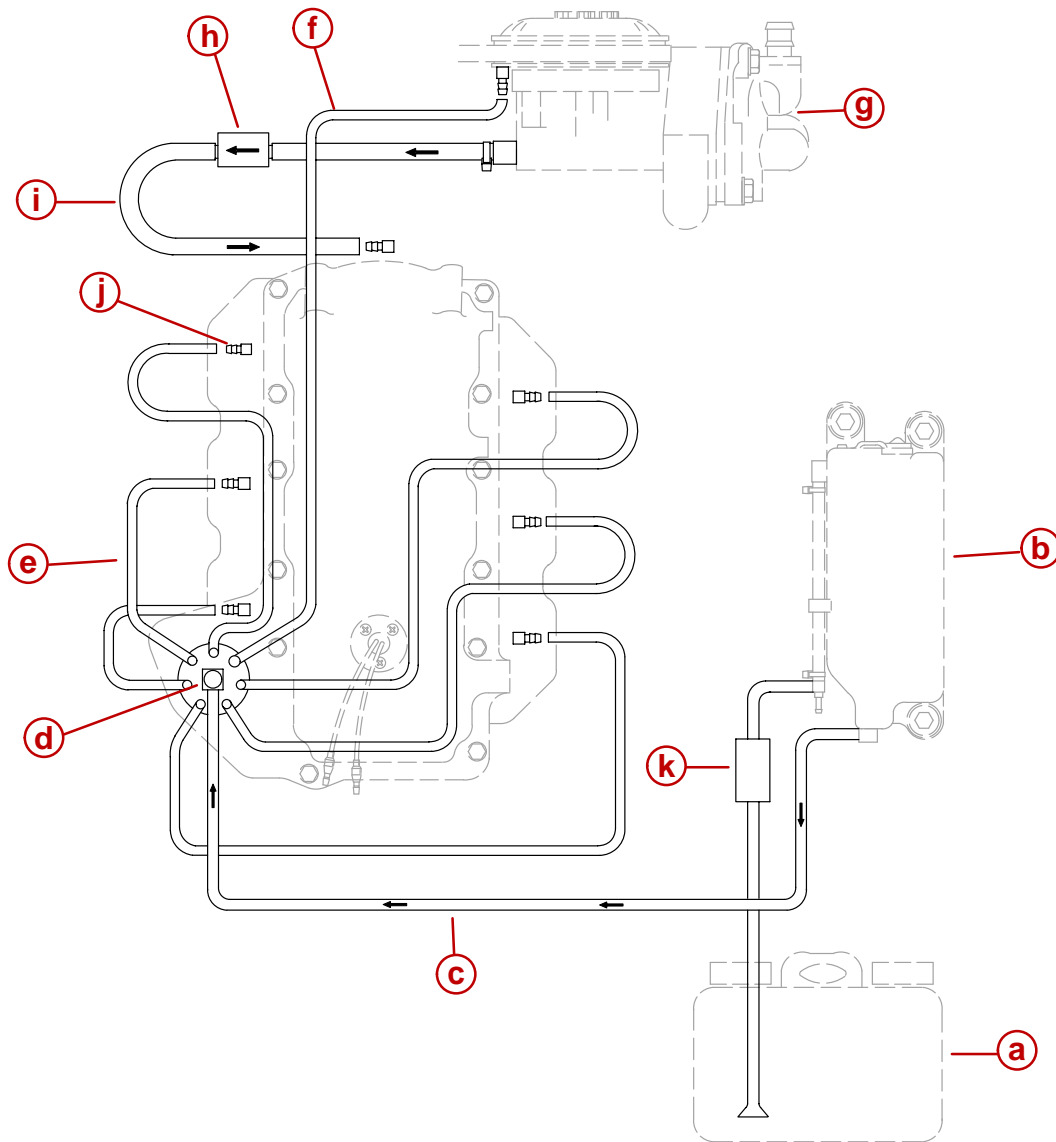
Using the DDT to activate auto prime, the oil pump should discharge 110 ml (cc) \pm 8 ml (cc) during the auto prime time period.

To check the oil pump output:

- Verify the onboard oil reservoir is full.
- Release any pressure (loosen cap) from the remote oil tank in the boat.
- With engine not running, use the DDT to activate the auto prime.
- Using a ml or cc graduated container, record the amount of oil needed to refill the onboard oil reservoir.
- Retighten cap on the remote oil tank in the boat.



Model Year 2000 Oil System – Oil Hose Installation

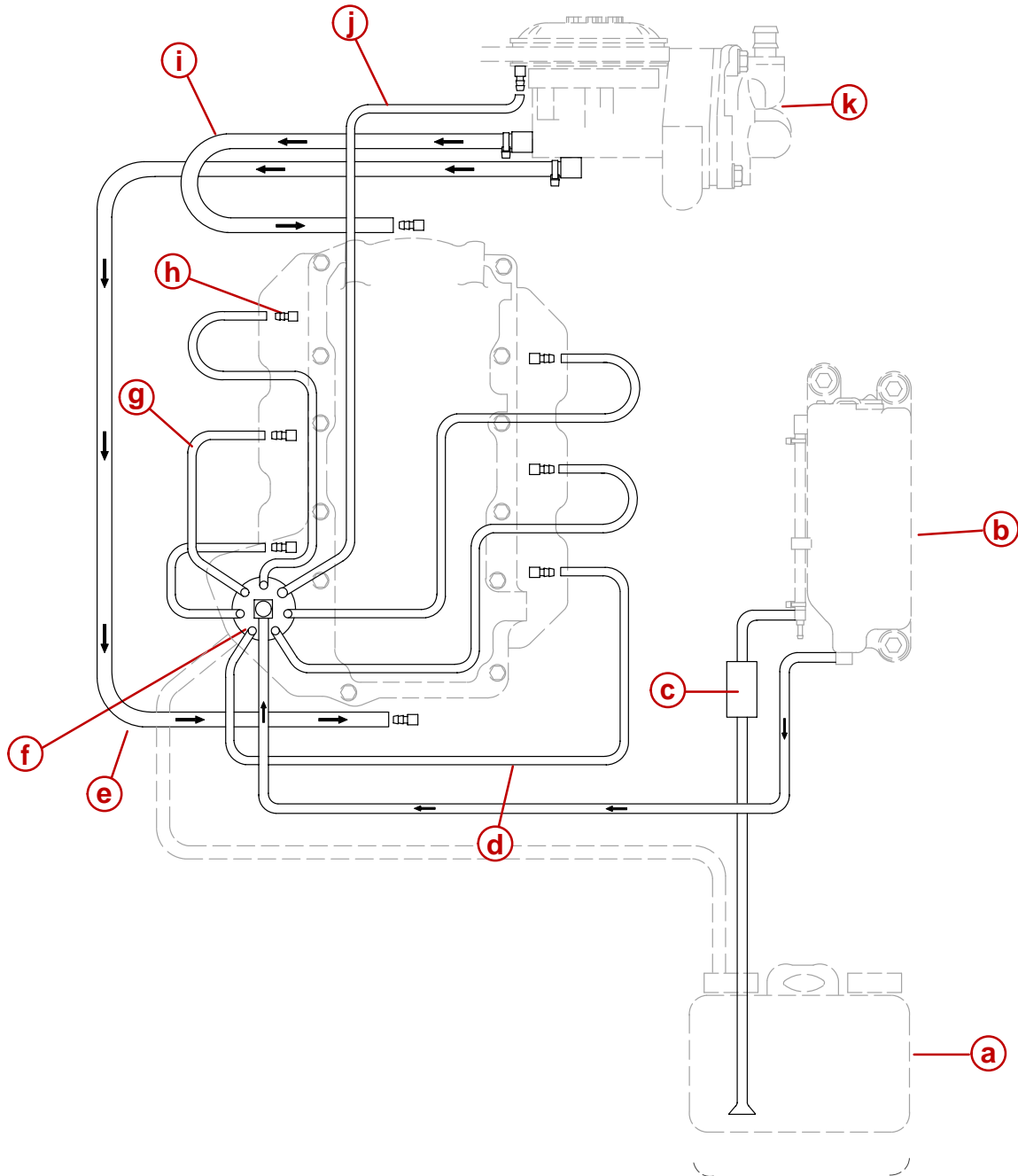


- a** - Remote Oil Tank
- b** - Engine Oil Reservoir
- c** - Oil Supply Hose to the Oil Pump
- d** - Oil Pump
- e** - Oil Supply Hoses to the Cylinders (6)
- f** - Oil Supply Hose to the Air Compressor
- g** - Air Compressor
- h** - Check Valve
- i** - Oil Return Hose from the Air Compressor
- j** - Fitting and Check Valve (6)
- k** - Filter

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Model Year 2001 Oil System – Oil Hose Installation



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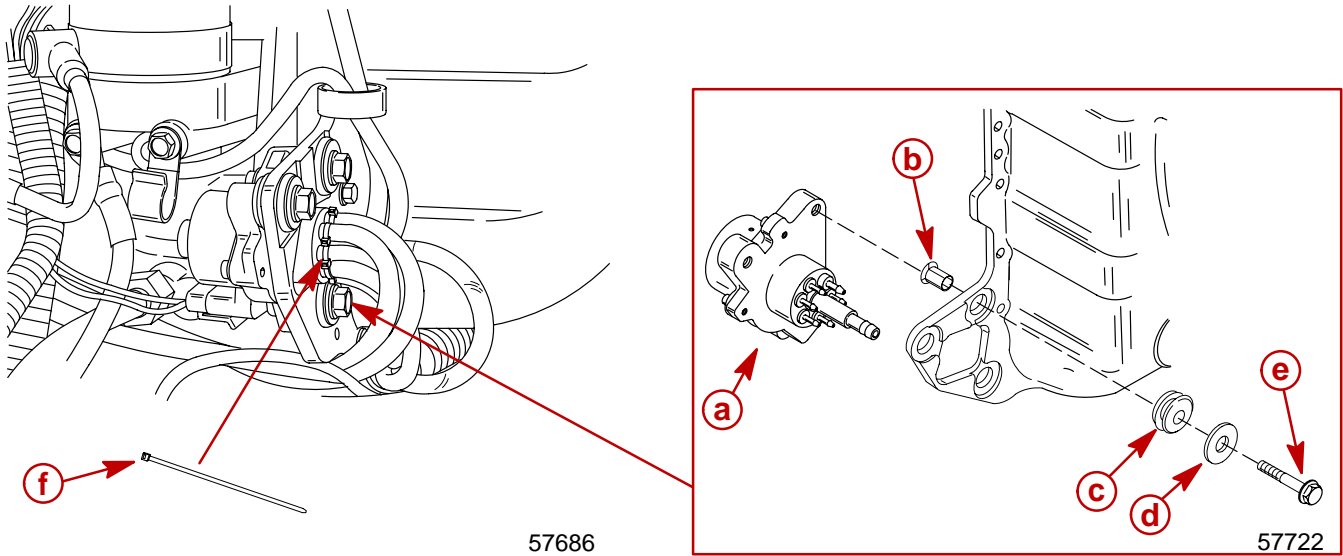
- a** - Remote Oil Tank
- b** - Engine Oil Reservoir
- c** - Filter
- d** - Oil Supply Hose to the Oil Pump
- e** - Oil Supply Hose to Lower Crankshaft Bearing
- f** - Oil Pump
- g** - Oil Supply Hoses to the Cylinders (6)
- h** - Fitting and Check Valve (8)
- i** - Oil Supply Hose to Upper Crankshaft Bearing
- j** - Oil Supply Hose to the Air Compressor
- k** - Air Compressor



Oil Pump Removal and Installation

REMOVAL

1. Disconnect the wiring harness from the pump.
2. Disconnect the oil hoses.
3. Remove three bolts and remove pump.



- a** - Oil Pump
- b** - Bushing (3)
- c** - Rubber Grommet (3) – Insert into Hole
- d** - Washer (3)
- e** - Bolt (3) – Torque to 16 lb. ft. (21.5 Nm)
- f** - Sta-Straps – Fasten All Hose Ends

INSTALLATION

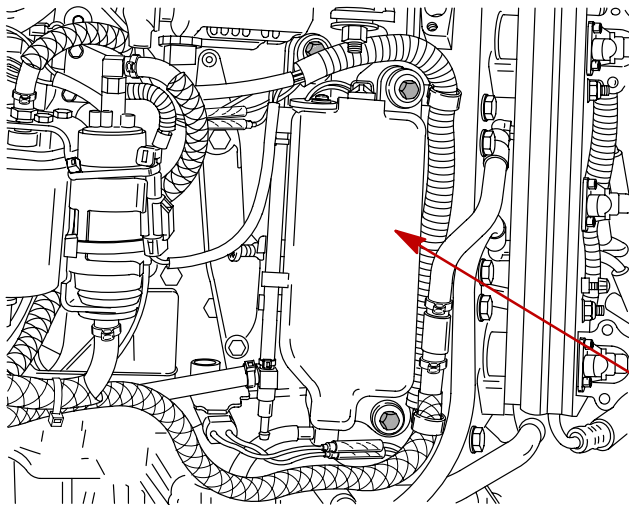
1. Install pump as shown.
2. Reconnect the oil hoses. Refer to Oil Injection Hose Installation for correct location. Fasten hoses to pump fittings with sta-straps.
3. Connect the wiring harness.
4. Refill the oil system. Refer to Priming the Oil Pump.



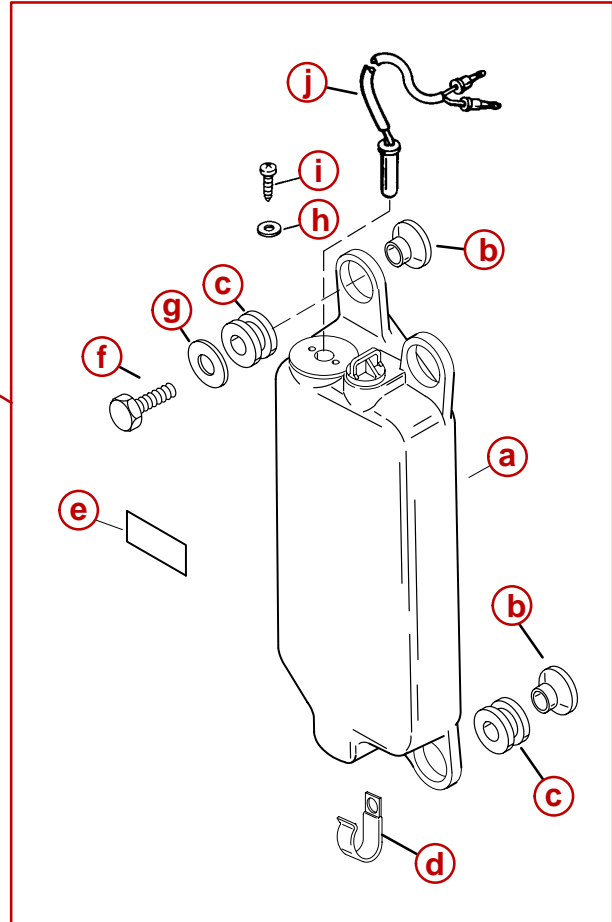
Engine Oil Reservoir Removal and Installation

REMOVAL

1. Disconnect the oil hoses. Plug the hoses to prevent spillage.
2. Disconnect the BLUE with BLACK STRIPE wire leads.
3. Remove three bolts securing oil tank to powerhead and remove tank.



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- a** - Oil Reservoir
- b** - Bushing (3)
- c** - Rubber Grommet (3) – Insert into Holes
- d** - J-Clip
- e** - Decal
- f** - Bolt (3) – Torque to 170 lb. in. (19 Nm)
- g** - Washer (3)
- h** - Washer
- i** - Screw (Drive Tight)
- j** - Low Oil Switch (Normally Closed Circuit)

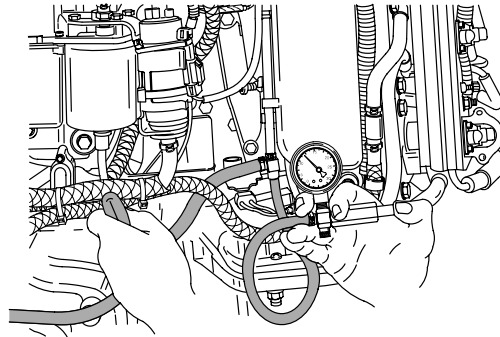
INSTALLATION

1. Install oil reservoir as shown.
2. Fasten the oil hoses with sta-straps.
3. Connect the BLUE with BLACK STRIPE wire leads.
4. Refill the oil system. Refer to Priming the Oil Pump.



Priming the Oil Pump

NOTE: If a new powerhead is being installed or oil hoses/oil pump has been removed, it is recommended all air be purged from oil pump/oil lines using gearcase leakage tester (FT-8950). Connect the leakage tester to the inlet t-fitting on the onboard oil reservoir. While clamping off the inlet hose, manually pressurize the reservoir to 10 psi. Using the Digital Diagnostic Terminal 91-823686A2, activate the oil pump prime sequence. Maintain the 10 psi pressure throughout the auto prime sequence. When the auto prime is completed, remove the leakage tester and refill the onboard oil reservoir.



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Priming the oil pump (filling pump and hoses using pressure) is required on new or rebuilt power heads and any time maintenance is performed on the oiling system that allows air into the oil system.

There are three methods for priming the oil pump:

METHOD 1 – SHIFT SWITCH ACTIVATION PRIME

This method does three things:

- a. Fills the oil pump, oil supply hose feeding pump and oil hoses going to the crankcase and air compressor.
- b. Activates break-in oil ratio.
- c. Initiates a new 120 minute engine break-in cycle.

Refer to priming procedure following.

METHOD 2 – (DDT) DIGITAL DIAGNOSTIC TERMINAL – RESET BREAK-IN

This method is the same as Method 1, except the run history and fault history are erased from the ECM.

Refer to procedure in the Technician Reference Manual provided with the Digital Diagnostic Software Cartridge Part. No. 91-822608-6 for Model Year 2000. Use cartridge 91-880118 for Model Year 2001.

METHOD 3 – (DDT) DIGITAL DIAGNOSTIC TERMINAL – OIL PUMP PRIME

This method fills the oil pump, oil supply hose feeding pump, and oil hoses going to the crankcase and air compressor.

Refer to procedure in the Technician Reference Manual provided with the Digital Diagnostic Software Cartridge Part. No. 91-822608-6 for Model Year 2000 and cartridge 91-880118 for Model Year 2001.

Conditions Requiring Priming the Oil Pump	
Condition	Priming Procedure
New engine	Use Method 1 or 2
Rebuilt Powerhead	Use Method 1 or 2

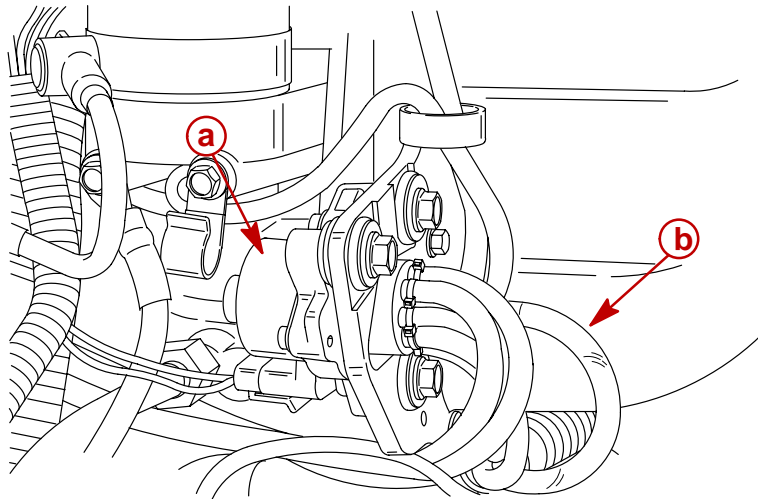


Conditions Requiring Priming the Oil Pump (Continued)	
New Powerhead	Use Method 1 or 2
Oil system ran out of oil	Use Method 3
Oil drained from oil supply hose feeding pump	Use Method 3
Oil pump removed	Use Method 3
Oil injection hoses drained	Use Method 3

Priming Procedure – Method 1

METHOD 1 – SHIFT SWITCH ACTIVATION PRIME PROCEDURE

Before starting engine for the first time, prime the oil pump. Priming will remove any air that may be in the pump, oil supply hose, or internal passages.



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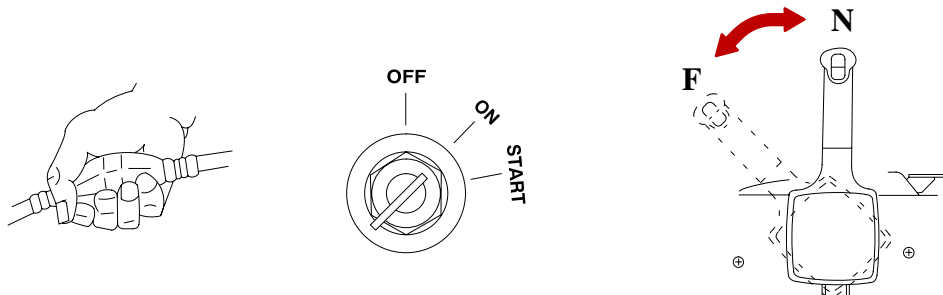
- a** - Oil Injection Pump
- b** - Oil Supply Hose

⚠ CAUTION

To prevent damage to the fuel pumps, fill the engine fuel system with fuel. Otherwise the fuel pumps will run without fuel during the priming process.

Prime the oil injection pump as follows:

1. Fill the engine fuel system with fuel. Connect fuel hose and squeeze primer bulb until it feels firm.
2. Turn the ignition key switch to the “ON” position.
3. Within the first 10 seconds after the key switch has been turned on, move the remote control handle from neutral into forward gear 3 to 5 times. This will automatically start the priming process.

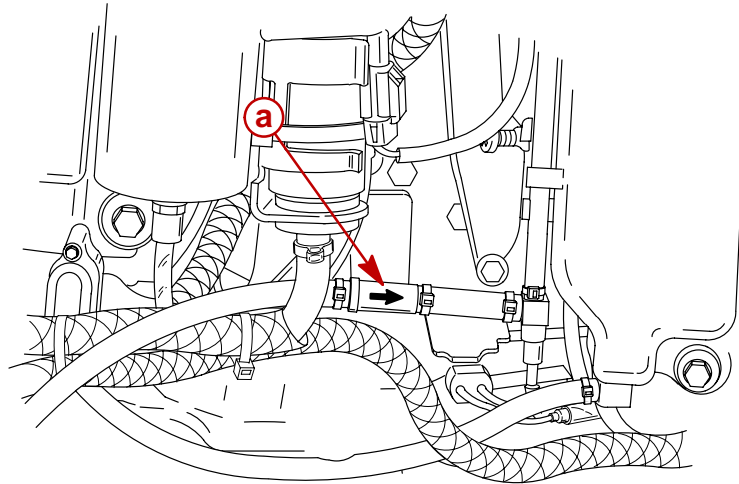


NOTE: It may take a few minutes for the pump to complete the priming process.



Remote Oil Hose Connections

NOTE: Oil hose with BLUE stripe contains a directional filter which is designed to trap any debris in the oil before the oil reaches the engine oil reservoir. The filter is marked with an arrow denoting direction of flow of oil and should be installed accordingly. Should engine oil reservoir oil level drop while remote oil tank oil level is normal, oil flow through inline filter has been reduced by debris and filter must be replaced.

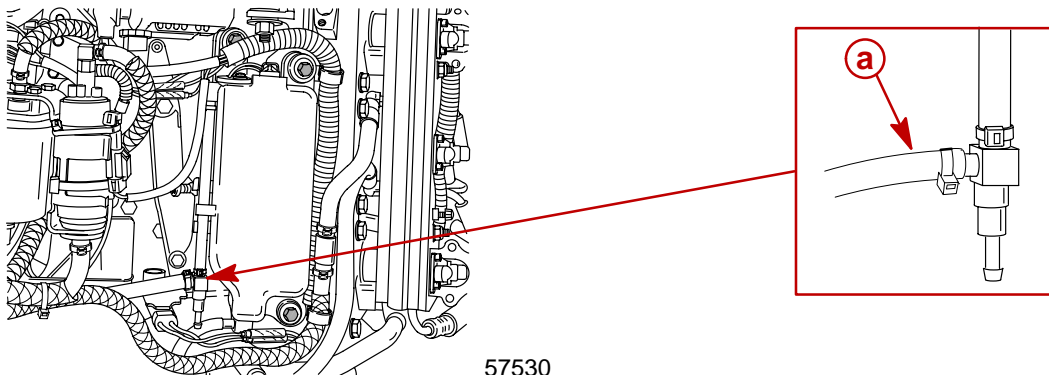


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a - Oil Filter

CONNECTING OIL HOSE WITH BLUE STRIPE

1. Remove shipping cap from fitting and connect oil hose (a). Fasten hose with sta-strap.



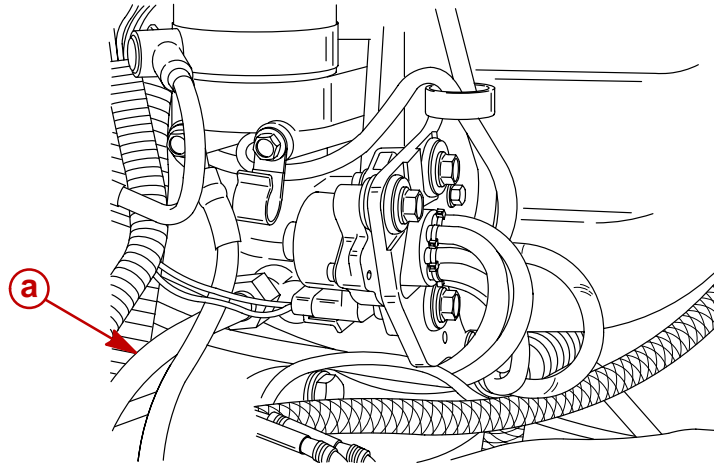
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a - Oil Hose with Blue Stripe



CONNECTING OIL HOSE WITHOUT BLUE STRIPE

1. Remove shipping cap from fitting and connect hose (a). Fasten hose with sta-strap.

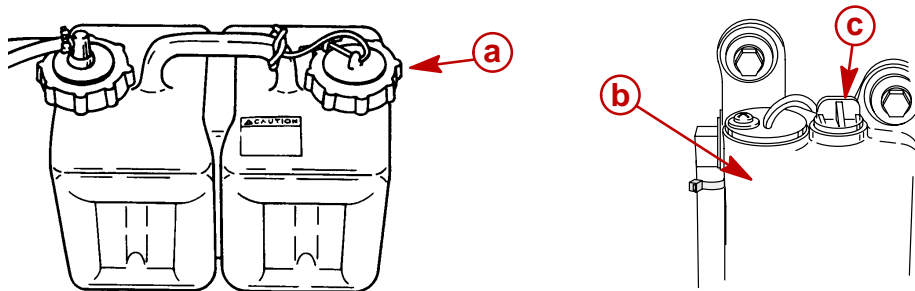


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a - Oil Hose Without Blue Stripe

Filling the Oil Tanks

1. Fill remote oil tank with the recommended oil listed in the Operation and Maintenance Manual. Tighten fill cap.
2. Remove cap and fill engine oil tank with oil. Reinstall the fill cap.
3. Remove air from remote oil hose. Refer to Purging Air from the Engine Oil Reservoir and Remote Oil Hose.

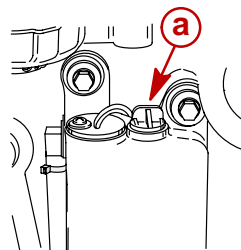


a - Fill Cap
b - Engine Oil Reservoir
c - Fill Cap

Purging Air From the Engine Oil Reservoir and Remote Oil Hose

NOTE: Before starting engine, make sure the oil pump has been primed.

1. Start the engine. Run the engine until all the air has been vented out of the reservoir and oil starts to flow out of the reservoir. Re-tighten fill cap.



a - Fill Cap



Oil Warning Systems

LOW OIL LEVEL

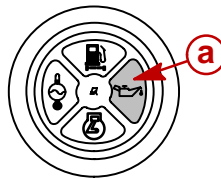
NOTE: The low oil condition must exist for a minimum of 15 seconds before horn or light is activated.

The system is activated when the oil in the engine mounted oil reservoir tank drops below 22 fl. oz. (175 ml). You still have an oil reserve remaining for 30 minutes of full speed operation.

NOTE: The engine mounted oil reservoir (located beneath the top cowl) along with the remote oil tank will have to be refilled (refer to Filling the Oil tanks).

The warning system works as follows:

Model Year 2000 – The OIL light (a) will come on and the warning horn sounds a series of four short tones. If you continue to operate the outboard, the light will stay on and the horn will sound four short tones every two minutes. The engine has to be shut off to reset the warning system.



Model Year 2001 – Use System Monitor or Smartcraft gauges to provide low oil information.

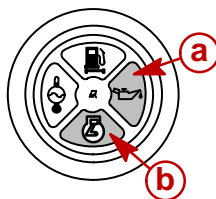
OIL PUMP NOT FUNCTIONING ELECTRICALLY

The system is activated if the oil pump stops functioning electrically. No lubricating oil is being supplied to the engine. Stop the engine as soon as possible. Continuing to operate the engine can result in severe engine damage.

The warning system works as follows:

Model Year 2000 – The OIL light (a) and CHECK ENGINE light (b) will come on and the warning horn will begin sounding. The warning system will automatically reduce and limit the engine speed to idle.

The engine has to be shut off to reset the warning system.



Model Year 2001 – Use System Monitor or Smartcraft gauges to provide oil pump information.



Oil System Troubleshooting

Low Oil Warning System is Activated

