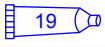
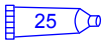
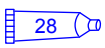
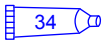
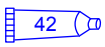
Manual Outline

Engine Specifications

Description	Specifications	
	QSD 2.8	QSD 4.2
Rated engine RPM (**Conditions Affecting Operation —Propeller Selection** for additional information)	For complete, specific engine performance data refer to the Cummins MerCruiser Diesel Performance Curves & Datasheeets at www.cmdmarine.com	
Engine type	In-line 4–cylinder diesel	In-line 6–cylinder diesel
Displacement	2.8 liter (169 cid)	4.2 liter (256 cid)
Firing order	1-3-4-2	1-5-3-6-2-4
Bore	94 mm (3.700 in.)	
Stroke	100 mm (3.937 in.)	
Compression ratio	17:1	
Valve clearance	Hydraulic	
Maximum pressure difference between cylinders	500 kPa (72 PSI)	
Idle RPM in neutral (engine at normal operating temperature)	700	600
Oil pressure at idle	2.4 bar [240 kPa] (35 PSI)	2.1 bar [210 kPa] (30 PSI)
Oil pressure at 3800 RPM	6.2 bar [620 kPa] (87 PSI)	6.6 bar [660 kPa] (93 PSI)
Oil temperature	100-110º C (212-230º F)	
Thermostat (water)	83° C (181° F)	89° C (192° F)
Thermostat (oil)	95° C (203° F)	87° C (187° F)
Coolant temperature	80–85° C (176–185° F)	
Electrical system	12-volt negative (–) ground	
Alternator rating	1540 W, 14 V, 110 A	
Recommended battery rating	750 CCA, 950 MCA, or 180 Ahm	
Starter	12 V, 2.4 kW	

Lubricant, Sealant, Adhesives

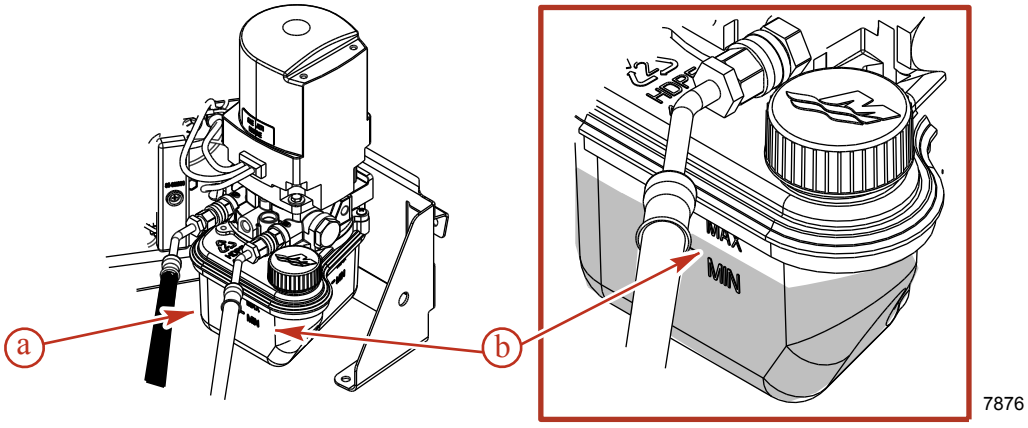
Tube Ref No.	Description	Where Used	Part No.
	Fleetguard Compleat with DCA4, Fleetguard Part Number CC2825	Closed cooling system	Obtain Locally
	Perfect Seal	Drain plug or fitting threads	92-34227 1
	Liquid Neoprene	All electrical connections	92- 25711 3
	Dexron III Automatic Transmission Fluid	Power-assisted steering system	Obtain Locally
	Special Lubricant 101	Steering cable grease fitting	92-802865Q02
		Steering cable	
		Propeller shaft	
		Propeller shaft splines	
	U-joint and Gimbal Bearing Grease	Gimbal bearing grease insert	92-802870A1
		Transom end grease fitting, engine end grease fitting, driveshaft grease fittings	

Power Trim Fluid

Checking

IMPORTANT: Check the fluid level with the sterndrive in the full down (in) position only.

1. Place the sterndrive in full down (in) position.
2. Observe the fluid level. The fluid level must be between the "MIN" and "MAX" lines on the reservoir.



a - Reservoir **b -** "MIN" and "MAX" lines

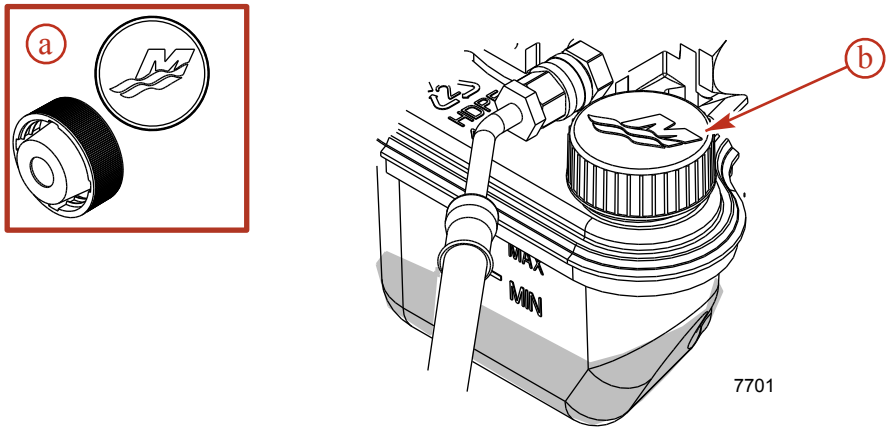
3. Fill as necessary with the specified fluid. See **Filling**.

Tube Ref No.	Description	Where Used	Part No.
114	Power Trim and Steering Fluid	Power trim pump	92-858074K01

Filling

1. If the fluid level is below the "MIN" line, the specified fluid must be added.
2. Remove the fill cap from the reservoir.

NOTE: *The fill cap is vented.*



Power trim pump reservoir shows the fluid level is below "MIN" line

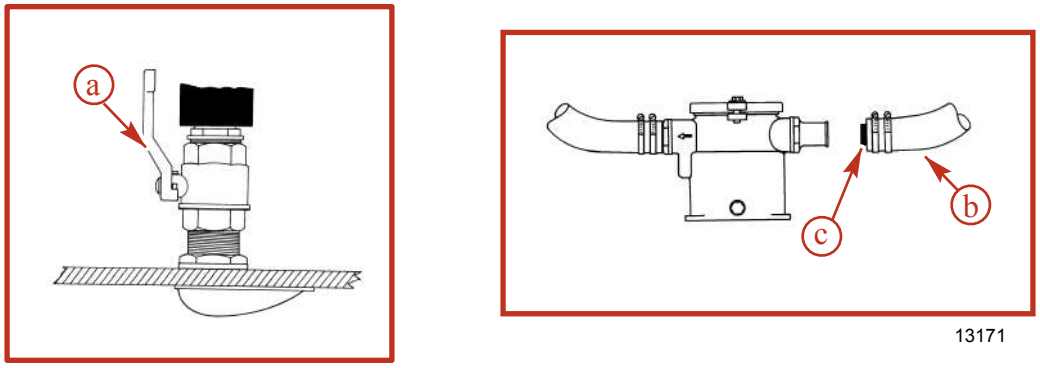
a - Fill cap assembly **b -** Fill cap installed

WITH THE BOAT IN THE WATER

NOTICE

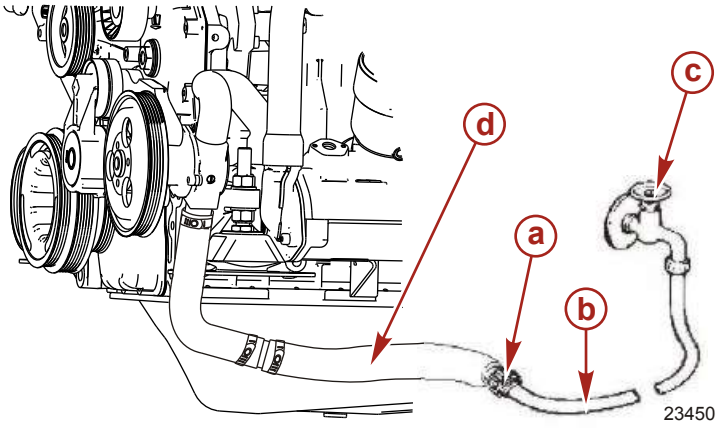
Disconnecting the seawater inlet hose will cause water to enter the bilge resulting in engine damage. Close the seacock before disconnecting the seawater inlet hose. Plug the seawater inlet hose immediately after disconnecting it.

1. Close the seacock, if equipped, or disconnect and plug the seawater inlet hose.



a - Seacock
b - Seawater inlet hose
c - Plug

2. Using an appropriate adapter, connect a flushing hose from a water tap to the seawater inlet hose connected to the seawater pump inlet.



2.8 shown, 4.2 similar

a - Adapter
b - Flushing hose
c - Water tap
d - Seawater inlet hose

3. Lower the sterndrive to the full down (in) position.
4. Partially open the water source to about 1/2 maximum. Do not use full water pressure.

Cause	Special Information
Leaking hoses	Refer to **Section 9—Power-assisted Steering System** for bleeding procedure.
Steering cables and/or steering helm	Cable or helm partially frozen from corrosion or rus, cable over-lubricated, improper cable installation.
Binding in sterndrive	Refer to the appropriate **Mercury MerCruiser Sterndrive Service Manual**.
Restriction in hydraulic hos	Causes a loss of pressure.
Control valve not positioned properly, not balanced properly, or the mounting nut is loose	
Mounting bracket adjusting screw loose or mounting tube is loose	
Faulty pump	Flow control valve may be sticking.
Worn piston ring or scored housing bore in cylinder	Causes loss of pressure
Leaking valve body or loose fitting spool	

Power Steering—Noisy Pump

Cause	Special Information
Drive belt	Check belt tension.
Low fluid level	
Air in fluid	Air leak in lines, pump, or air from installation.
Faulty pump	Use stethoscope to listen for noise in pump.
Restricted fluid passages	Kinks or debris in hoses or debris in passages.
Stop nut adjusted improperly	Refer to the appropriate **Mercury MerCruiser Sterndrive Service Manual**.
Incorrect or substandard steering cables installed that do not meet ABYC standards	Refer to the appropriate **Mercury MerCruiser Sterndrive Service Manual**.

Power Steering—Fluid Leaks

Cause	Special Information
Loose hose connections	Refer to **Section 9A** for bleeding instructions.
Damaged hose	
Oil leaking from top of pump	System overfilled, fluid contains water, fluid contains air.
Cylinder piston rod seal	
Faulty seals in valve	
Faulty seals in O-rings in pump	
Cracked or porous metal parts	

Seawater Pump—Insufficient Water Flow

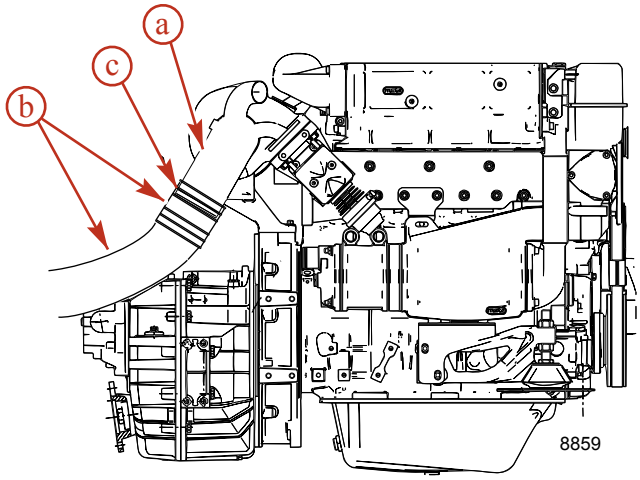
Cause	Special Information
Drive belt	Loose, worn, or broken
Seawater shut off valve partially or fully closed	
Clogged or improperly installed sea strainer	

Exhaust System Connections

NOTICE
Hot spots in exhaust hoses can damage hoses and cause leaks. Ensure that discharge water from the exhaust elbow flows without restriction through all hoses and fittings.

IMPORTANT: Exhaust bellows, hoses, or tubes must be secured at each connection with at least two hose clamps.

1. Connect the exhaust hoses and tubes so that they do not restrict the flow of discharge water from the exhaust elbow.
2. Install at least two hose clamps on each exhaust hose and tube connection.
3. Tighten the exhaust system hose clamps securely.



Typical

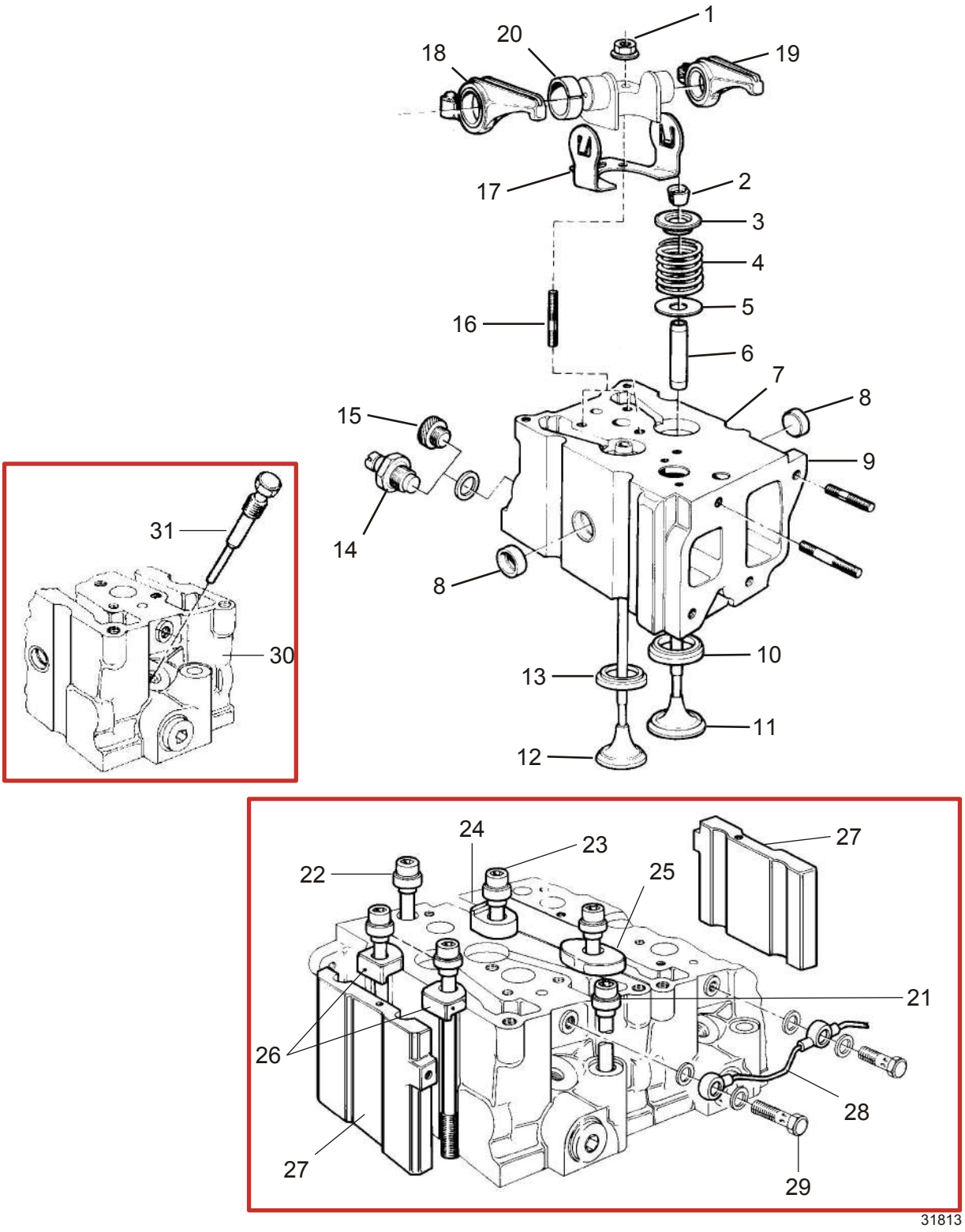
a - Exhaust elbow
b - Exhaust tube or hose
c - Hose clamps

Fluid Connections

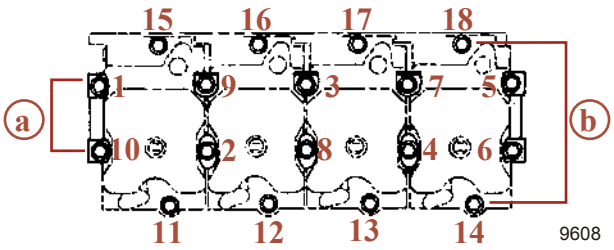
Seawater Hoses

IMPORTANT: The seawater hose used must be wire-reinforced to avoid collapsing the hose when suction is created by seawater pump impeller.

1. Connect the seawater hose from the seacock to the seawater strainer.
2. Connect the seawater hose from the seawater strainer to the seawater pump hose connector.


1
20
18
19
17
2
3
4
5
16
6
7
8
15
9
14
8
10
13
11
12
31
30
24
23
22
25
27
21
26
28
27
29
31813

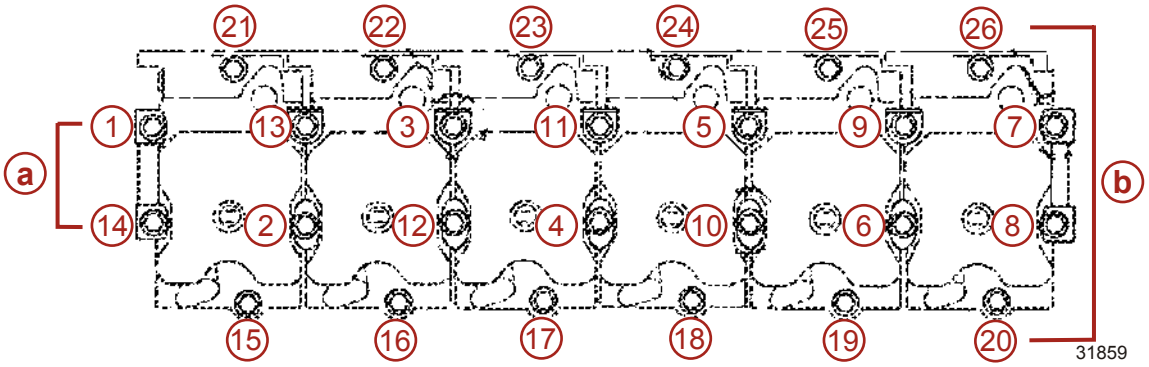
14. Using the appropriate wrench from the cylinder head service kit, **lightly** hand-tighten the bolts in the numbered torque sequence shown.



2.8 torque sequence bolt numbering

a - Center (14M) bolt set

b - Side (12M) bolt set



4.2 torque sequence bolt numbering

a - Center (14M) bolt set

b - Side (12M) bolt set

Cylinder Head Service Tool Kit	91-806563A 1

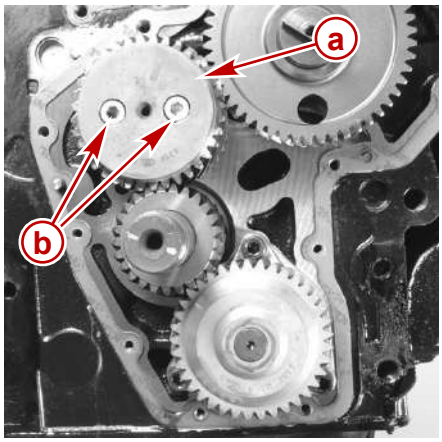
15. Correctly align the cylinder heads by temporarily installing the exhaust manifold with gaskets and finger-tighten each flange nut.
16. Slightly loosen the 12M and 14M bolts as needed to allow the cylinder heads to align.
17. Hand tighten the exhaust manifold nuts sufficiently to align the cylinder heads to the exhaust manifold.
18. Hand tighten all 14M and 12M cylinder head bolts in the numbered torque sequence given in step 14.

4. Check that the oil pump gear is not in a bind by ensuring that there is some clearance (backlash) between the crankshaft gear and oil pump gear. Check the installation if no backlash is detected between the gears.
5. Install the timing gear cover.
6. Complete the engine assembly.
7. Verify oil pressure and check for leaks when you start the engine.

Idler Gear

Removal

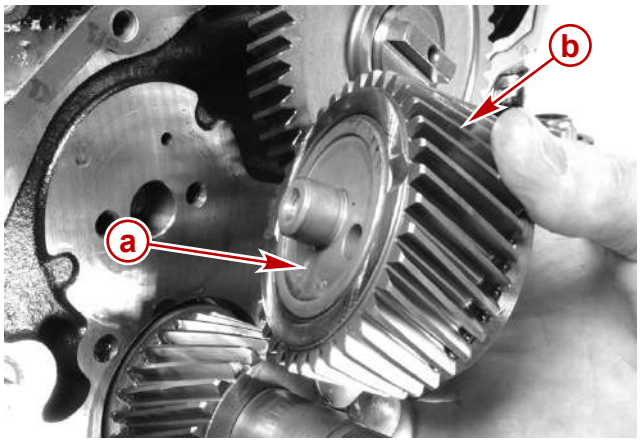
1. Position the engine at cylinder number 1 TDC and lock or pin the flywheel. See **Establishing TDC (Top Dead Center)**.
2. Remove the timing gear cover.
3. Remove the two idler gear bushing screws.



16262

a - Idler gear bushing **b -** Idler gear bushing screw

4. Remove the idler gear bushing and idler gear assembly.



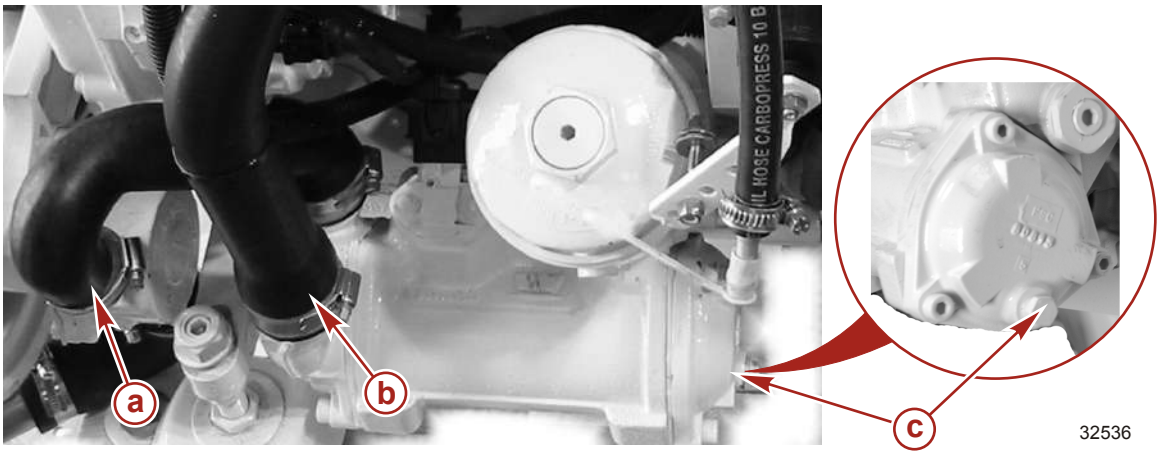
16263

a - Idler gear bushing **b -** Idler gear assembly

Oil Filter and Oil Cooler Assembly

Removal

1. If the boat is to remain in the water, close the seacock (if equipped) or disconnect and plug the seawater inlet hose.
2. Drain the seawater from the cooling system.
3. Remove the seawater pump outlet hose to the oil cooler assembly.



a - Seawater pump outlet hose
b - Oil cooler seawater outlet hose
c - Drain plug

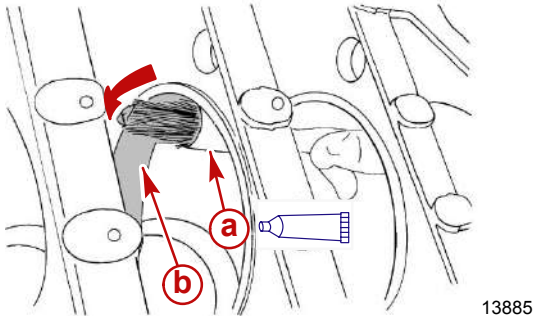
4. Disconnect the oil cooler seawater outlet hose from the oil cooler assembly.
5. Remove the drain plug from the aft end cover of the oil cooler.

NOTICE
Discharge of oil, coolant, or other engine/drive fluids into the environment is restricted by law. Use caution not to spill oil, coolant, or other fluids into the environment when using or servicing your boat. Be aware of the local restrictions governing the disposal or recycling of waste, and contain and dispose of fluids as required.

6. Unscrew and remove the oil filter assembly.

CRANKSHAFT

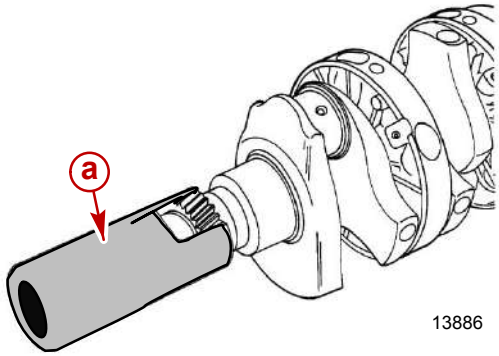
1. Lubricate the main bearing bores in the cylinder block.



a - Brush dipped in lubricant
b - Main bearing bore

Tube Ref No.	Description	Where Used	Part No.
	Molykote	Main bearing bores	Obtain Locally

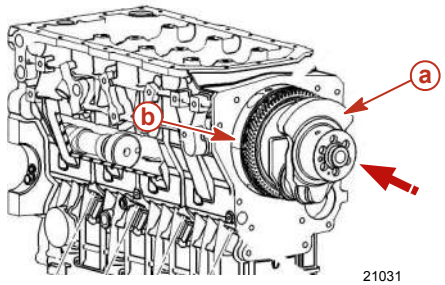
2. Install the Crankshaft Gear Cover Assembly Tool over the timing gear to protect the front main bearing.



a - Crankshaft Gear Cover Assembly Tool

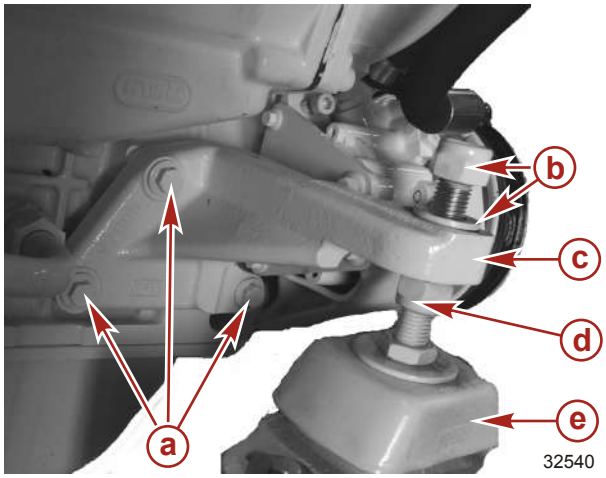
Crankshaft Gear Cover Assembly Tool	91-801333504

3. Position the engine cylinder block horizontal with the oil pan flange facing up.
4. Carefully insert the crankshaft with the main bearing carriers attached into the cylinder block.



a - Crankshaft assembly
b - Main bearing carrier entering cylinder block

3. Torque the front mount bracket screws.

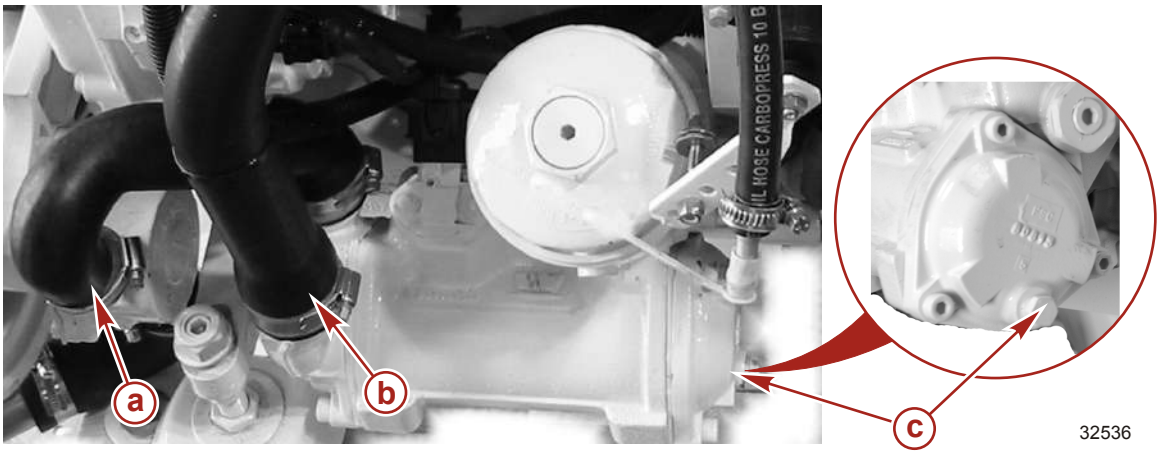


Port side shown, starboard attachment similar

a - Engine mount attaching screws
b - Isolator to mount nut and lock washer
c - Engine mount bracket
d - Adjusting nut
e - Engine mount

Description	Nm	lb. in.	lb. ft.
Front mount screw	78.5	–	58

4. Install the two seawater hoses on the oil cooler.



a - Seawater pump outlet hose
b - Oil cooler seawater outlet hose
c - Drain plug

5. Remove the engine's secondary support and lower the engine with a hoist.
6. Install the front engine mount to engine bed fasteners and hardware. Tighten securely.
7. Align the engine and drive. Adjust the mounts as needed. See **Section 2B: Engine Installation**.

Remote Control Neutral Start Safety Circuit

⚠ WARNING

Starting the engine with the drive in gear can cause serious injury or death. Never operate a boat that does not have a neutral-safety-protection device.

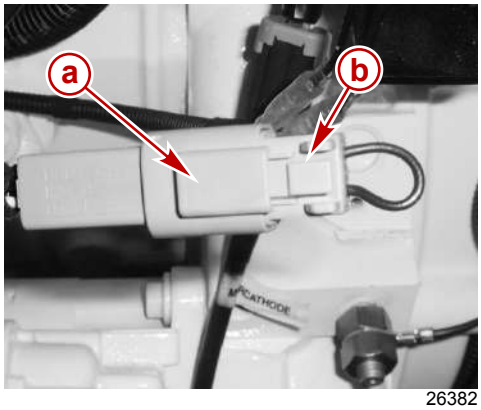
The neutral safety switch connection prevents the engine from starting while the remote control is in either the forward or reverse gear.

Primary Station

⚠ WARNING

Improperly installing the remote control can result in serious injury or death. Always remove the jumper plug from the neutral safety connection on the engine and install it correctly to the remote control.

1. Disconnect the jumper plug from the neutral safety switch connector located on the engine if necessary.

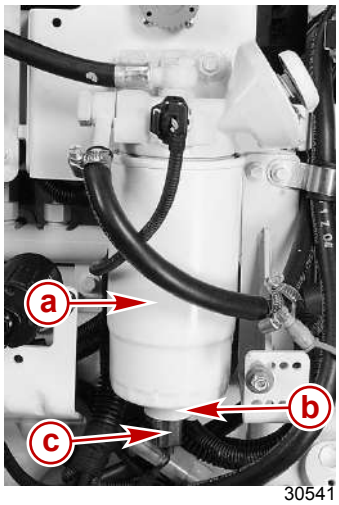


26382

a - Neutral safety switch connector
b - Jumper plug

2. Install a proper connector to the neutral switch wires leading to the remote control.

2. Open the drain by turning the drain cap counterclockwise (as viewed from the bottom of the filter) until fuel starts to drain. Do not remove the drain cap.



a - Filter
b - Drain cap
c - WIF sensor wire connection

3. Drain until the fuel is clear in appearance.
4. Close the drain cap by turning it clockwise. Tighten it securely.
5. Fill the fuel filter. See **Filling**.

Replacing

⚠ WARNING

Performing service or maintenance without first disconnecting the battery can cause product damage, personal injury, or death due to fire, explosion, electrical shock, or unexpected engine starting. Always disconnect the battery cables from the battery before maintaining, servicing, installing, or removing engine or drive components.

IMPORTANT: The element cannot be cleaned and reused. It must be replaced.

1. Disconnect both battery cables from the battery.
2. Disconnect the Water in Fuel (WIF) sensor wires, if equipped.

Circuit Description

The MAP sensor and Intake Air Temperature (IAT) sensor form an assembly. The MAP sensor portion of this assembly is a pressure transducer that measures changes in the intake manifold pressure. The pressure changes as a result of engine load and speed change, and the MAP sensor converts this to a voltage output signal.

NOTE: *This component may be referred to as a boost pressure sensor due to the presence of a turbocharger.*

The ECM sends a 5 volt reference signal to the MAP sensor. As the manifold pressure changes, the electrical resistance of the MAP sensor also changes. By monitoring the sensor output voltage, the ECM knows the manifold pressure. A higher pressure, low vacuum (high voltage) requires more fuel, while a lower pressure, higher vacuum (low voltage) requires less fuel. The ECM uses the MAP sensor to control fuel delivery and injection.

A faulty MAP sensor circuit can generate the following diagnostic trouble codes.

DTC	Reason	Effect	Condition	
P0235	Boost pressure sensor voltage out of range. The MAP sensor output voltage is above the upper limit or below the lower limit or there is an implausibility with the barometric pressure sensor.	No effect on the engine.	>4848.48 mV <337.2 mV difference between atmospheric sensor >150 hPa	
P0238	High boost pressure warning. Intake manifold pressure signal indicates the intake manifold pressure has exceeded the maximum limit for the given engine rating.	The engine torque limitation will limit the engine speed to 3600 RPM.	MR504	>3300 hPa
			MR704	
			MR706	>3400 hPa
P0651	Sensor supply 2 voltage out of range. The sensor supply 2 circuit output voltage is above the upper limit or below the lower limit. This circuit supplies power to the throttle position 2 sensor, the fuel rail pressure sensor, and the boost pressure sensor.	The engine fuel quantity limitation will limit the engine speed to 3000 RPM.	>5.2 V <4.8 V	

ECM 60-Pin Connector "A" CKT pin	Name
40	MAP signal
13	5-volt reference signal
23	Sensor ground (–)

Test Description

Verify continuity between the following pins:

ECM 60-Pin Connector "A"	4-terminal connector at MAP
40	4
13	3
23	1

Verify the sensor voltage on pin 40 of the ECM 60-pin connector "A" or on pin 4 of the MAP sensor as a function of pressure.