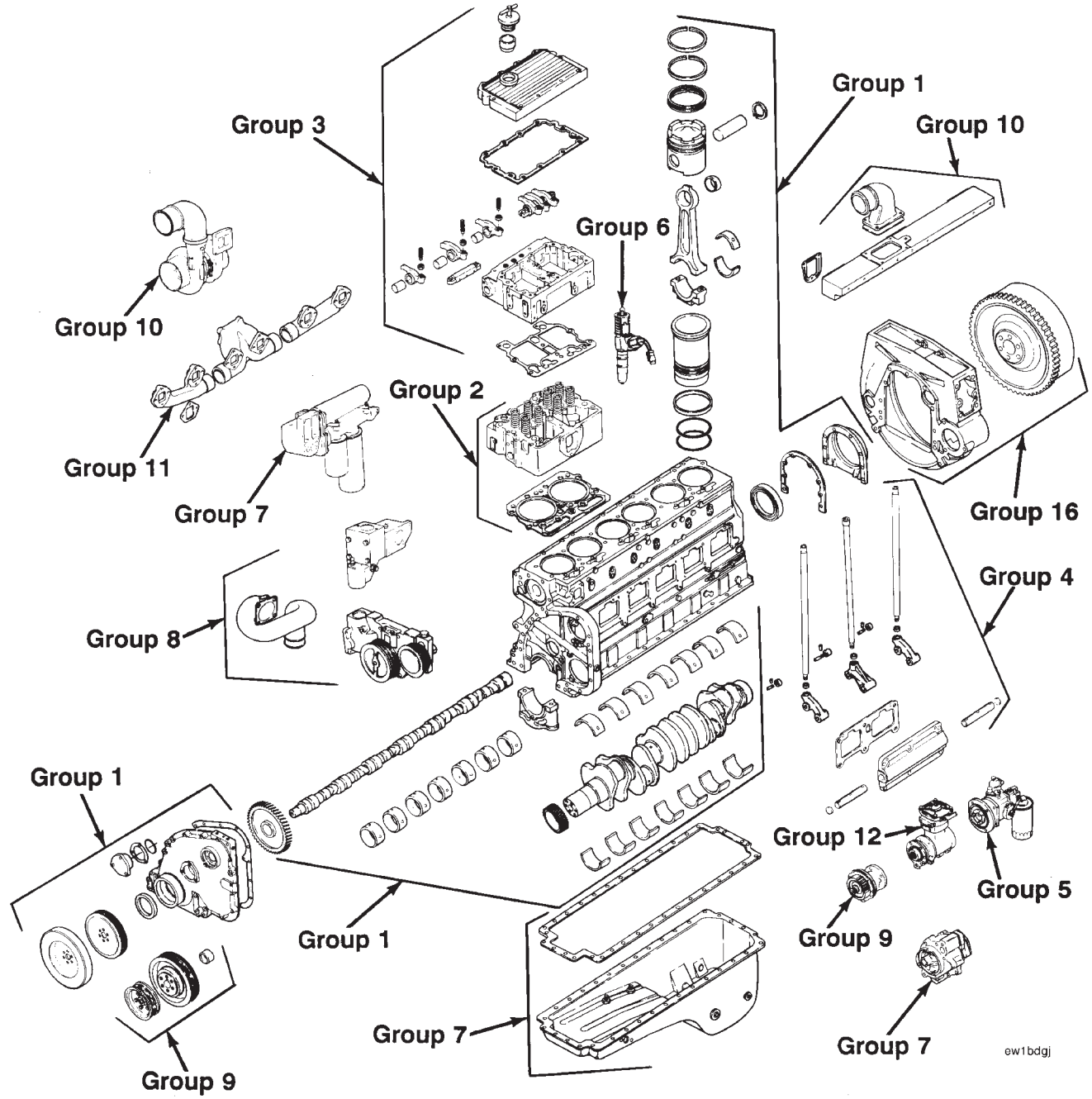


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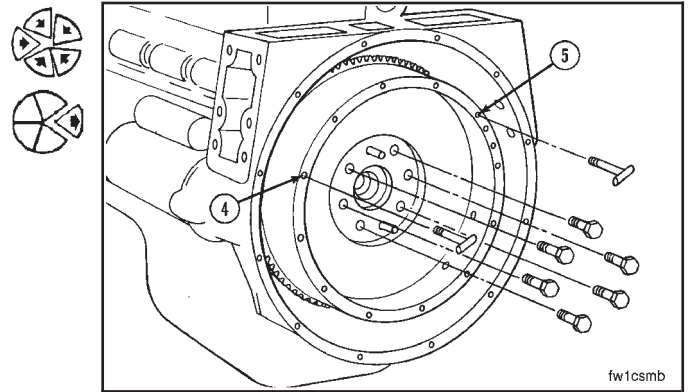
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# Cummins 22-Group System Exploded Diagram



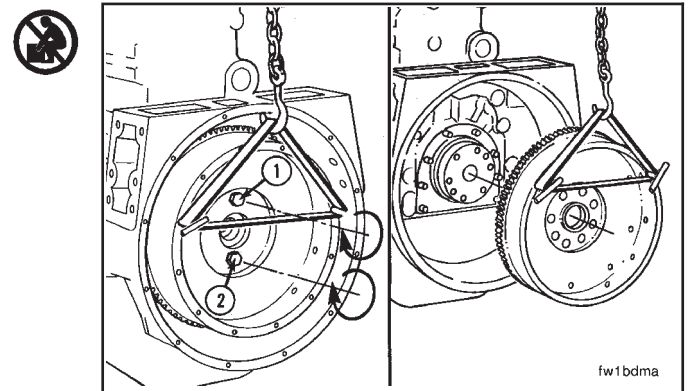
Determine the capscrew thread size, and install two "T-handles" in the flywheel at points (4) and (5).

Remove the remaining four flywheel mounting capscrews.



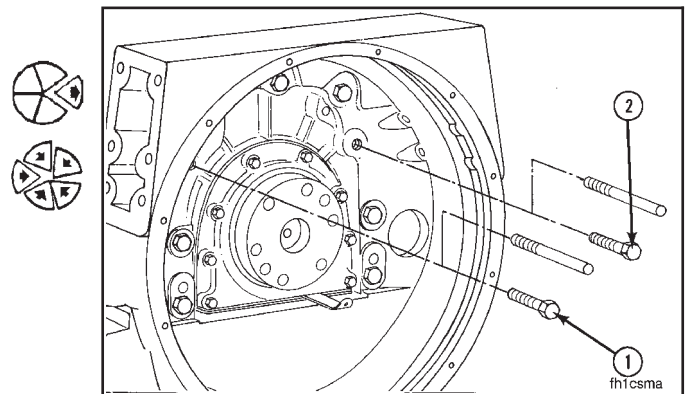
**Warning:** Because this part weighs more than 23 kg [50 lbs], two people or a hoist will be required to lift the flywheel to avoid personal injury.

Tighten capscrews (1) and (2) in alternating sequence to loosen the flywheel.



## Flywheel Housing - Removal

Remove capscrews (1) and (2), and install two 5/8 - 18 X 4-inch guide studs.

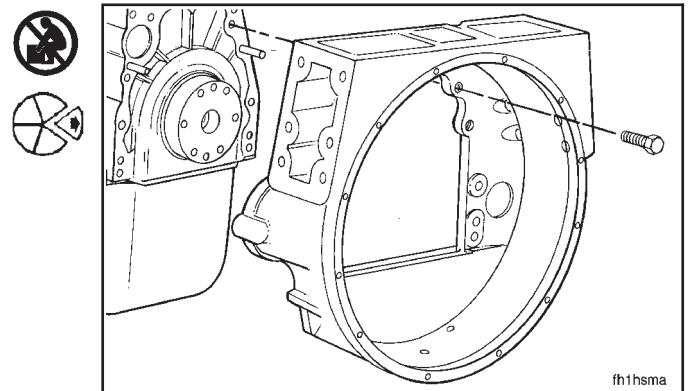


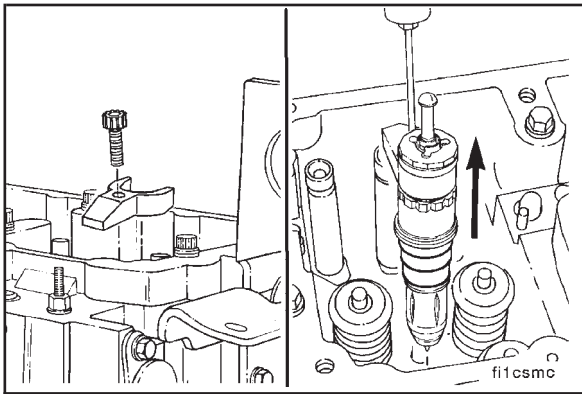
**Warning:** Because this part weighs more than 23 kg [50 lbs], two people or a hoist will be required to lift the flywheel housing to avoid personal injury.

Remove the remaining capscrews and the flywheel housing.

**NOTE:** Use a mallet to loosen the housing from the dowels in the cylinder block if necessary.

Remove the guide studs.





### STC Engines

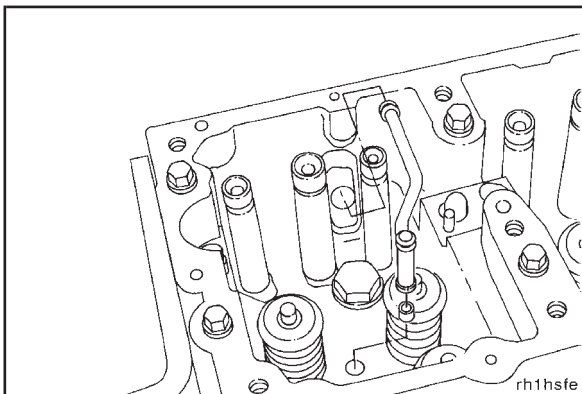


Remove the injector hold down clamp capscrew and the clamp.

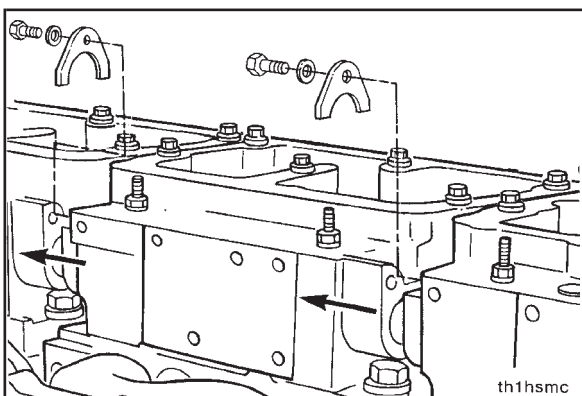


Use injector puller, Part No. 3822697, to remove the STC injectors.

Insert the threaded end of the puller into the tapped hole in the STC oil feed lock nut.



Remove the internal oil tube and the rubber grommet which is located in the cylinder head.

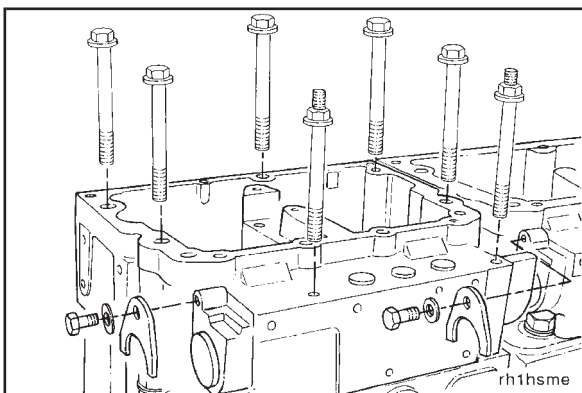


### Rocker Lever Housing - Removal



Remove the water manifold tube clamps. Use service tool, Part No. 3823819, to push or pry the adjacent water tubes into the rocker housing cavity.

For example, the tube between housing No. 1 and No. 2 **must** be pushed into housing No. 2. The tube between housing No. 2 and No. 3 **must** be pushed into housing No. 3.

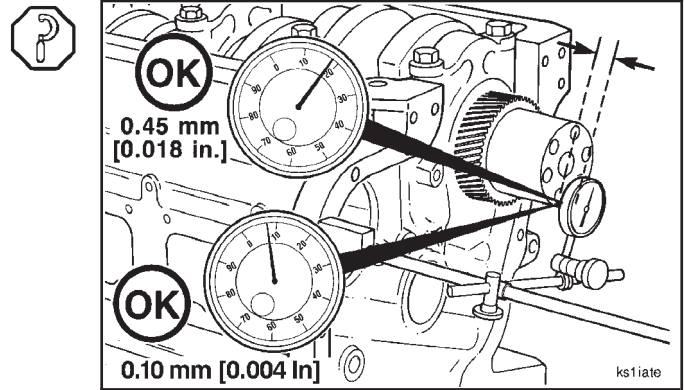


Remove the rocker housing mounting capscrews.

**NOTE:** To prevent increased wear, mark each rocker lever housing as it is removed so it can be installed back in its original location.

If the rocker housing assemblies are to be installed after rebuild with their original parts, mark each rocker lever housing as it is removed so it can be installed back in its original location thus taking advantage of worn-in mating parts.

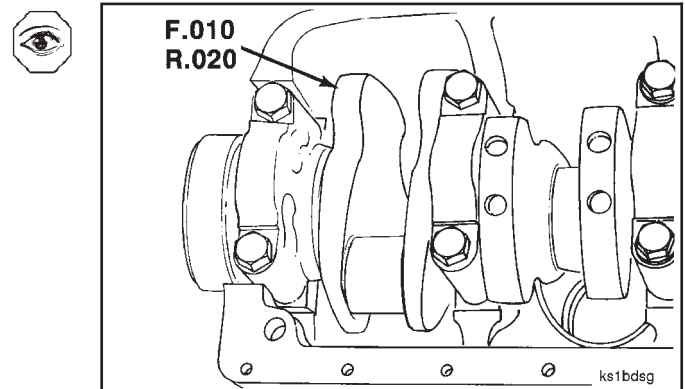
Measure the crankshaft end clearance. The end clearance specification for a new or reground crankshaft with new thrust bearings is 0.10 mm [0.004-inch] to 0.45 mm [0.018-inch].



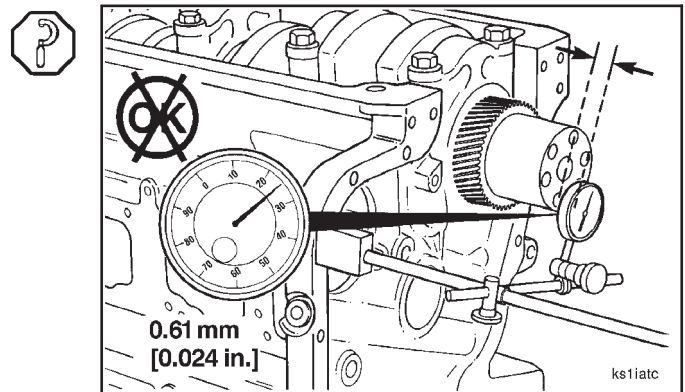
**NOTE:** Crankshafts that have been reground on the thrust bearing surfaces are marked for oversize thrust bearings on the rear crankshaft counterweight. If the crankshaft counterweight is marked, check the thrust ring part number to make sure the correct thrust ring size is used.

Example: F-.010 - Front 0.25 mm [0.010-inch]

Example: R-.020 - Rear 0.51 mm [0.020-inch]



If the crankshaft end clearance is more than 0.58 mm [0.023-inch], use oversize thrust bearings to adjust the end clearance to the correct specification.

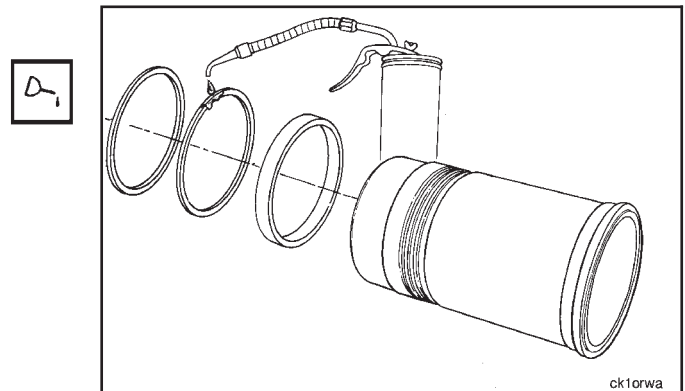


## Cylinder Liners - Installation

**NOTE:** Make sure the cylinder block and all parts are clean before assembly. If used liners are being installed again, any sealing rings removed **must** be installed with the same liner in the same cylinder.

Use vegetable oil to lubricate the new liner o-rings and the crevice seals.

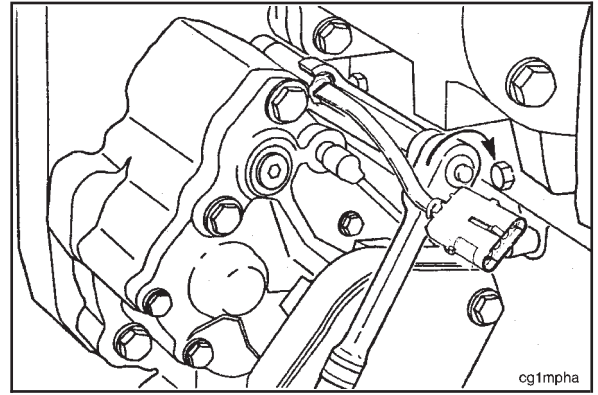
**NOTE:** Use vegetable oil to lubricate the o-rings. Do **not** use lubricating oil on the o-rings. The o-rings will increase in size after they have been lubricated with oil.



## CELECT™ Engine Position Sensor (EPS) - Installation

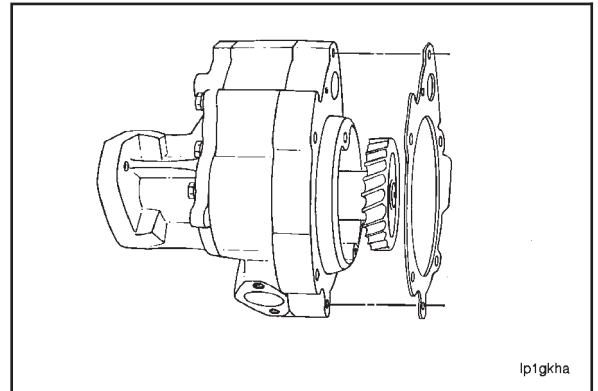
Install a new EPS in the mounting hole in the block. Make sure a new o-ring is present and in place. Use service tool, Part No. 3822747. Tighten the EPS.

**Torque Value:** 34 N•m [25 ft-lb]



## Lubricating Oil Pump - Installation

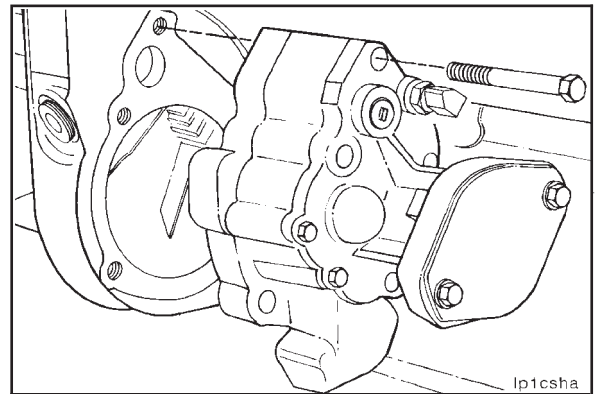
Install a new gasket on the mounting trunion of the lubricating oil pump.



Install the lubricating oil pump in the mounting hole in the cylinder block gear flange.

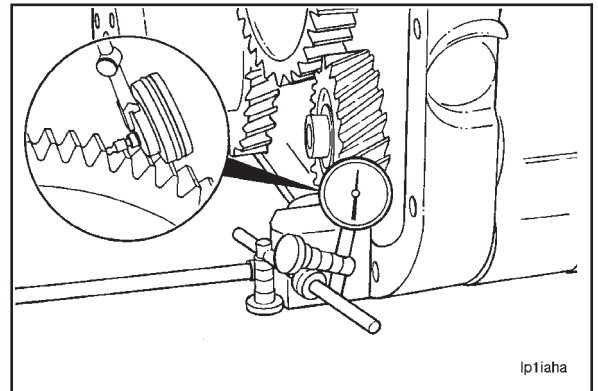
Install and tighten the five mounting capscrews.

**Torque Value:** 54 N•m [40 ft-lb]



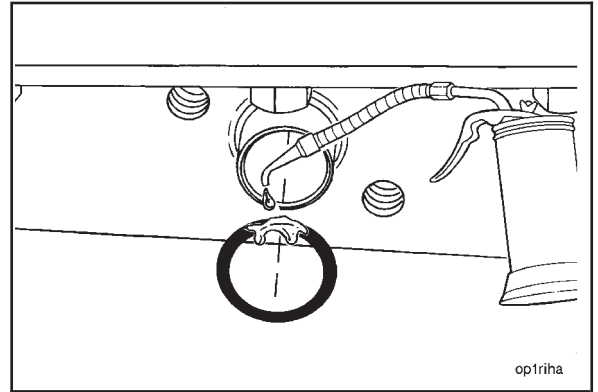
Use a dial indicator to check the backlash between the lubricating oil pump and the camshaft gear.

Install the tip of the dial indicator against a tooth on the lubricating oil pump drive gear as shown.



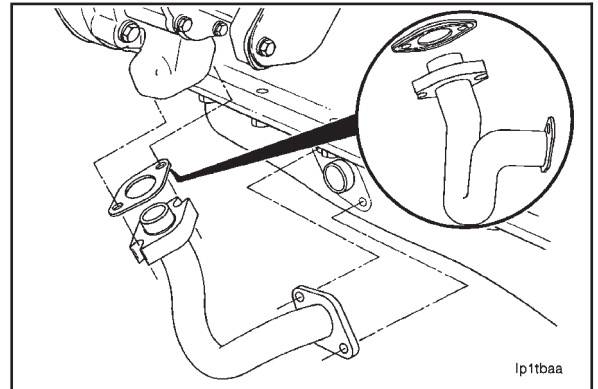
Install a new o-ring on the oil pan lubricating oil suction tube.

Use clean vegetable oil to lubricate the o-ring.



Loosely install the lubricating oil transfer tube assembly with the lubricating oil pump mounting flange, new sealing ring, new gasket, and the mounting capscrews to the oil pan and lubricating oil pump.

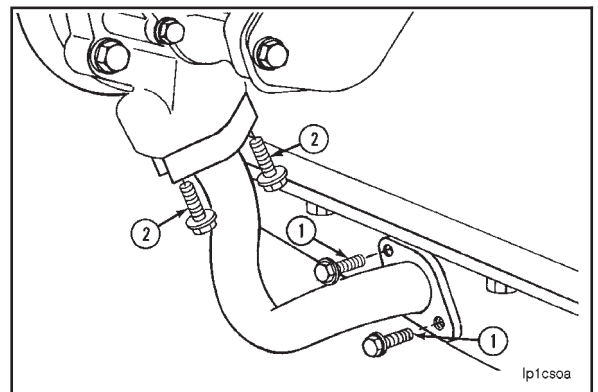
**NOTE:** The printed side of the mounting flange gasket on the oil transfer tube **must** be toward the flange.



Tighten the capscrews in the following sequence:

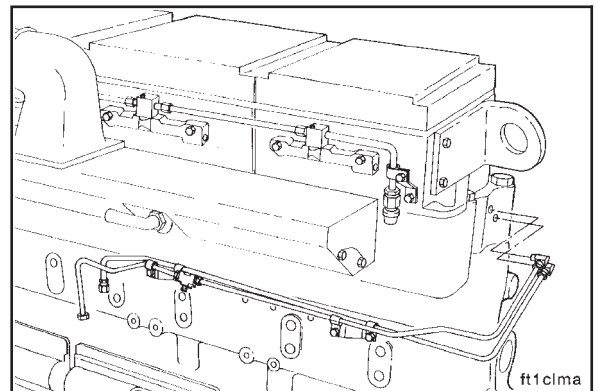
- First, tighten the two capscrews (1) at the oil pan.
- Second, tighten the capscrews (2) at the lubricating oil pump.

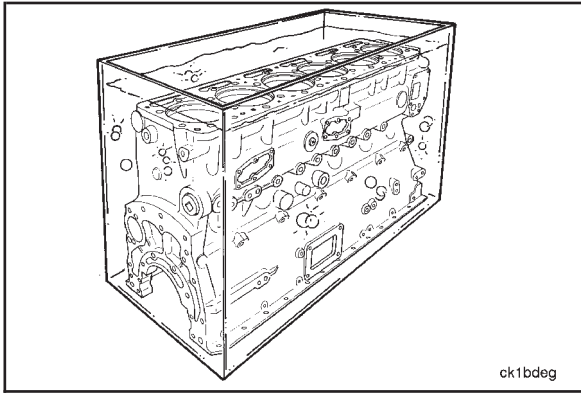
**Torque Value:** 47 N•m [35 ft-lb]



## Fuel Tubing - Installation

Install fuel supply tube and fuel return tube to the engine. Tighten the tube nuts to the torque value specified for the size of the tube. Refer to the chart in Section 18. Secure the tubing with the required clamps. Tighten the mounting capscrews to the torque value specified for the size of the capscrew. Refer to the chart in Section 18.





**Warning:** Use a face shield, rubber gloves, an apron, and boots and obey the warning label on the cleaning solution used to prevent personal injury.



**Caution:** Use a cleaning solution that will not damage the camshaft bushings if the bushings have not been removed.

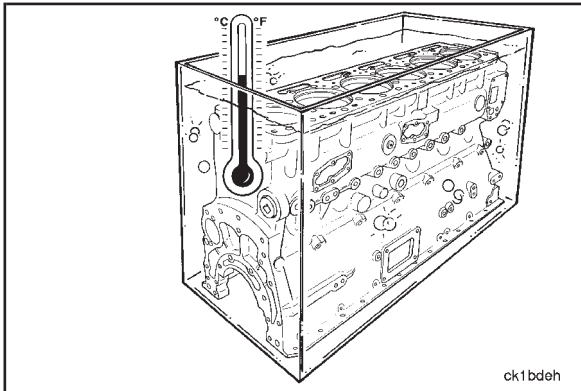


Remove the block from the engine stand. Put the block in a cleaning tank.



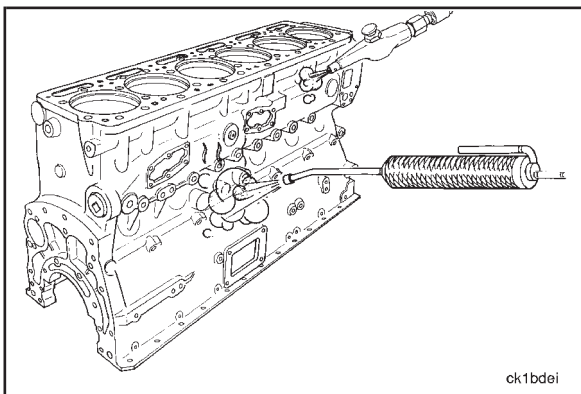
Follow the instructions of the manufacturer of the cleaning tank and the manufacturer of the cleaning solution.

**NOTE:** Cummins Engine Company, Inc., does **not** recommend any specific cleaning solution.



The best results can be obtained by using a cleaning solution that can be heated to 80° C to 95° C [180° F to 200° F].

Use a cleaning tank that will mix and filter the cleaning solution to get the best results.



**Warning:** Use a face shield, rubber gloves, an apron, and boots and obey the warning label on the cleaning solution used to prevent personal injury.



Remove the block from the cleaning tank.

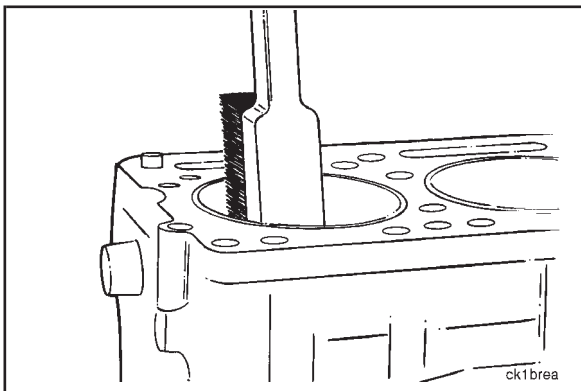


Clean all the oil passages using a steam cleaner.



**Caution:** Make sure all the water is removed from the capscrew holes and the oil passages to prevent rust formation in the cylinder block.

Use compressed air to dry the block.



**Warning:** Naptha and methyl ethyl ketone (MEK) are flammable materials and must be used with care. Do not use starting fluid as a cleaning agent. It can cause personal injury if ignited.



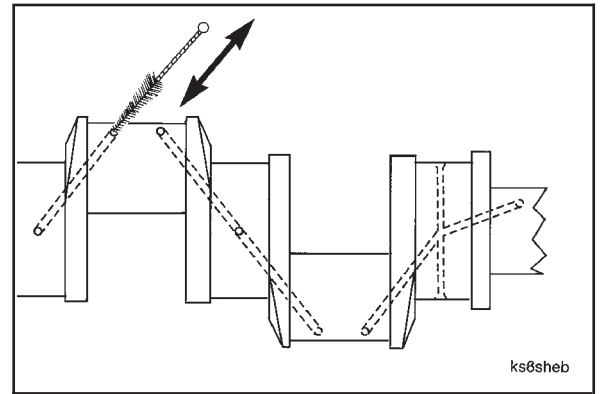
Clean the cylinder block counterbores with a suitable hydrocarbon solvent such as naptha, methyl ethyl ketone (MEK), or trichlorethane 1, 1, 1 (methyl chloroform).



## Cylinder Block N14

Use a bristle brush, Part No. ST-876, and solvent to clean all the oil drillings.

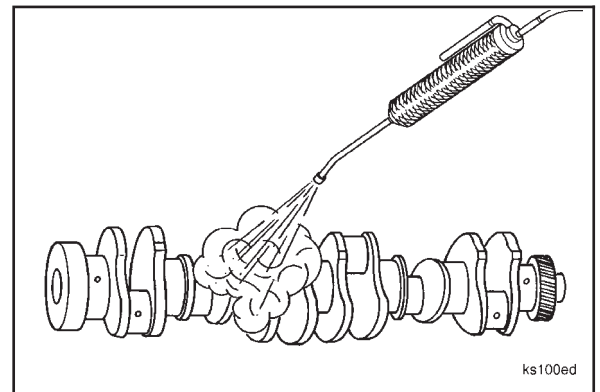
## Crankshaft - Cleaning and Inspection (01-14) Page 1-55



**Warning:** When using a steam cleaner, wear protective clothing and safety glasses or a face shield. Hot steam can cause serious personal injury.

Steam clean the crankshaft and dry it with compressed air.

**NOTE:** Make sure to blow out the threaded holes on each end of the crankshaft and the oil drillings.

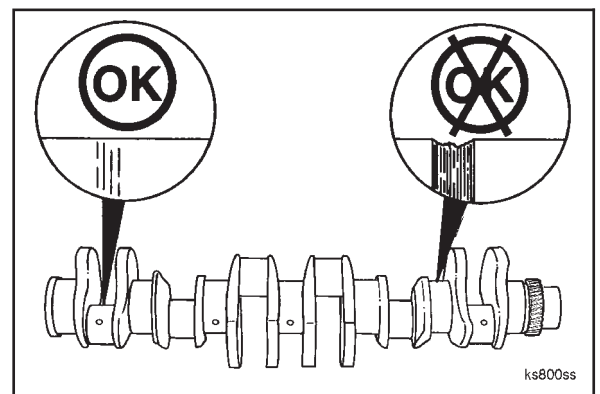


## Inspection

Visually inspect the machined surfaces for scratches or nicks.

Use a fine crocus cloth to remove the nicks and scratches.

**NOTE:** If scratches or nicks can be felt with a fingernail after the crankshaft has been polished with a crocus cloth, the crankshaft **must** be replaced or reconditioned.

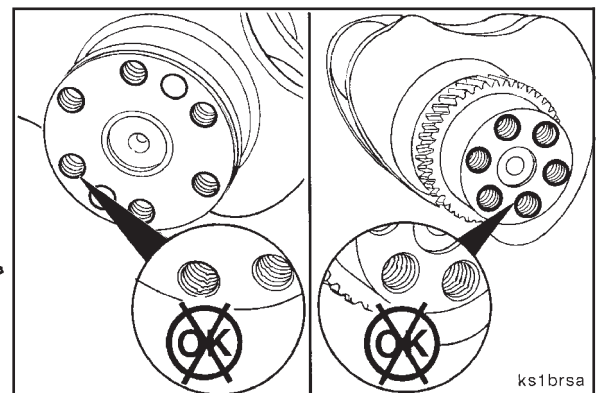


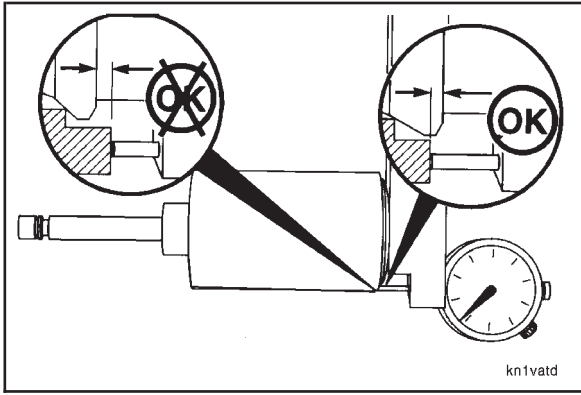
Visually inspect the threaded capscrew holes for damage.

Use one of the following methods to repair any threaded holes:

1. Use a tap to clean the burrs from the threads.
2. Use a thread repair insert.

If necessary, refer to the Alternative Repair Manual, Bulletin No. 3379035, for repair instructions.

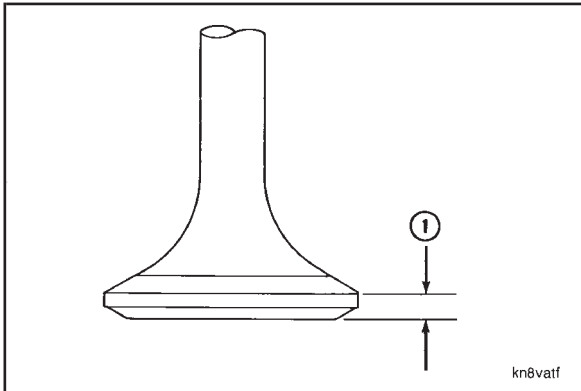




### Inspection

Use the N14 valve head checking tool to measure the head thickness of the valve.

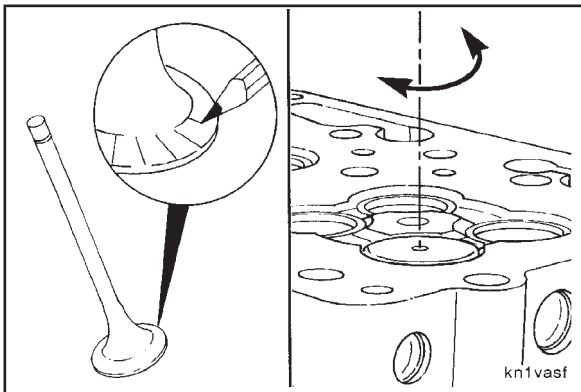
**NOTE:** If the valve head is below the end of the tool, the valve **must** be replaced.



If a valve checking tool is **not** available, put the valve on a flat surface and measure the head thickness (1) at the outside diameter.

Head Thickness (at O.D.)		
mm		in
2.90	MIN	0.114

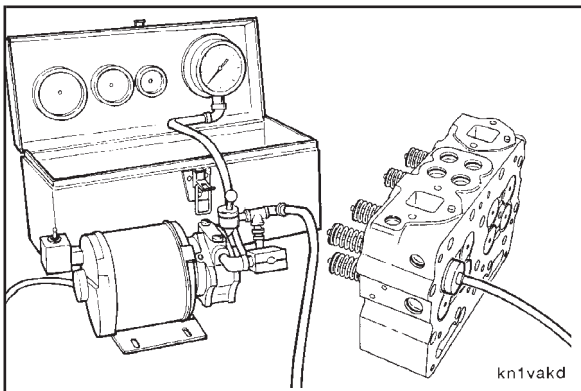
**NOTE:** If the valve head is worn thinner than the minimum specified, the valve(s) **must** be replaced.



Use a lead pencil or Dykem to mark across the valve face as shown. Install the valve in the valve guide.

Hold the valve against the valve seat, and rotate the valve backward and forward three or four times. Correct contact against the valve seat will break the marks on the valve face.

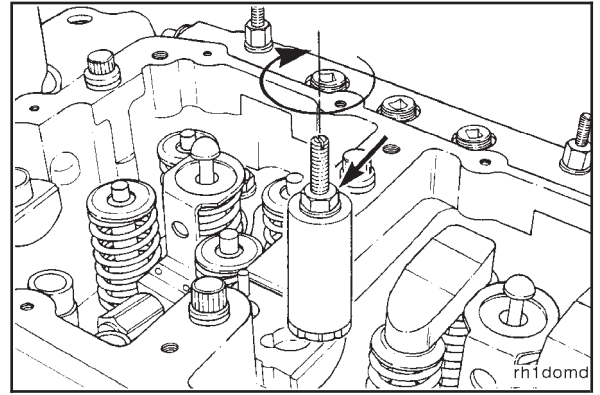
**NOTE:** Valves and valve seats that are correctly machined do **not** require the use of lapping compound to make an air tight seal. If lapping compound is required, inspect the adjustments of the facing machine and the condition of the grinding stone.



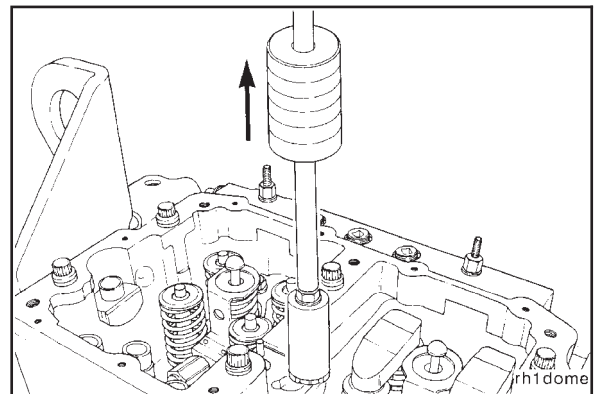
Install the valves in the cylinder head. Refer to "Assembly" under Cylinder Head - Rebuild (02-02).

Use valve vacuum tester, Part No. ST-1257, to vacuum test the valve seating. Refer to Cylinder Head - Vacuum Testing Valve Seating for Reuse (02-10).

Tighten the hexagon nut to grip the dowel.



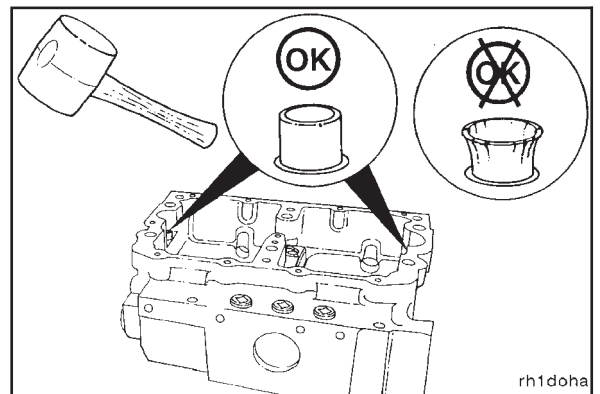
Mount the slide hammer on the 1/4-inch dowel remover and pull the dowel.



### Installation

**Caution:** Do not use a hammer or damage to the dowel will result.

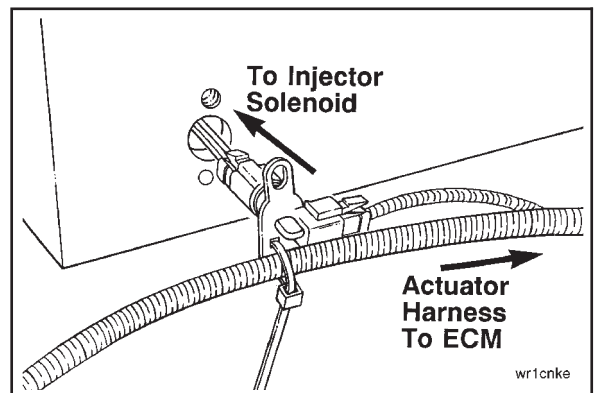
Use a mallet to install the ring dowels and pin dowels.

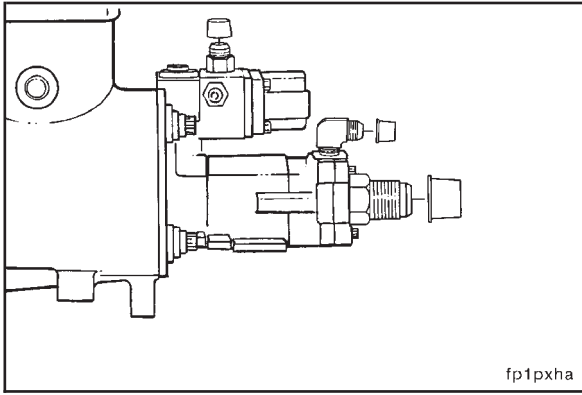


### Metri-Pack Pass Through Connector - Replacement (03-08)

#### Removal

The Metri-Pack pass through connectors connect the actuator harness to each of the injector solenoid wires in the rocker lever housing.

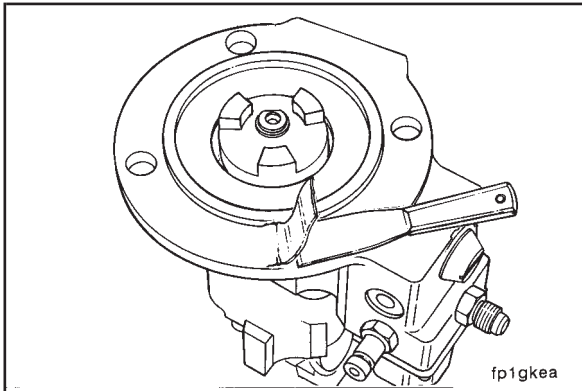




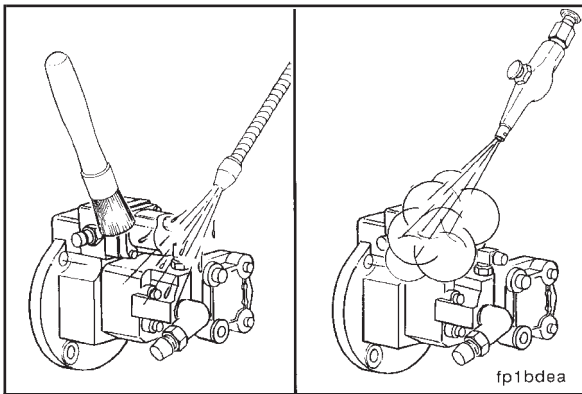
### Cleaning - CELECT™ Fuel Pump



Install plastic cup plugs or tape on all openings of the fuel pump to prevent dirt or cleaning solvent from entering the pump.



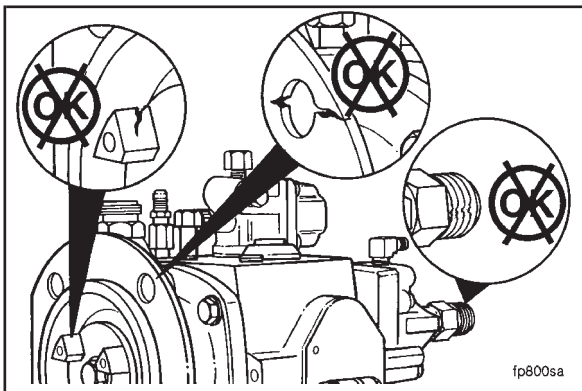
Remove the gasket material from the front cover gasket sealing surface.



**Caution:** Use a cleaning solvent approved for cleaning aluminum to prevent damage to the fuel pump.



Use a brush and solvent to clean the fuel pump exterior. Dry with compressed air.



### Inspection - PT Fuel Pump

Visually inspect the fuel pump body and front cover for cracks or other damage.

Visually inspect the fuel pump assembly for damaged capscrews and damaged or loose fuel fittings.

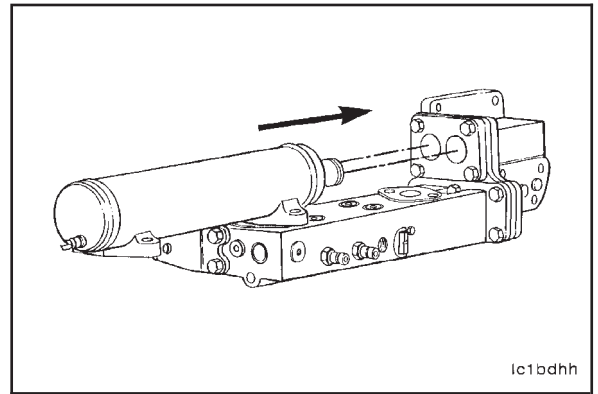
Visually inspect the drive coupling lugs for excessive wear or damage.

## Lubricating Oil System N14

Install the oil cooler core on the oil cooler transfer connection (housing) by inserting the transfer tubes into the o-ring adapters.

**NOTE:** Make sure the o-ring adapters move freely when the transfer tubes are inserted as this will allow tubes to be centered in the adapters.

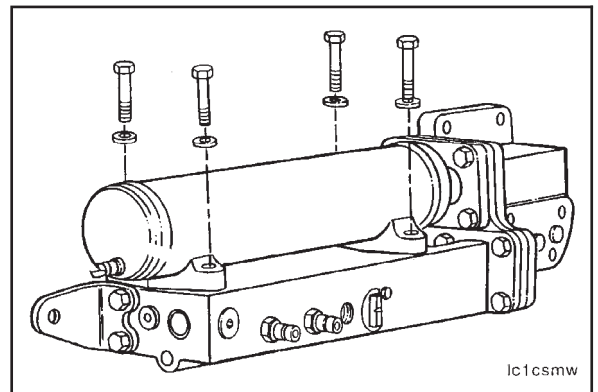
## Lubricating Oil Cooler Assembly - Rebuild (07-11) Page 7-37



Install the oil cooler core mounting gaskets and hold down capscrews.

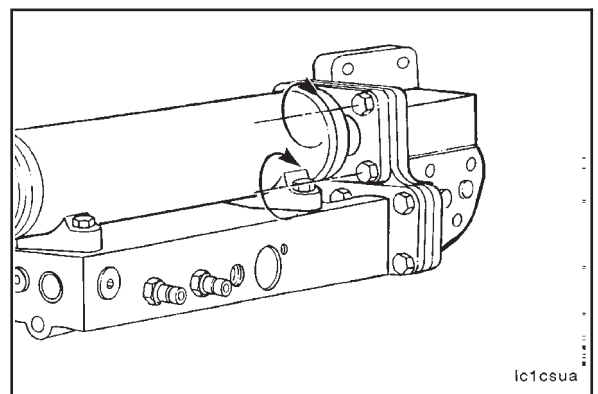
Tighten the hold down capscrews.

**Torque Value:** 27 N•m [20 ft-lb]

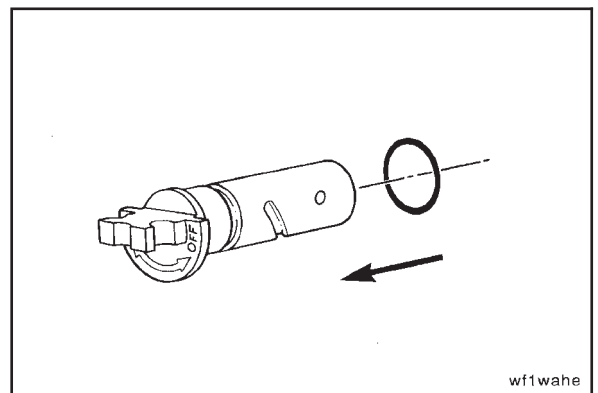


Alternately tighten the o-ring adapter retainer capscrews.

**Torque Value:** 47 N•m [35 ft-lb]



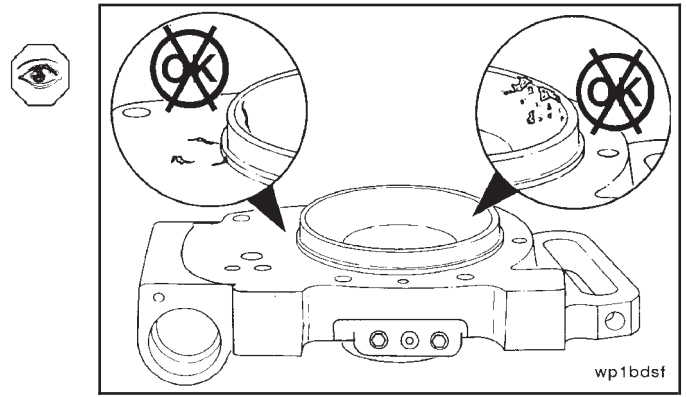
Install a new o-ring on the coolant filter shutoff valve.



### Inspection

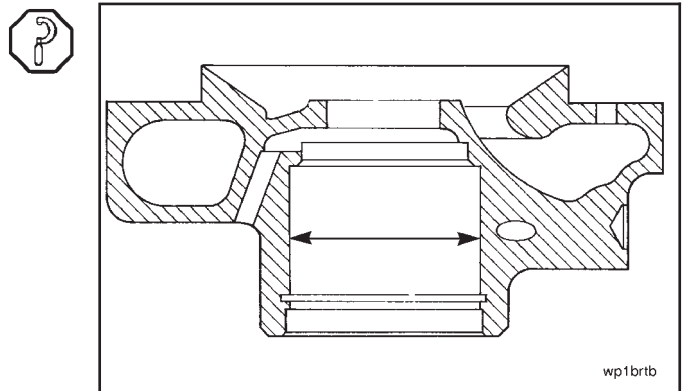
Visually inspect the water pump body for cracks, porosity, or excessive corrosion.

**NOTE:** If the part being inspected does **not** meet the specification given or if it is damaged or no alternative is given, the part **must** be replaced.



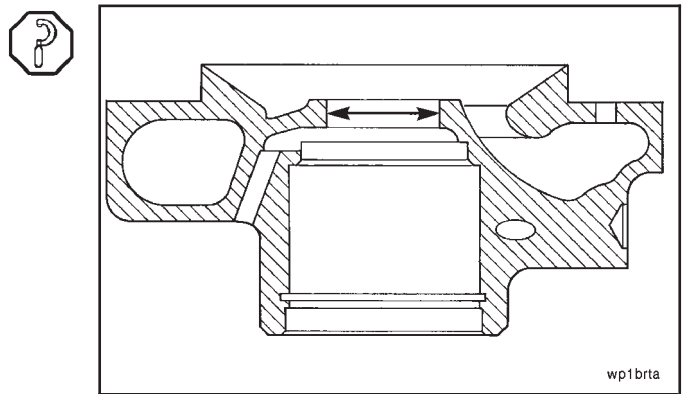
Measure the water pump body bearing bore inside diameter.

Water Pump Body Bearing Bore I.D.		
mm		in
61.988	MIN	2.4405
62.014	MAX	2.4415

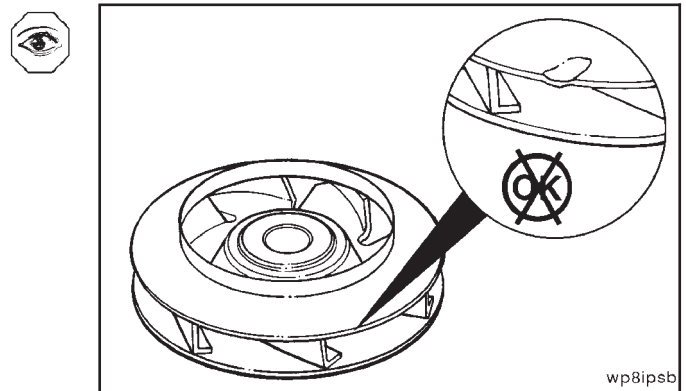


Measure the water pump body seal and seat assembly bore inside diameter.

Seal and Seat Assembly Bore I.D.		
mm		in
36.45	MIN	1.435
36.47	MAX	1.436

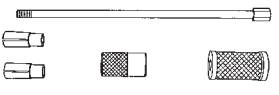
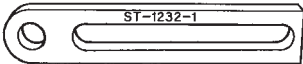

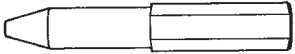
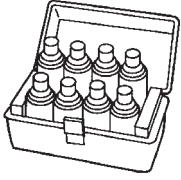


Visually inspect the water pump impeller for cracks or damage.



## Mounting Adaptations - Service Tools

The following special tools are recommended to perform procedures in Group 16. The use of these tools is shown in the appropriate procedure. These tools can be purchased from your local Cummins Authorized Repair Location.

Tool No.	Tool Description	Tool Illustration
ST-1134	<p><b>Dowel Pin Extractor</b></p> <p>Use to pull dowel pins and crosshead guides.</p>	 <p style="text-align: right; font-size: small;">c88toga</p>
ST-1232-1 (in Part No. ST-1232)	<p><b>Plate</b></p> <p>Use in conjunction with drill and ream bushing sets to accurately drill and ream holes in flywheel housings for the installation of standard oversize dowel pins.</p>	 <p style="text-align: right; font-size: small;">fh8toge</p>
ST-1232-2 (in Part No. ST-1232)	<p><b>Spacer Washer</b></p> <p>Use in conjunction with drill and ream bushing sets to accurately drill and ream holes in flywheel housings for the installation of standard oversize dowel pins.</p>	 <p style="text-align: center; font-size: small;">ST-1232-2</p> <p style="text-align: right; font-size: small;">fh8togf</p>
3375052 (in Part No. ST-1232)	<p><b>Locator Pin</b></p> <p>Use in conjunction with drill and ream bushing sets to accurately drill and ream holes in flywheel housings for the installation of standard oversize dowel pins.</p>	 <p style="text-align: right; font-size: small;">fh8togg</p>
3375432	<p><b>Crack Detection Kit</b></p> <p>This kit provides a convenient way to detect cracks in any engine component.</p>	 <p style="text-align: right; font-size: small;">bp8tcgj</p>
3376495	<p><b>Drill/Ream Bushing Set</b></p> <p>Use to drill and ream holes in flywheel housing for the installation of dowel pins.</p>	