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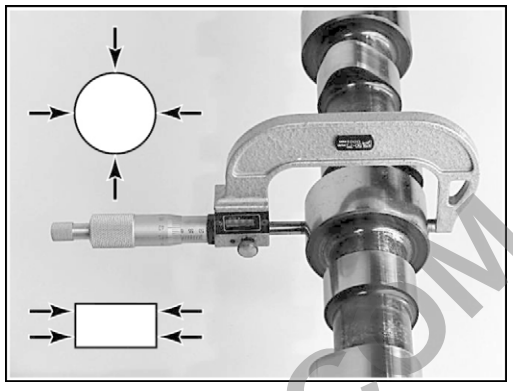
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Camshaft bearing journal

Reference: **Valve drive Camshaft - Measure (B.10.A.40.44 - F.40.A.16)**

Minimum	**59.962 mm**	**2.3607 in**
Maximum	**60.013 mm**	**2.3627 in**

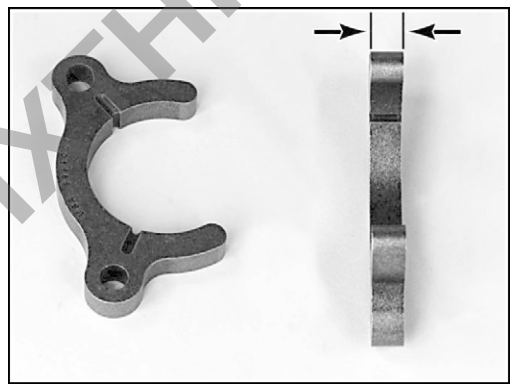


RCPH05CDC327AAB 2

Camshaft thrust plate

Reference: **Valve drive Camshaft - Measure (B.10.A.40.44 - F.40.A.16)**

Minimum	**9.40 mm**	**0.370 in**
Maximum	**9.60 mm**	**0.378 in**

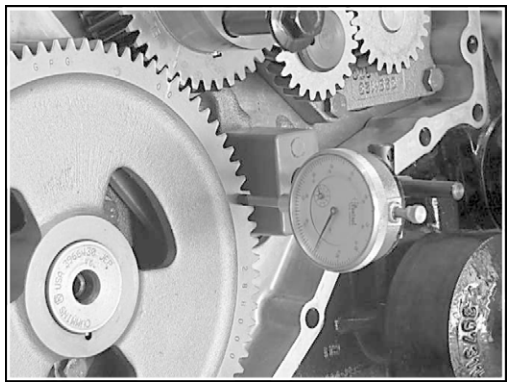


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Camshaft end play

Reference: **Valve drive Camshaft - End play (B.10.A.40.44 - F.40.E.10)**

Minimum	**0.12 mm**	**0.005 in**
Maximum	**0.50 mm**	**0.020 in**



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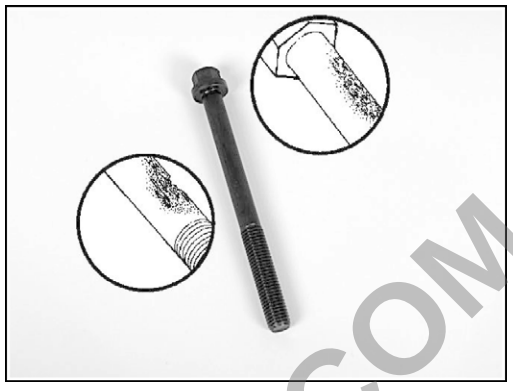
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Cylinder head cap screws – Corrosion or pitting

Reference: **Cylinder head - Visual inspection (B.10.A.72 - F.40.A.10)**

Do NOT reuse cap screws under the following conditions:

- if visible corrosion or pitting exceeds **1.0 cm²** (**0.155 in²**) in area: for example, a **9.525 mm** x **9.525 mm** (**0.375 in** x **0.375 in**) area is acceptable, but a **12.7 mm** x **12.7 mm** (**0.5 in** x **0.5 in**) area is not acceptable,
- if visible corrosion exceeds **0.12 mm** (**0.005 in**) in depth,
- if visible corrosion or pitting is located within **3.2 mm** (**0.125 in**) of the fillets or threads.

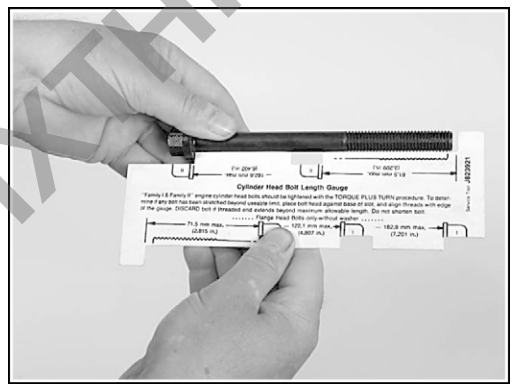


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Cylinder head cap screw – Free length

Reference: **Cylinder head - Measure (B.10.A.72 - F.40.A.16)**

Maximum	**162.6 mm**	**6.4 in**

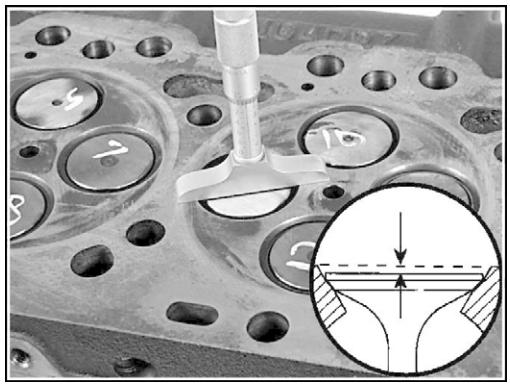


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Cylinder head – Valve recess

Reference: **Cylinder head - Assemble (B.10.A.72 - F.10.A.20)**

Minimum	**0.84 mm**	**0.033 in**
Maximum	**1.32 mm**	**0.052 in**

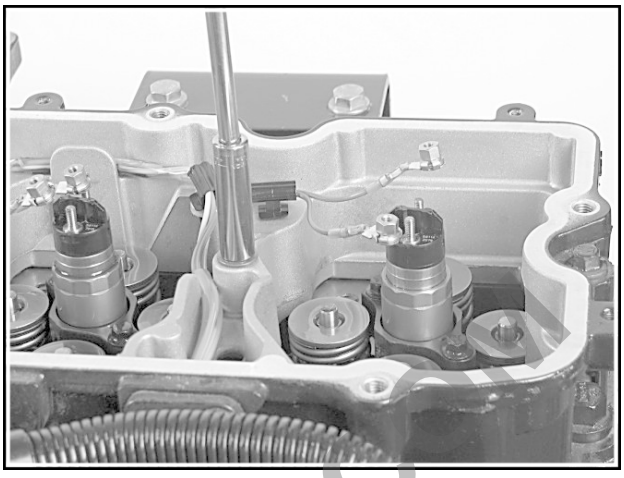


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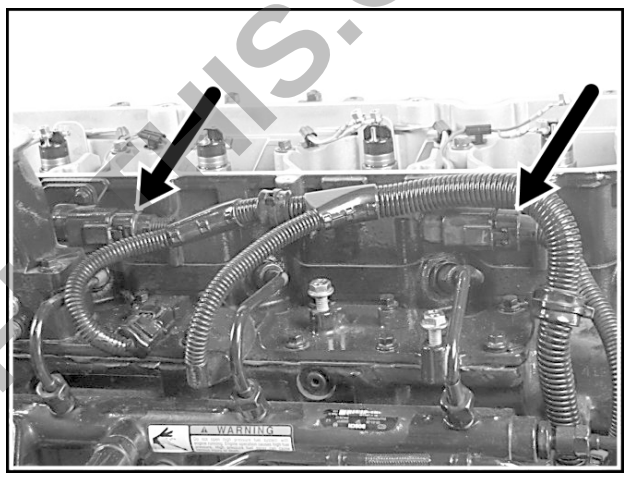
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4. Install the housing on the cylinder head and secure with the original cap screws. Tighten the screws from the center outward. Torque the cap screws to **24 Nm** (**212 lb in**).



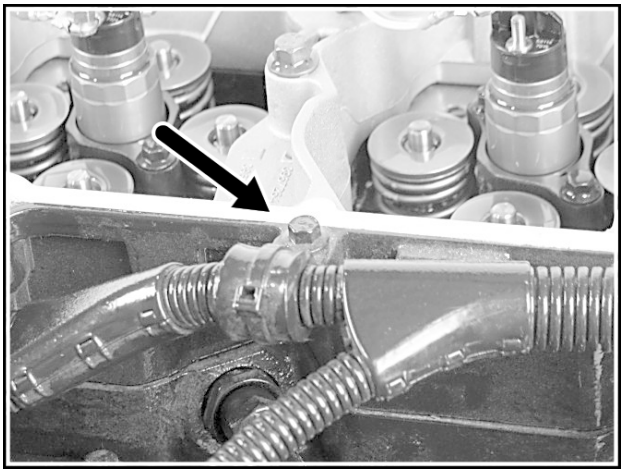
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5. Connect the three engine harness connectors to the injector harnesses.



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6. Install the engine harness clamp on the housing.



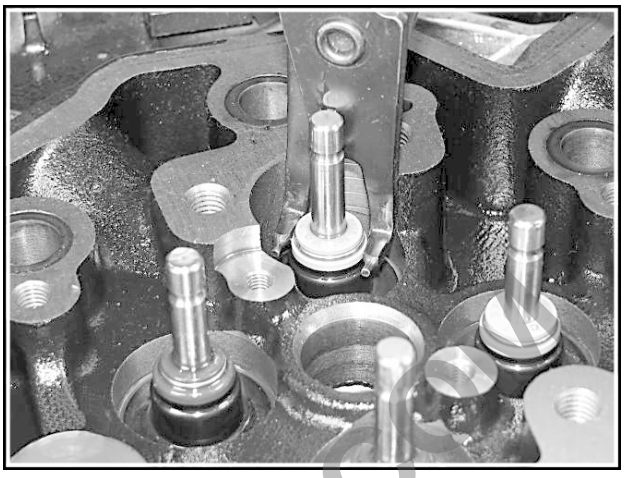
RCPH05CDC284AAA 6

Next operation: Connect the harness leads to the injectors. See **Fuel injector - Install (B.20.A.29 - F.10.A.15)**.
Next operation: Valve cover - Install (B.10.A.74 - F.10.A.15)
Next operation: Install the blowby recirculation tube and drain tube. See **Blowby re-circulation system - Install (B.60.A.26 - F.10.A.15)**.

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8. Use a pliers with a **90 °** head to remove the seals from the valve stems. Discard the seals.



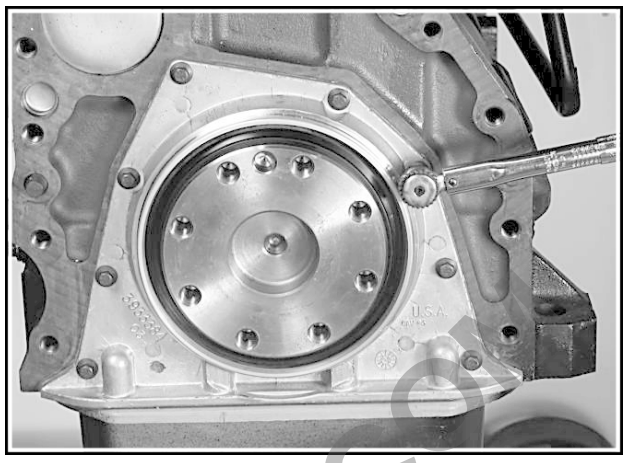
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Next operation: Return to **Cylinder head - Disassemble (B.10.A.72 - F.10.A.25)**

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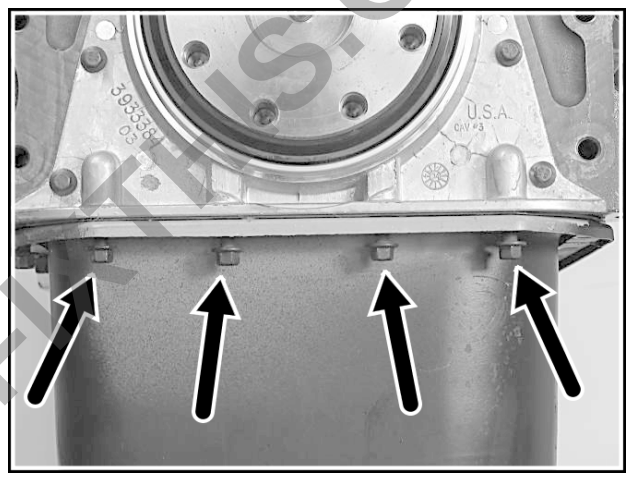
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10. Remove the driver screw from the crankshaft. Tighten and then torque the rear cover cap screws to **10 Nm** (**86 lb in**).



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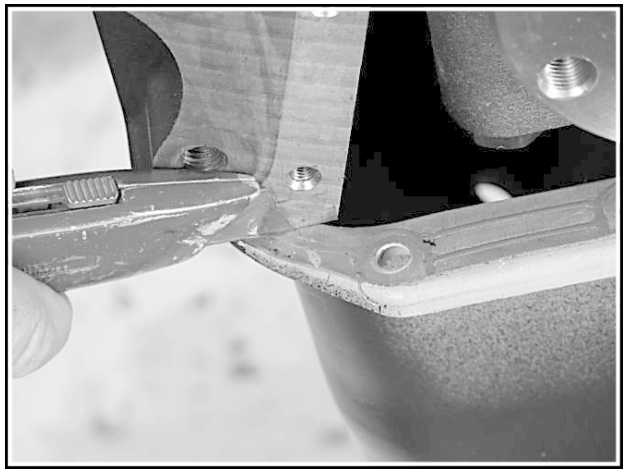
11. Install the four oil pan cap screws. Torque the cap screws to **28 Nm** (**21 lb ft**).



RCPH05CDC941AAA 11

Gasket repair

12. If the oil pan gasket was damaged during separation from the rear cover and damage does not extend beyond the rear cover, the gasket can be repaired. Cut the damaged gasket at both sides of the rear cover.

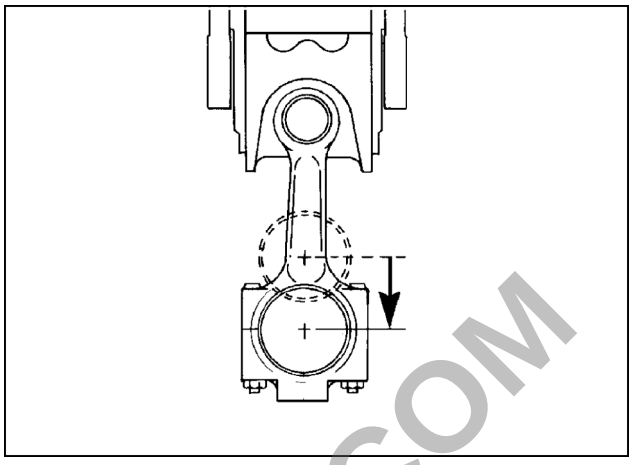


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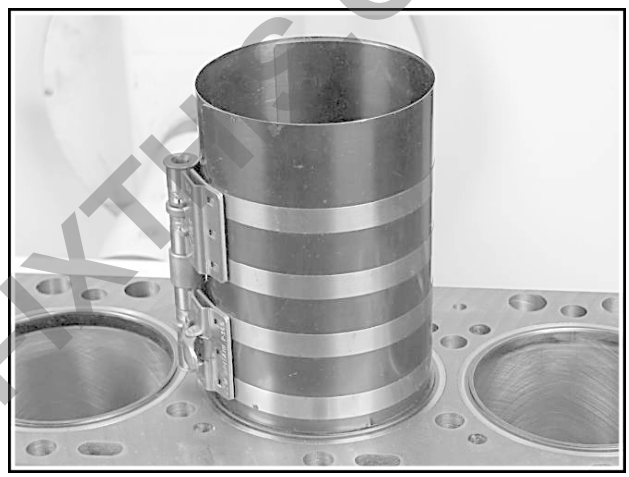
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7. Rotate the crankshaft so the journal for the connecting rod being installed is at bottom dead center (BDC).



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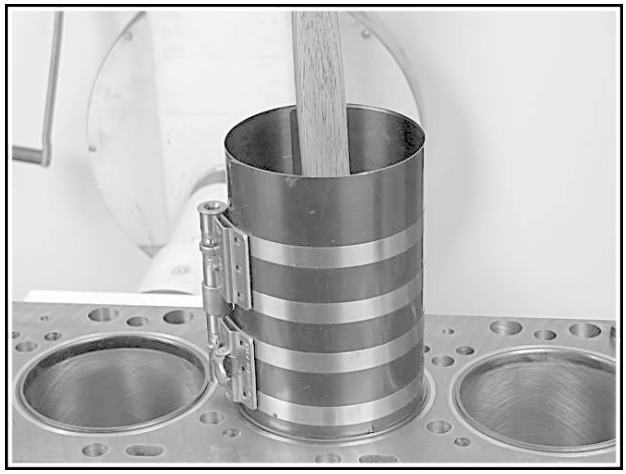
8. Insert the connecting rod through the cylinder liner until the spring compressor **OEM6268** or equivalent contacts the top of the liner.



RCPH05CDC695AAA 8

9. Hold the ring compressor against the cylinder liner. Push the piston through the ring compressor and into the cylinder liner. Push the piston until the top ring is completely in the cylinder liner.

NOTE: *If the piston does not move freely, remove the piston and inspect for broken or damaged rings.*



RCPH05CDC696AAA 9

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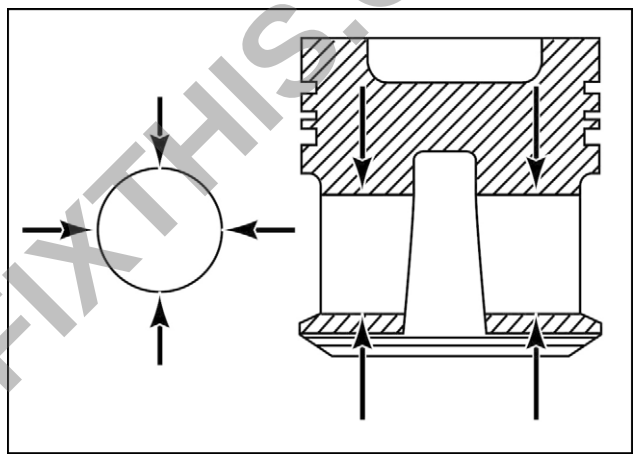
4. Measure the pin bore when the piston temperature is at **20 °C** (**68 °F**).

IMPORTANT: *Add **0.013 mm** (**0.0005 in**) to the expected bore diameter for each **5 °C** (**10 °F**) temperature increase over **20 °C** (**68 °F**), up to **32 °C** (**90 °F**).*



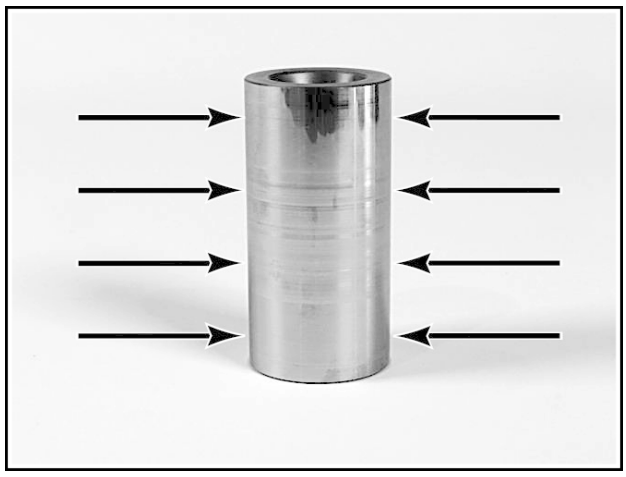
RCPH05CDC549AAA 4

5. Measure the bore at the points indicated. The expected bore diameter range is **45.006 - 45.012 mm (1.7719 - 1.7721 in)**.



RCIL05CDC002AAA 5

6. Inspect the piston pin for nicks, gouges and excessive wear. Inspect the piston pin outside diameter. See **Piston Pin - Measure (B.10.A.47.15.10 - F.40.A.16)** for expected dimensions.



RCPH05CDC438AAB 6

Next operation: Connecting rod and piston - Assemble (B.10.A.47 - F.10.A.20)
Next operation: Connecting rod and piston - Install (B.10.A.47 - F.10.A.15)
Next operation: Oil pan - Install (B.60.A.23 - F.10.A.15)
Next operation: ENGINE COOLANT SYSTEM - Filling (B.50.A - F.60.A.10)
Next operation: LUBRICATION SYSTEM - Filling (B.60.A - F.60.A.10)

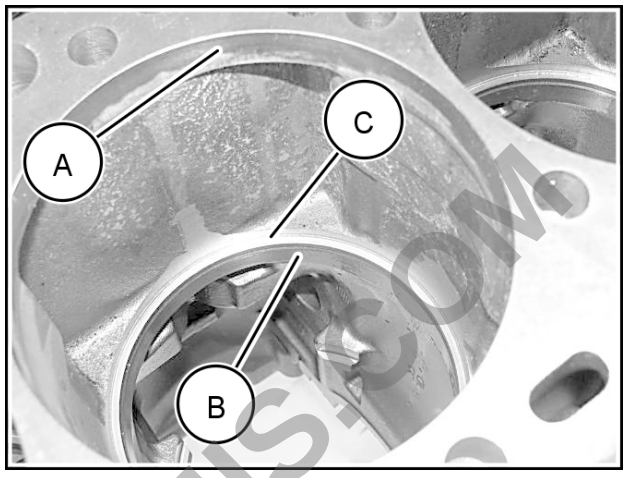
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Cylinder block Liner - Install (B.10.A.70.15 - F.10.A.15)

Prior operation: Cylinder block Liner - Measure (B.10.A.70.15 - F.40.A.16)

1. Clean all deposits and debris from sealing surfaces **(A)**, **(B)** and **(C)**. Use a Scotch-Brite™ pad or equivalent and solvent to polish the surfaces. Due to critical machining tolerances, care must be taken not to remove additional material.



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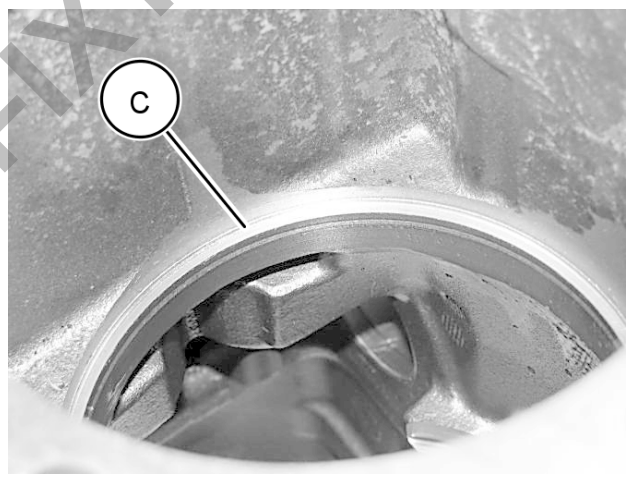
⚠ WARNING ⚠

When using solvents, acids or alkaline materials for cleaning, follow the manufacturer's recommendations for use. Wear goggles and protective clothing to reduce the possibility of personal injury. M995

⚠ WARNING ⚠

Some solvents are flammable and toxic. Read the manufacturer's instructions before using. Personal injury can result from misuse. M996

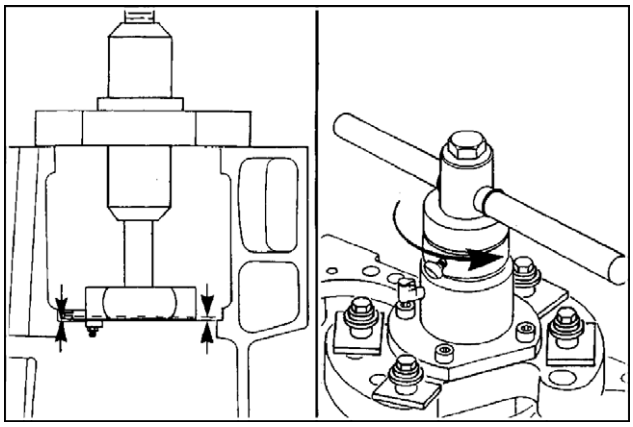
2. If surface **(C)** has cracks or signs of the extreme wear, the counterbore requires machining and the installation of shims for the correct liner protrusion.



RCPH05CDC733AAA 2

3. Use Cummins Counterbore Cutter 3163785 to machine the counterbore to the proper depth.

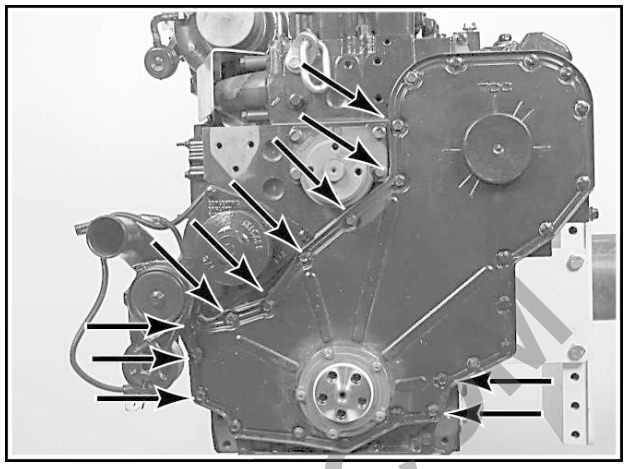
NOTE: *Cummins cutter plate 3823567 and cutter bit 3823570 MUST be used with the counterbore machining tool.*


RCSC05CDC099AAA 3

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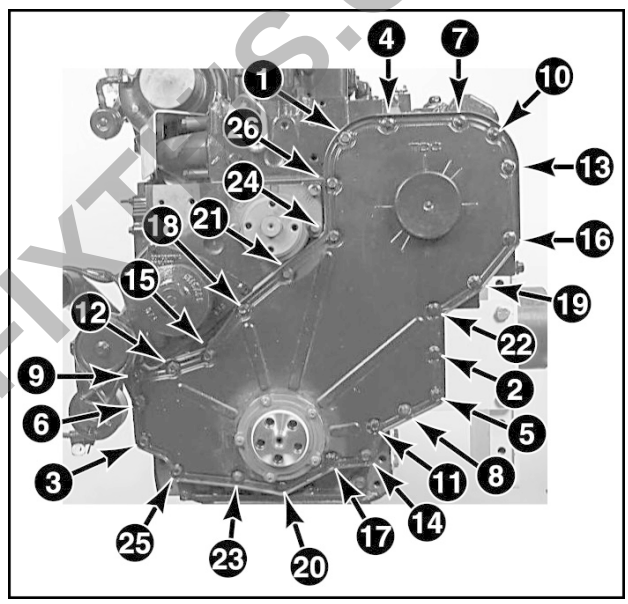
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4. Install the front cover on the housing. Install the cap screws in the front cover with the longer cap screws at the locations shown.



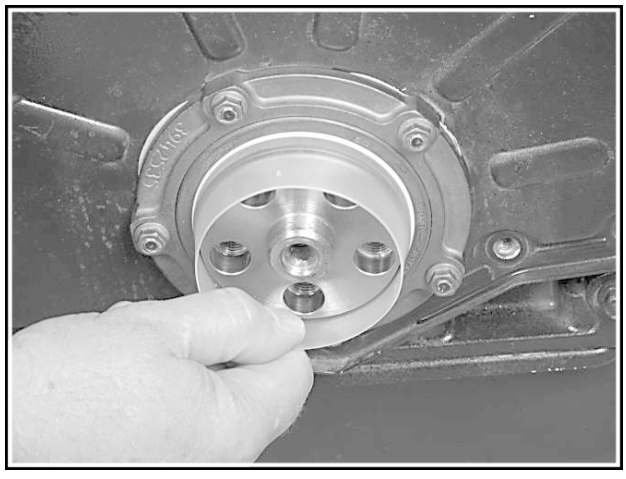
RCPH05CDC102ABB 4

5. Tighten and torque the cap screws to **24 Nm** (**18 lb ft**) in the pattern shown.



RCPH05CDC102ABD 5

6. Remove the plastic pilot from the front seal if required.



RCPH05CDC098ABA 6

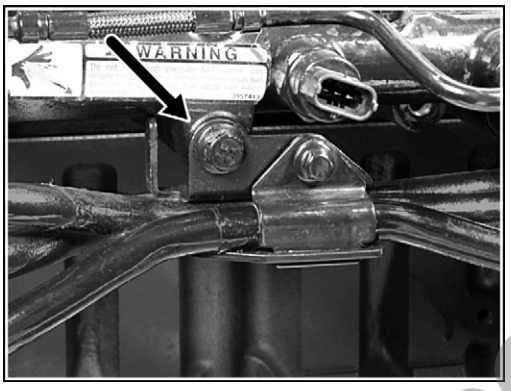
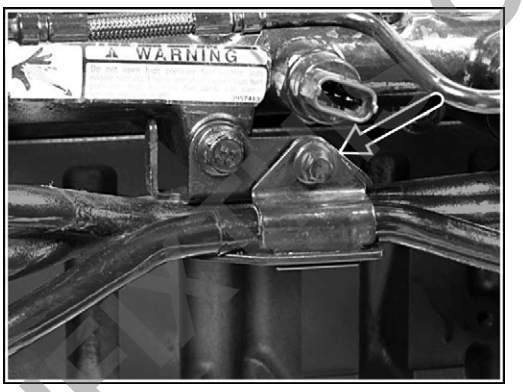
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Component	N·m	Identification	lb-ft
Quick disconnect fuel line bracket cap screw	**24 Nm**	 RCPH05CDC219ABA 4	**18 lb ft**
Fuel line clamping plate cap screw	**24 Nm**	 RCPH05CDC219ABA 5	**18 lb ft**

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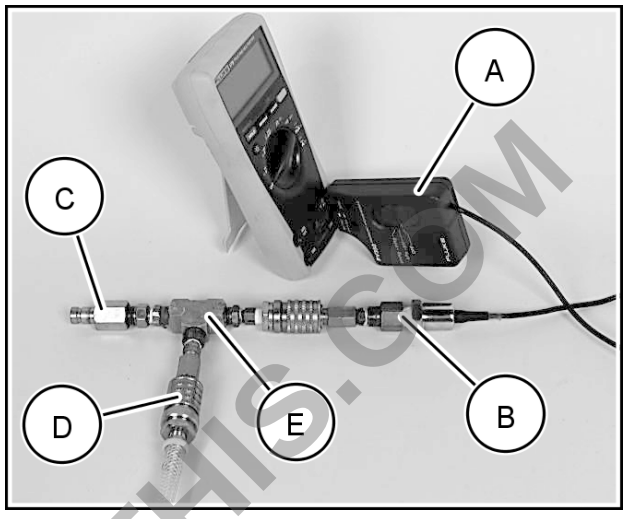
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FUEL AND INJECTION SYSTEM - Supply restriction (B.20.A - F.40.C.21)

2388, 2377

1. The testing tools shown in this procedure use a digital voltmeter (DVM) with a pressure/vacuum module – **3164491 (CUMMINS) (A)**. Wherever the pressure transducer **(B)** for the module is shown a conventional analog gauge can be substituted. Other required components for this procedure are:

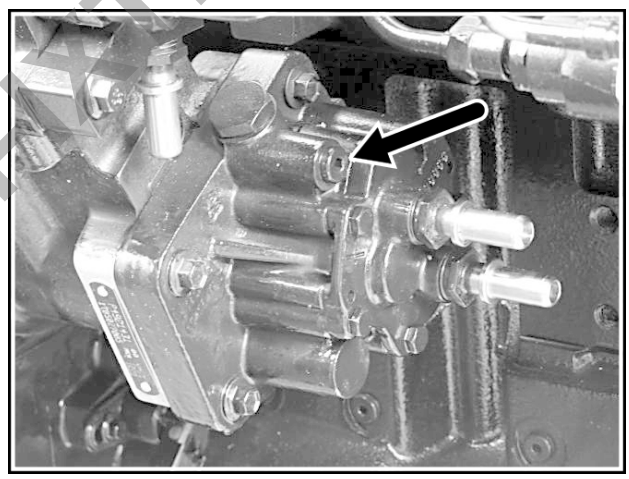
   • two **10 mm** Compucheck® fittings – **3824842 (CUMMINS)** – which connect to the test fixture at point **(C)**,
   • the orificed diagnostic fuel line **(D)** – **3164621 (CUMMINS)**,
   • and a Tee fitting **(E)**.



RCPH05CDC114ABA 1

2. Install a **10 mm** Compucheck® fitting – **3824842 (CUMMINS)** – in the test port at the inlet to the gear pump.

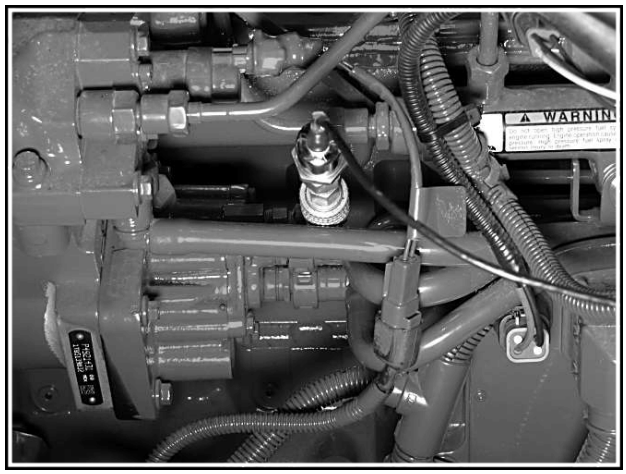
NOTE: *Some components removed for photo clarity.*



RCPH05CDC997AAA 2

3. Connect an analog or digital pressure gauge to the fitting. The gauge range must be from **0 - 762 mm Hg (0 - 30 in Hg)**.

NOTE: *A **90 °** fitting and quick disconnect coupler to the transducer for a digital pressure/vacuum module is shown.*



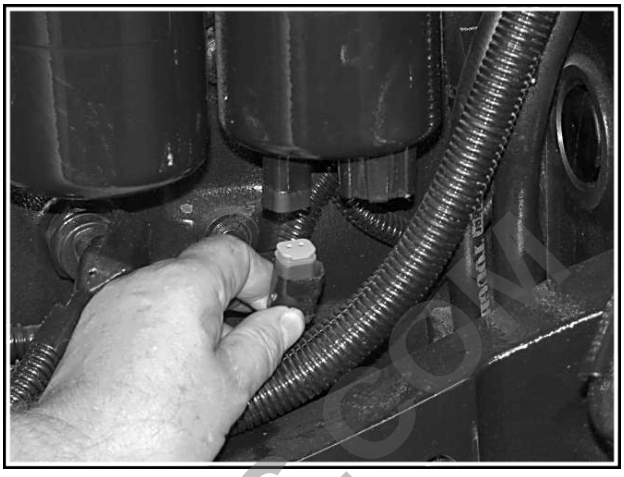
RCPH05CDC238ABA 3

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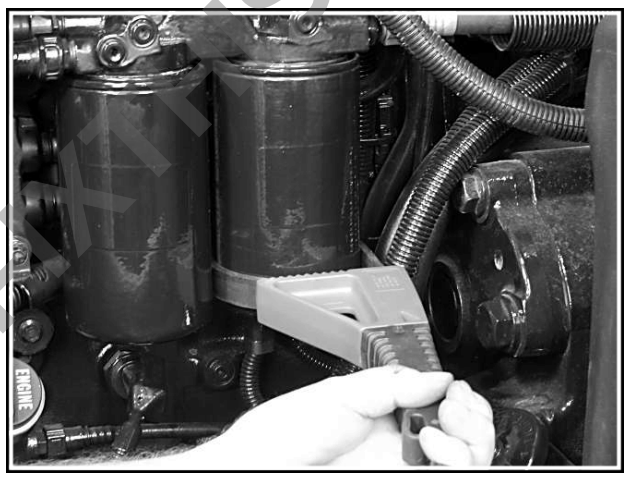
Fuel filter system Pre-filter - Remove (B.20.A.24.10 - F.10.A.10)

1. Disconnect the harness connector to the water in fuel sensor.



RCPH05CDC225ABA 1

2. Remove the pre-filter from the filter head.



RCPH05CDC226ABA 2

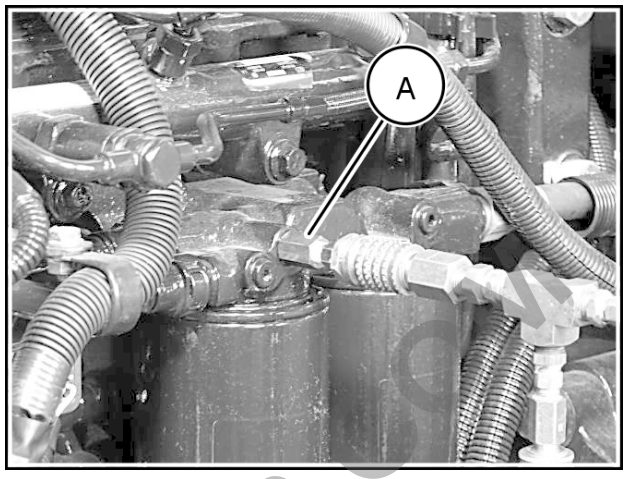
Next operation: Fuel filter system Fuel filter - Remove (B.20.A.24.22 - F.10.A.10)
Next operation: Fuel filter system Pre-filter - Install (B.20.A.24.10 - F.10.A.15)

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Engine will run

4. To measure gear pump pressure at rated condition, install a **10 mm** x **1.5 in** Compucheck® fitting **(A)** – **3824842 (CUMMINS)** – in the outlet port of the 2 micron fuel filter.



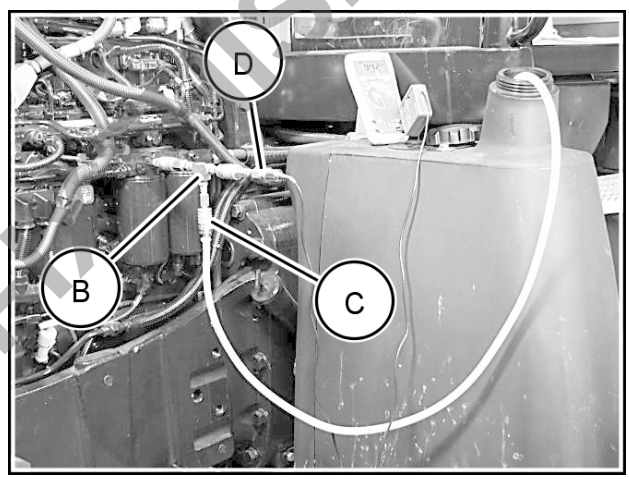
RCPH05CDC115ABA 3

5. Connect a Tee fitting **(B)** to the Compucheck® fitting.

   Connect the orificed diagnostic fuel line **(C)** – **3164621 (CUMMINS)** – to the Tee. Route the hose back to the fuel tank.

   Connect an analog or digital pressure gauge **(D)** to the open port on the Tee.

NOTE: *The gauge range should be* ***0 - 1034 kPa (0 - 150 psi)****.*



RCPH05CDC116ABA 4

6. Operate the engine at high idle and observe the gear pump pressure.

   Minimum gear pump pressure MUST be **483 kPa** (**70 psi**).

NOTE: *Value shown in psi.*



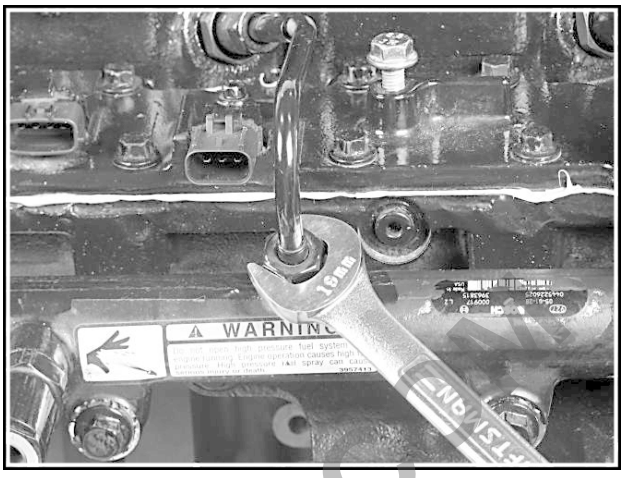
RCPH05CDC118ABA 5

7. If the gear pump pressure is low, check for excessive supply restriction. See **FUEL AND INJECTION SYSTEM - Supply restriction (B.20.A - F.40.C.21)**.

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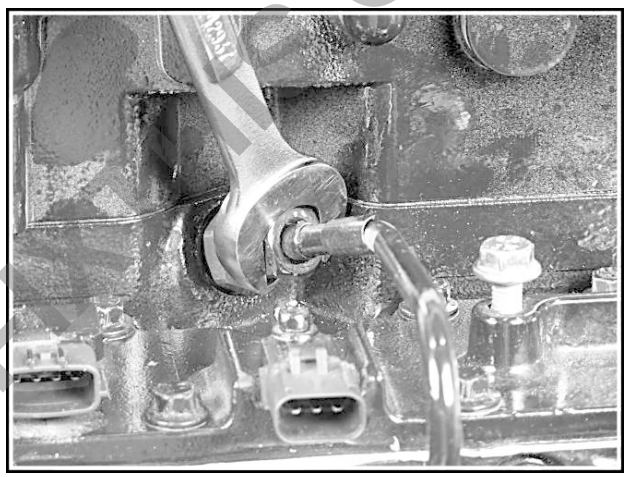
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4. Loosen the connector for each fuel connector supply line at the fuel rail.



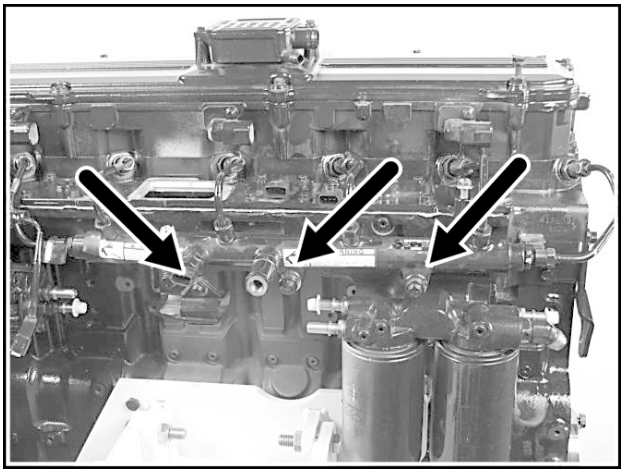
RCPH05CDC904AAA 4

5. Disconnect the supply line from each fuel connector.



RCPH05CDC901AAA 5

6. Remove the three cap screws and remove the fuel rail from the block.



RCPH05CDC898AAA 6

Next operation: High pressure common rail Common rail - Visual inspection (B.20.A.30.25 - F.40.A.10)

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Fuel line High pressure - Visual inspection (B.20.A.36.20 - F.40.A.10)

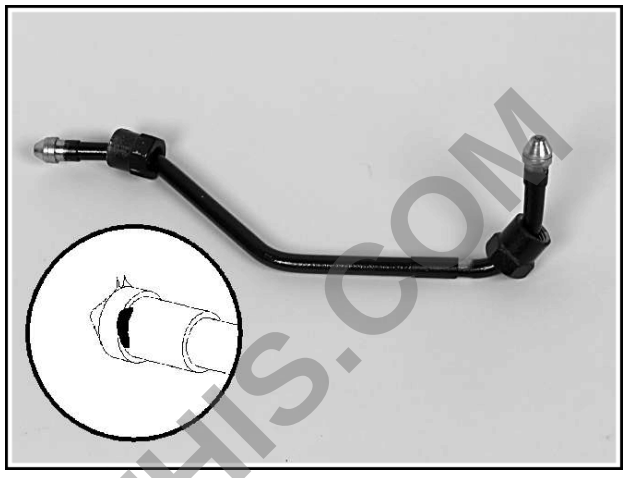
Prior operation: Fuel line High pressure - Remove (B.20.A.36.20 - F.10.A.10)

Fuel rail supply

1. Check the ferrules for burrs or foreign material.

   Inspect the cone sealing surface for deformation that would prevent reuse.

   Check for cracks or other damage.



RCPH05CDC905AAB 1

Next operation: Fuel line High pressure - Install (B.20.A.36.20 - F.10.A.15)

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Magnetic base

The magnetic base is used to support the dial indicator when testing wastegate actuator movement.

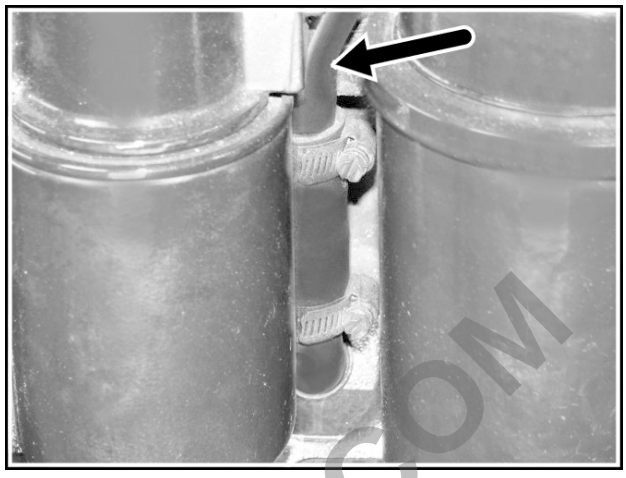


RCPH05CDC701AAA 6

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4. Install the oil drain tube in the return hose to the block between the filters.



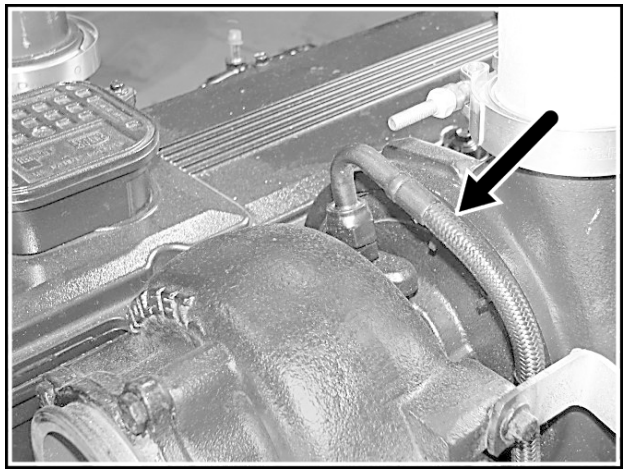
RCPH05CDC182AAA 4

5. Lubricate the bearings by pouring **59 - 89 mL (2 - 3 US fl oz)** of clean engine oil into the supply port. Rotate the turbine wheel while pouring to allow oil to enter the bearing housing.



RCPH05CDC184AAA 5

6. Replace the O-ring in the bearing supply port if required. Use the two hand, two wrench method to install the oil supply line.



RCPH05CDC180AAA 6

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AIR INTAKE SYSTEM - Problem solving (B.30.A - G.40.A.30)

OPERATION

Refer to **AIR INTAKE SYSTEM - Dynamic description (B.30.A - C.30.A.10)**.

TROUBLESHOOTING

- A thorough analysis of a customer's complaint is the key to successful troubleshooting. The more information known about a complaint, the faster and easier the problem can resolved.
- The tables are organized to locate a problem by doing the easiest and most logical things first. Complete all steps in the sequence from top to the bottom.
- It is NOT possible to list all possible solutions to all possible problems; however, these tables are organized to stimulate a thought process that will lead to the cause and correction of the problem.
- Follow these basic troubleshooting steps:
  - Get all the facts concerning the complaint.
  - Analyze the problem thoroughly.
  - Relate the symptoms to the basic engine systems and components.
  - Consider any recent maintenance or repair work that might relate to the complaint.
  - Double check before beginning any disassembly.
  - Use the order in the tables to eliminate the simplest problems first.
  - When the problem is located, perform a thorough repair.
  - When the repair is complete, operate the engine to make sure the complaint has been corrected.

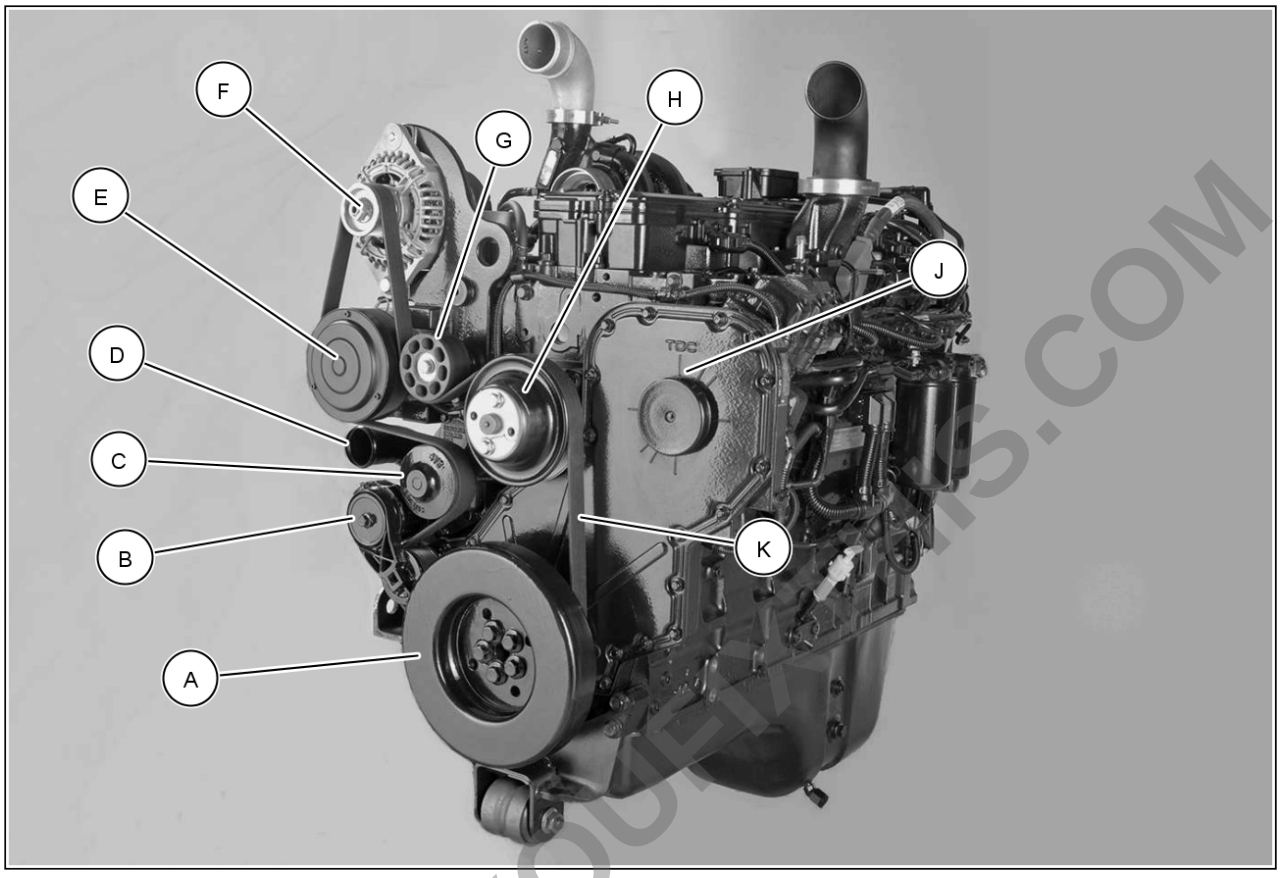
⚠ **WARNING** ⚠

Troubleshooting presents the risk of death, personal injury or equipment damage. Troubleshooting must be performed by trained, experienced technicians. M1161

Problem	Possible Cause	Correction
Intake manifold air temperature above specification	Step 1: Fan drive belt is broken.	Check the drive belt. Replace the belt, if required. Refer to **Fan and drive Belt - Install (B.50.A.54.44 - F.10.A.15)**.
	Step 2: Cold weather winter front is closed.	Open the cold weather winter front. Maintain a minimum opening of **384 cm²** (**60 in²**) – or approximately **19.6 cm** (**7.5 in**) x **19.6 cm** (**7.5 in**).
	Step 3: Air cooler, radiator, hydraulic fluid cooler, condenser and/or fuel cooler fins are damaged or obstructed with debris.	Inspect all components. Clean as required. Refer to **Radiator - Visual inspection (B.50.A.32 - F.40.A.10)**.
	Step 4: Electronic fault codes active or high counts of inactive fault codes.	Use INSITE® to view active and inactive fault codes.
	Step 5: Programmable parameters or selected features are NOT correct.	Check the programmable parameters and the selected features with the electronic service tool.
	Step 6: Fan drive or controls are malfunctioning.	Check the fan drive pulleys and belt tensioner; refer to **Fan and drive Belt tensioner - Visual inspection (B.50.A.54.49 - F.40.A.10)**. Refer to the chassis service manual and test the viscous drive.

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ENGINE COOLANT SYSTEM - Component identification (B.50.A - C.40.C.20)



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Engine front

A. Vibration damper (rubber or viscous)
B. Belt tensioner
C. Water pump
D. Water inlet from radiator
E. Compressor
F. Alternator
G. Idler puller
H. Fan pulley
J. Top dead center (TDC) mark
K. Drive belt

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Fan and drive Belt - Install (B.50.A.54.44 - F.10.A.15)

Prior operation: Fan and drive Belt - Visual inspection (B.50.A.54.44 - F.40.A.10)

1. Use a **0.5 in** socket drive to raise and hold the belt tensioner. Install the belt and release the tensioner.

NOTE: *The belt tensioner is spring-loaded and MUST be pivoted away from the belt.*

NOTE: *Position the belt over the grooved pulleys first. While raising the tensioner, slide the belt over the coolant pump pulley.*

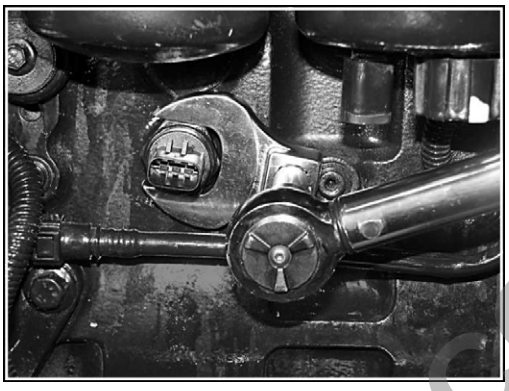


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Sensing system Oil pressure - Torque (B.60.A.95.91 - D.20.A.10)

Component	N·m	Identification	lb-ft
Oil pressure sensor	**23 Nm**	 RCPH05CDC354ABA 1	**18 lb ft**

Sensing system Oil pressure - Service limits (B.60.A.95.91 - D.20.A.20)

Oil pressure sensor

Reference: **Sensing system Oil pressure - Test (B.60.A.95.91 - F.40.C.01)**

There must be continuity between pin 2 and 3 and no continuity between the remaining pin combinations on the sensor connector.

Replace the sensor if the correct continuity is not present.



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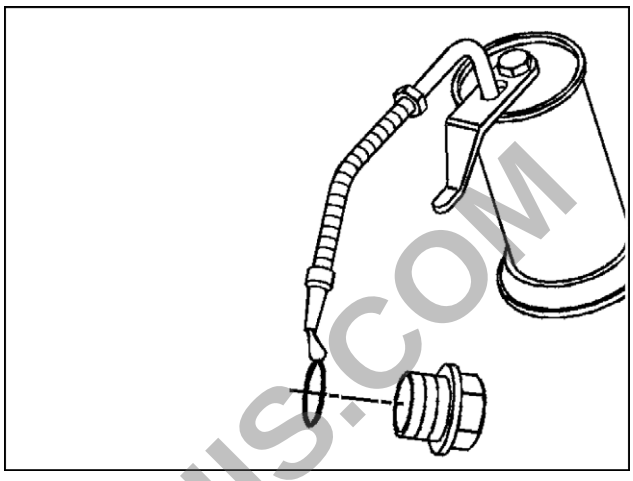
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Oil pressure regulator valve - Install (B.60.A.25 - F.10.A.15)

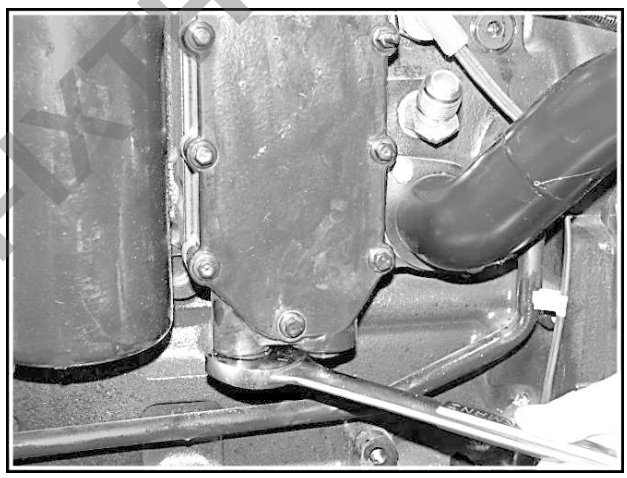
Prior operation: Oil pressure regulator valve - Visual inspection (B.60.A.25 - F.40.A.10)

1. Install a new O-ring seal on the threaded plug and lubricate with clean engine oil.



RCSC05CDC003AAA 1

2. Install the pressure regulator assembly. Torque the plug to **80 Nm** (**59 lb ft**).



RCPH05CDC301AAA 2

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Sensing system Oil pressure - Test (B.60.A.95.91 - F.40.C.01)

Prior operation: Sensing system Oil pressure - Visual inspection (B.60.A.95.91 - F.40.A.10)

1. Use a digital voltmeter to measure resistance between the pins at the sensor connector.

   There must be continuity between pin 2 and 3 and no continuity between the remaining pin combinations.

   Replace the sensor if the correct continuity is not present.



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Next operation: Sensing system Oil pressure - Install (B.60.A.95.91 - F.10.A.15)

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