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Torque (- A.90.A.10)

IMPORTANT: *When replacing cap screws, always use a cap screw of the same measurement and strength as the cap screw being replaced.*

Metric cap screws and nuts are identified by the grade number stamped on the head of the cap screw or on the surface of the nuts. U.S. customary cap screws are identified by radial lines stamped on the head of the cap screw.

Cap screw marking and torque value – Metric

Commercial steel class												
	8.8				10.9				12.9			
	Cap screw head marking											
	 rh04h178 1				 rh04h179 2				 rh04h180 3			
Dia.	Cast iron		Aluminum		Cast iron		Aluminum		Cast iron		Aluminum	
mm	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb	Nm	ft lb
6	9	5	7	4	13	10	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	23	17	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	65	50	30	25	70	50	30	25
12	80	60	55	40	115	85	55	40	125	95	55	40
14	125	90	90	65	180	133	90	65	195	145	90	65
16	195	140	140	100	280	200	140	100	290	210	140	100
18	280	200	180	135	390	285	180	135	400	290	180	135
20	400	290	–	–	550	400	–	–	–	–	–	–

NOTES

1. Always use the torque values listed in the above table when specific torque values are not supplied in a procedure.
2. Do NOT use these torque values in place of specified torque values in a procedure.
3. The values in the table are based on lubricated threads.

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⚠ **WARNING** ⚠

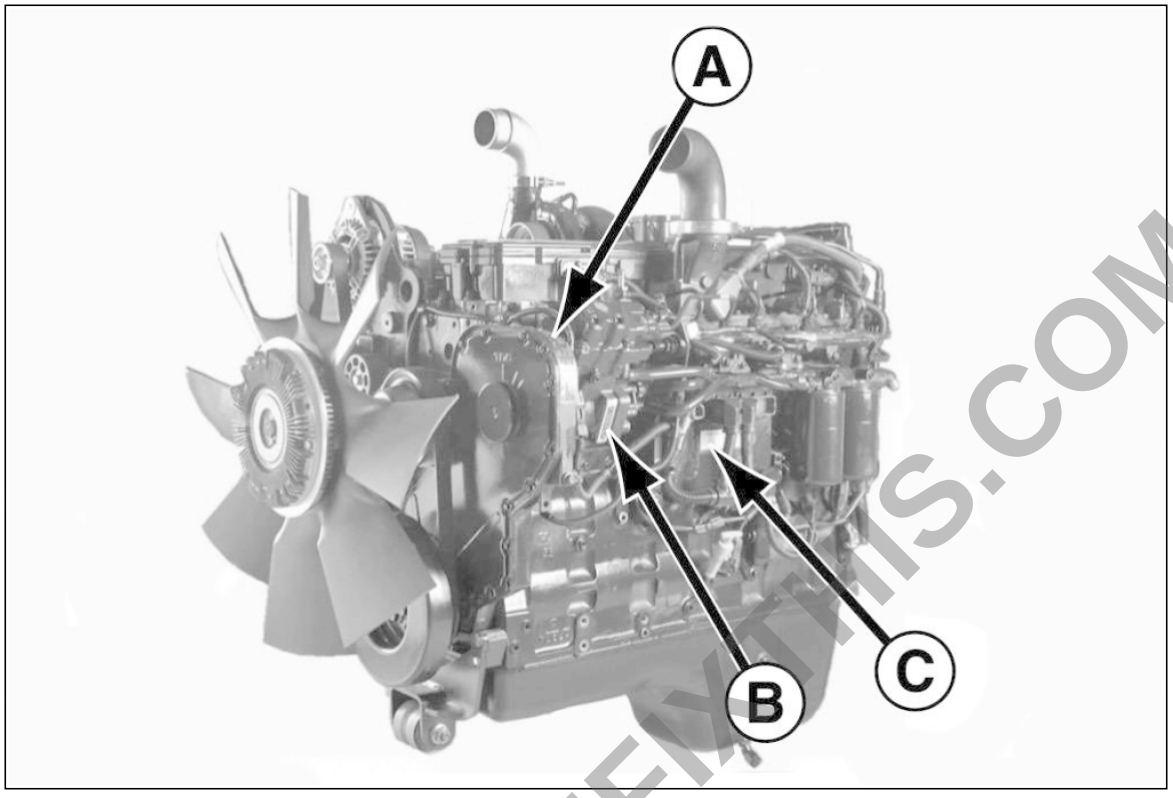
Troubleshooting presents the risk of death, personal injury or equipment damage. Troubleshooting must be performed by trained, experienced technicians. M1161

Problem	Possible Cause	Correction
Engine acceleration or response poor	If the owner/operator interview indicates the problem is low power, poor acceleration or poor response,	Perform the troubleshooting steps in the sequence below: • Fuel and injection system check • Air intake system check • Electronic control check • Engine check Begin with **ENGINE - Testing (B.10.A - G.40.A.20)**.
Cranking fuel pressure is low	If the owner/operator interview indicates the problem is low power, poor acceleration or poor response,	Perform the troubleshooting steps in the sequence below: • Fuel and injection system check • Air intake system check • Electronic control check • Engine check Begin with **ENGINE - Testing (B.10.A - G.40.A.20)**.
Engine operating fuel pressure is low	If the owner/operator interview indicates the problem is low power, poor acceleration or poor response,	Perform the troubleshooting steps in the sequence below: • Fuel and injection system check • Air intake system check • Electronic control check • Engine check Begin with **ENGINE - Testing (B.10.A - G.40.A.20)**.
Engine decelerates slowly	If the owner/operator interview indicates the problem is low power, poor acceleration or poor response,	Perform the troubleshooting steps in the sequence below: • Fuel and injection system check • Air intake system check • Electronic control check • Engine check Begin with **ENGINE - Testing (B.10.A - G.40.A.20)**.
Engine difficult to start or will not start (Exhaust smoke)	If the owner/operator interview indicates the problem is engine will not start, engine difficult to start, or engine shuts off unexpectedly,	Perform the troubleshooting steps in the sequence below: • Starting system check • Fuel and injection system check • Air intake system check • Electronic control check Begin with **ENGINE - Testing (B.10.A - G.40.A.20)**.

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Product identification (- A.80.A.10)



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Data plate locations

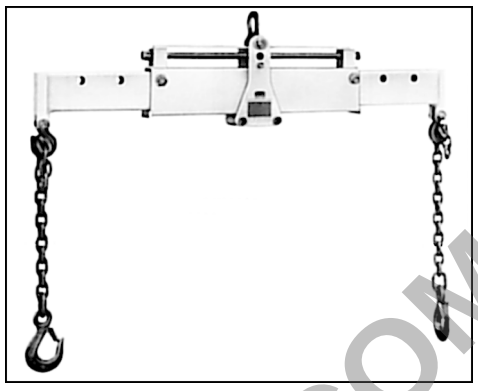
A — Engine data plate
B — Fuel injection pump data plate
C — Engine control module (ECM) data plate

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Load-Rotor® positioning sling – OEM4130

This sling is used for the handling and positioning of engines, transmissions and other bulky components during installation and removal.



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ENGINE - General specification (B.10.A - D.40.A.10)

Horsepower	Refer to engine dataplate.
Firing order	1.5.3.6.2.4
Displacement	**8.3 L** (**504.5 in³**)
	8.9 L (**540.0 in³**)
Bore and stroke	
6TAA-8304	**114 mm** (**4.49 in**) x **135 mm** (**5.32 in**)
6TAA-9004	**114 mm** (**4.49 in**) x **144.5 mm** (**5.69 in**)
Dry weight	
6TAA-8304	**694 kg** (**1530 lb**)
6TAA-9004	**706 kg** (**1555 lb**)
Wet weight	
6TAA-8304	**723 kg** (**1595 lb**)
6TAA-9004	**738 kg** (**1625 lb**)
Overhead adjustment	
Intake valve adjustment	**0.305 mm** (**0.012 in**)
Exhaust valve adjustment	**0.559 mm** (**0.022 in**)

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ENGINE - Testing (B.10.A - G.40.A.20)

N°	Test Point	Expected Result	Other Result (Possible Cause)
1	• Turn the keyswitch ON. • Connect the INSITE® electronic service tool. Use INSITE® to check for active faults codes or high counts of inactive fault codes.	Active faults or high counts of inactive faults found. Follow the guided troubleshooting for the fault conditions.	Active faults or high counts of inactive faults NOT found. Perform basic troubleshooting checks. Go to Step 2.
2	Check the following items before continuing: • Verify the fuel level in the tank(s). • Verify there have not been any changes to the control part list components on the engine. • Verify that fuel grade is correct for the application. • Verify engine is operating at recommended altitude. • Verify engine oil at the correct level. • Verify that engine parasitics have NOT changed. • Verify that engine duty cycle has NOT changed. • Verify that engine cranking speed is greater than 150 rpm. • Verify that battery voltage is adequate.	All items are NOT correct. Correct the failure and verify the complaint is no longer present after the repair.	All items are correct. Determine the engine symptoms. Go to Step 3.
3	• Interview the owner/operator and verify the complaint. Is the engine symptom low power, poor acceleration or poor response?	YES Perform the troubleshooting steps in the order listed below: **FUEL AND INJECTION SYSTEM - Check (B.20.A - F.40.A.11)** **AIR INTAKE SYSTEM - Check (B.30.A - F.40.A.11)** **Electronic control - Check (B.10.A.92 - F.40.A.11)** **ENGINE - Check (B.10.A - F.40.A.11)**	NO Go to Step 4.

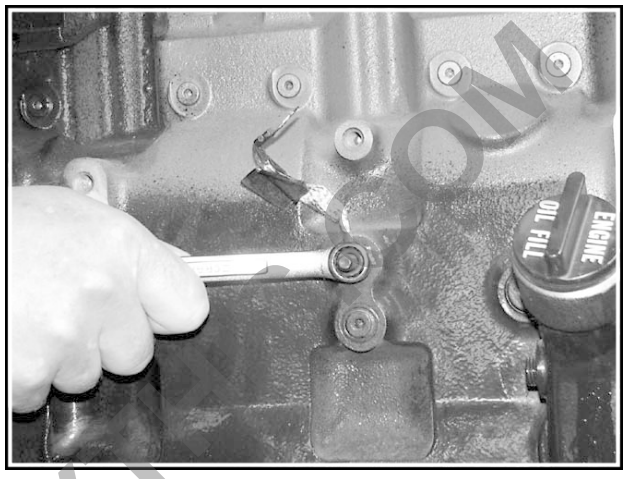
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ENGINE - Place on stand (B.10.A - F.35.A.10)

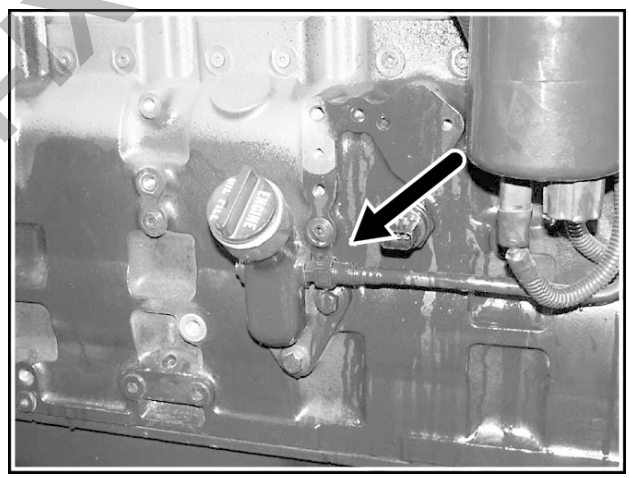
Prior operation: Refer to the engine removal section of the chassis repair manual. In addition to these operations, the following components must be removed from the engine before it can be installed on the engine repair stand:
Prior operation: Electronic control Control module - Remove (B.10.A.92.91 - F.10.A.10)
Prior operation: Fuel line Cooling plate - Remove (B.20.A.36.30 - F.10.A.10)
Prior operation: Sensing system Oil level indicator - Remove (B.60.A.95.90 - F.10.A.10)

1. Remove the ground wire for the engine control module (ECM).



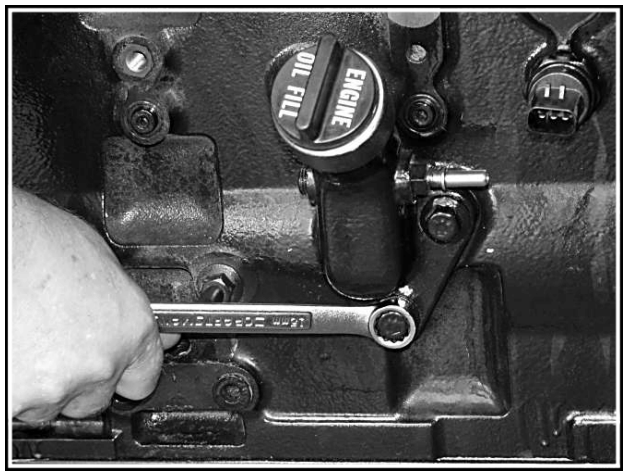
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2. Disconnect the blowby recirculation drain tube from the oil fill assembly .



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3. Remove the cap screws and remove the oil fill assembly.

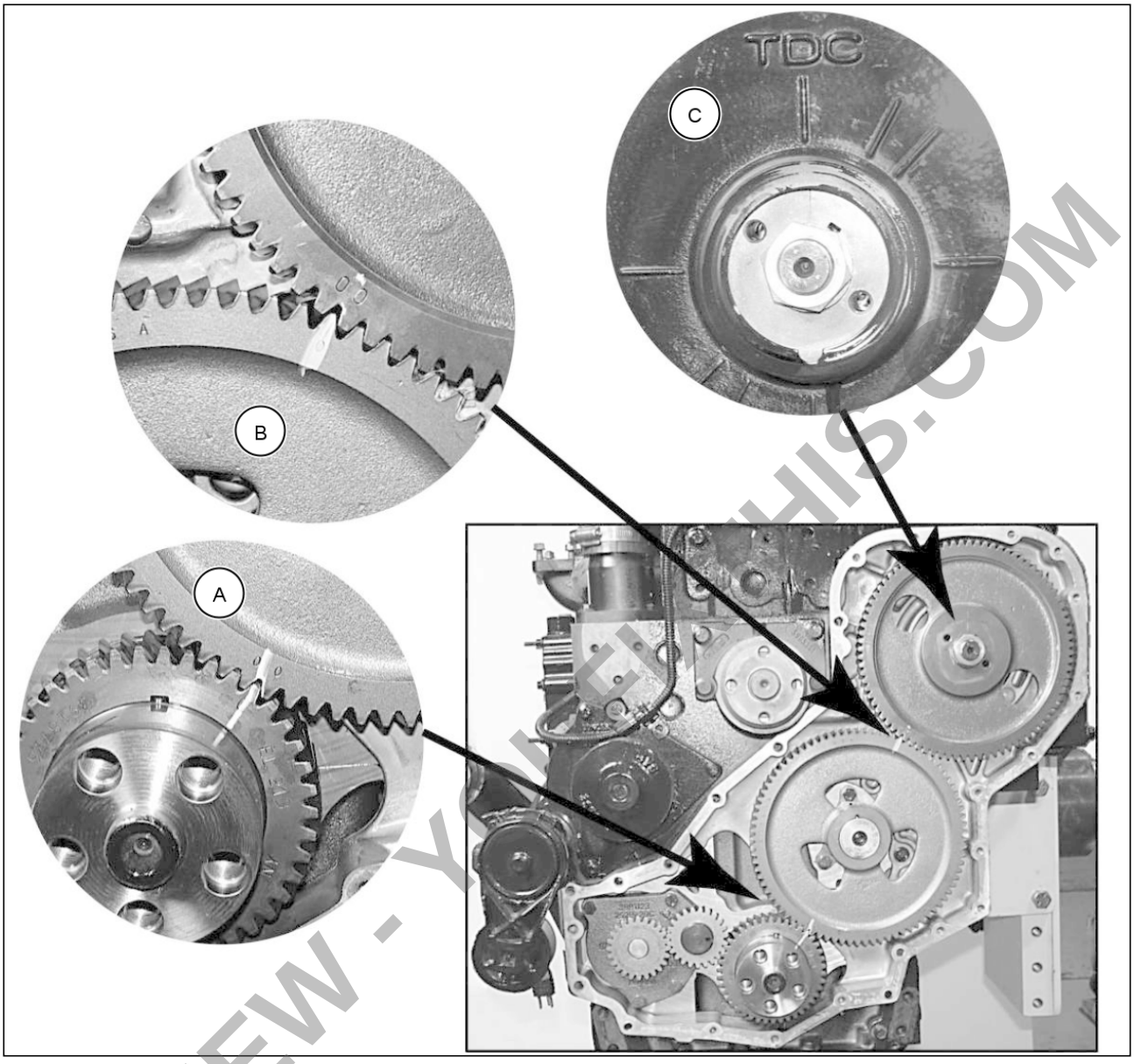


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Timing gear - Static description (B.10.A.45 - C.30.A.20)



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Correct Timing Gear Location

A. Crankshaft to camshaft gear timing marks
B. Camshaft to fuel pump gear timing marks
C. Top dead center timing mark on the fuel pump gear

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Safety rules (- A.50.A.10)

Read and understand all of the safety precautions and warnings before performing any repair. This list contains the general safety precautions that must be followed for your personal safety. Additional safety precautions are included in the procedures where they apply.

General safety precautions

- The work area around the engine must be dry, well lit, ventilated, free from clutter, ignition sources and hazardous substances.
- Always wear protective glasses and protective shoes when working.
- Stay clear of rotating parts which can cut, mutilate or strangle.
- Do NOT wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery [negative (-) cable first] and discharge any capacitors before beginning any repair work. Put a “Do NOT Operate” tag in the cab or on the controls.
- Only use proper engine barring techniques when rotating the engine manually. Do NOT attempt to rotate the crankshaft by pulling or prying on the fan. This practice may cause serious personal injury, property damage, fan damage or premature fan failure.
- When coolant is hot from engine operation, allow the engine to cool before slowly loosening the pressure cap to relieve pressure in the cooling system.
- ALWAYS use blocks or the proper engine stand to support the engine before performing any repair work. Do NOT work on an engine which is only supported by floor jacks or a hoist.
- Relieve all pressure in the air, oil and cooling systems before any lines, fittings or related items are removed or disconnected. Be alert for possible pressure when disconnecting any component from a system that uses pressure. Do NOT check for leaks with your hand. High pressure oil or fuel can cause personal injury.
- To reduce the possibility of personal injury, use a hoist or an assistant when lifting components that weigh **23 kg** (**50 lb**) or more. Make sure all lifting equipment – such as chains, hooks or slings – is in good condition and of the correct capacity. Make sure all lift hooks are positioned correctly. ALWAYS use a spreader bar when necessary; lifting hooks must NOT be side-loaded.
- Corrosion inhibitor, a component of coolant additives and lubricating oil, contains alkali. Do NOT get the substance in eyes. Avoid prolonged or repeated contact with skin. Do NOT swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF THE REACH OF CHILDREN.
- Naptha and Methy Ethyl Ketone (MEK) are flammable materials and MUST be used with caution. Follow the manufacturer’s instructions when using these materials. KEEP OUT OF THE REACH OF CHILDREN.
- To prevent burns, be aware of heated parts and hot fuel in lines, tubes and compartments on recently operated engines.
- ALWAYS use tools that are in good condition. Understand the correct use of the tool before performing repair work. Use ONLY genuine CNH replacement parts.
- ALWAYS use the same fastener part number (or equivalent) when replacing fasteners. Do NOT use a fastener of lesser quality when replacing components.
- Do not perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some government agencies have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion and prolonged contact with used engine oil.
- Coolant is toxic. If NOT reused, follow local environmental regulations for proper disposal.

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POWER PRODUCTION - B

ENGINE - 10.A

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Piston, single piece – Piston pin bore diameter

Reference: **Connecting rod and piston Piston - Measure (B.10.A.47.15 - F.40.A.16)**

Minimum	**45.006 mm**	**1.7719 in**
Maximum	**45.012 mm**	**1.7721 in**



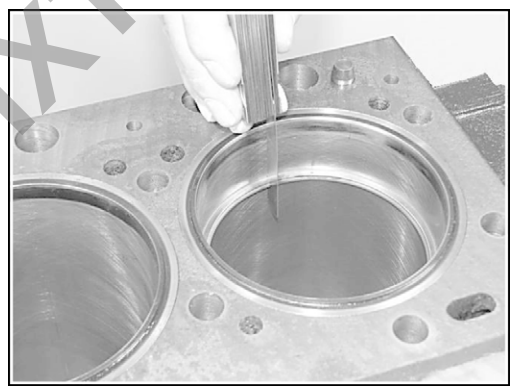
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Piston Ring - Service limits (B.10.A.47.15.05 - D.20.A.20)

Piston ring gap

Reference: **Piston Ring - Measure (B.10.A.47.15.05 - F.40.A.16)**

Top ring		
Minimum	**0.30 mm**	**0.014 in**
Maximum	**0.65 mm**	**0.025 in**
Intermediate ring		
Minimum	**0.85 mm**	**0.033 in**
Maximum	**1.15 mm**	**0.045 in**
Oil control ring		
Minimum	**0.30 mm**	**0.012 in**
Maximum	**0.73 mm**	**0.028 in**



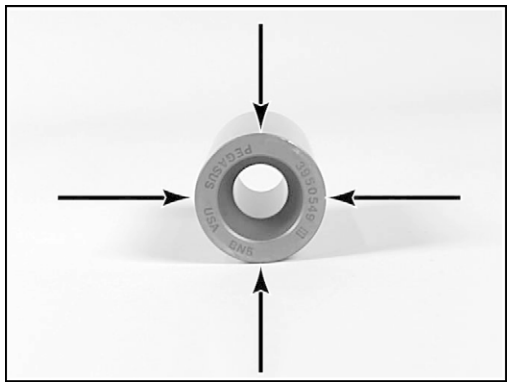
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Piston Pin - Service limits (B.10.A.47.15.10 - D.20.A.20)

Piston pin diameter

Reference: **Piston Pin - Measure (B.10.A.47.15.10 - F.40.A.16)**

Minimum	**44.997 mm**	**1.7715 in**
Maximum	**45.003 mm**	**1.7718 in**

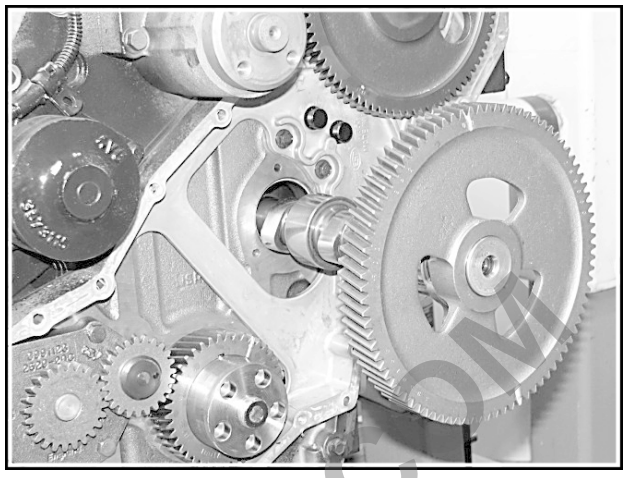


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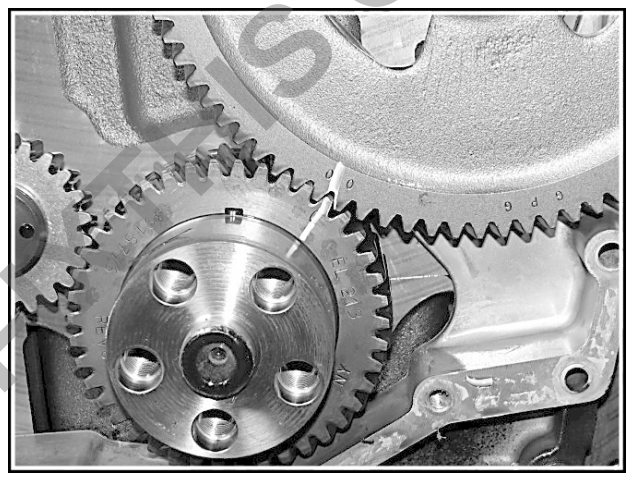
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4. Before the camshaft gear engages the crankshaft gear, check the camshaft for freedom of rotation. When installed properly, the camshaft MUST rotate freely.



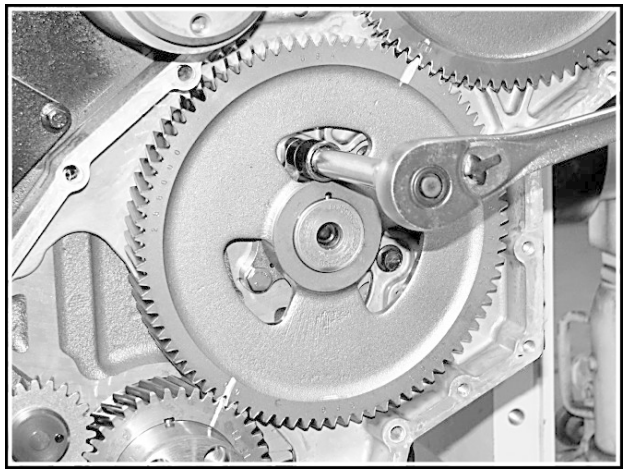
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5. Align the timing marks between the camshaft gear and the crankshaft gear, and completely install the camshaft.



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6. Install the cap screws on the thrust plate. Torque the cap screws to **24 Nm** (**18 lb ft**).



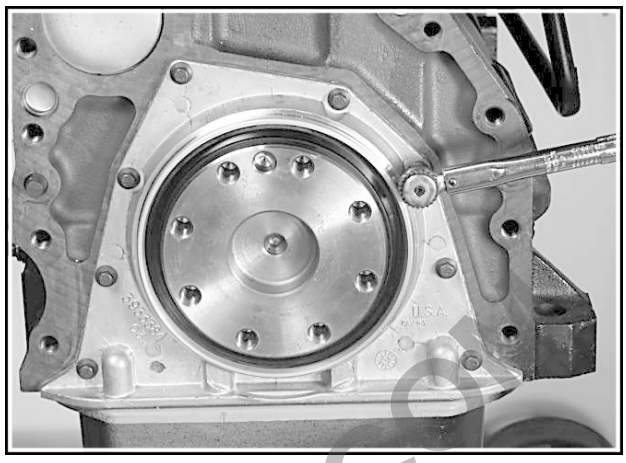
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Next operation: Valve drive Camshaft - End play (B.10.A.40.44 - F.40.E.10)

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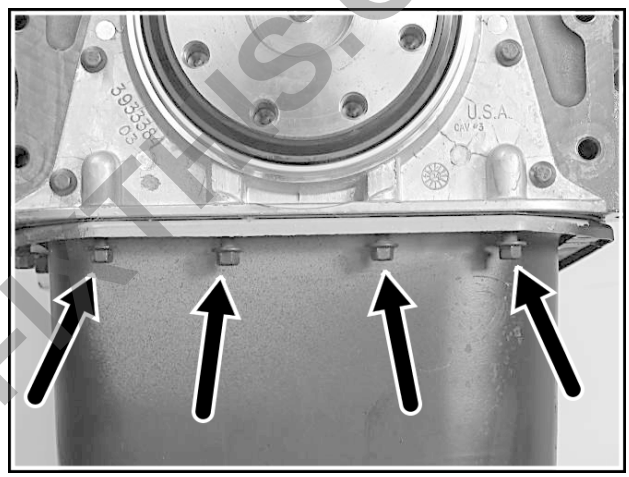
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10. Remove the driver screw from the crankshaft. Tighten and then torque the rear cover cap screws to **10 Nm** (**86 lb in**).



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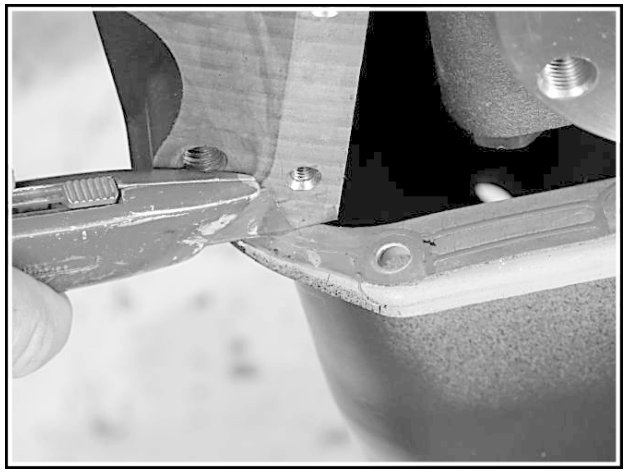
11. Install the four oil pan cap screws. Torque the cap screws to **28 Nm** (**21 lb ft**).



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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.



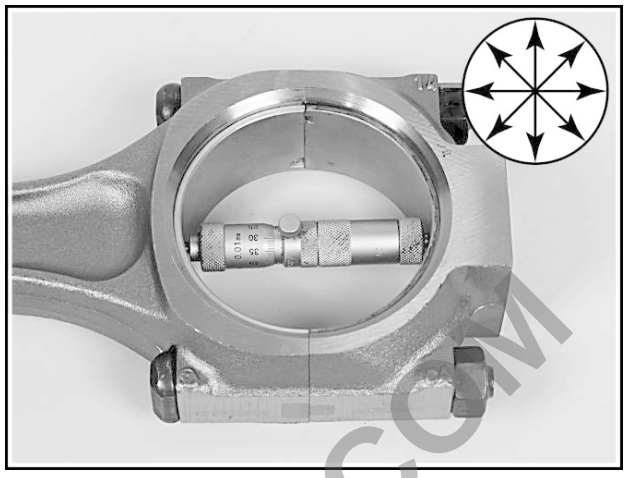
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4. To determine bearing clearance, measure the connecting rod crankshaft bore with the bearing shells installed and the rod caps tightened.

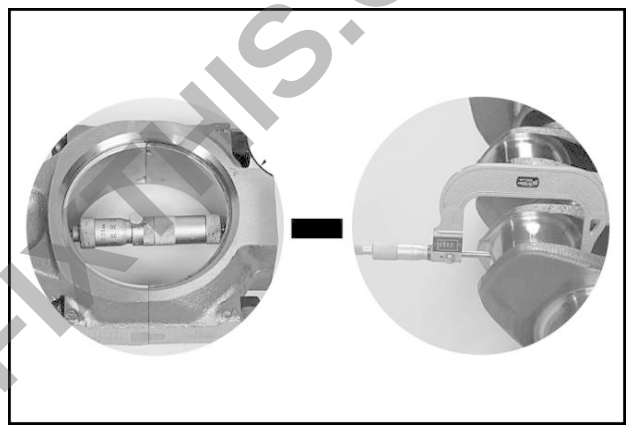
   Step 1 – Torque to **60 Nm** (**44 lb ft**).
   Step 2 – Loosen cap screws.
   Step 3 – Torque to **70 Nm** (**52 lb ft**).
   Step 4 – Advance 60 degrees.



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5. Subtract the crankshaft journal diameter from the rod inside diameter (with bearings) to determine bearing clearance.

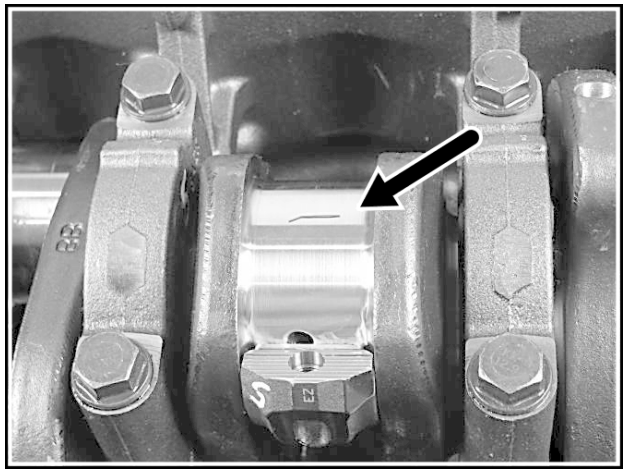
   The bearing clearance acceptable range is **0.038 - 0.116 mm (0.0015 - 0.0045 in)**.



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6. Bearing clearance can also be determined with plastigage™ during engine assembly. Place the plastigage™ on the crankshaft, and install the lower bearing and rod cap.

   Step 1 – Torque to **60 Nm** (**44 lb ft**).
   Step 2 – Loosen cap screws.
   Step 3 – Torque to **70 Nm** (**52 lb ft**).
   Step 4 – Advance 60 degrees.

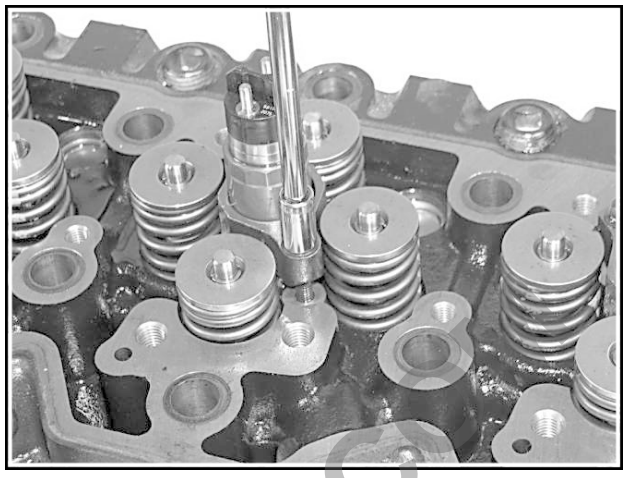


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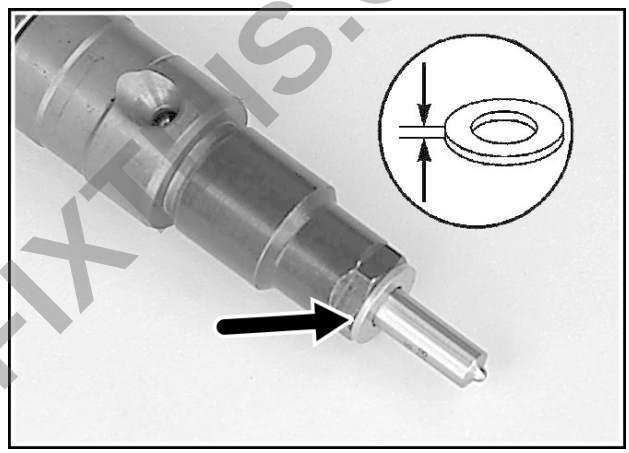
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4. Remove the injector. Refer to **Fuel injector - Remove (B.20.A.29 - F.10.A.10)**.



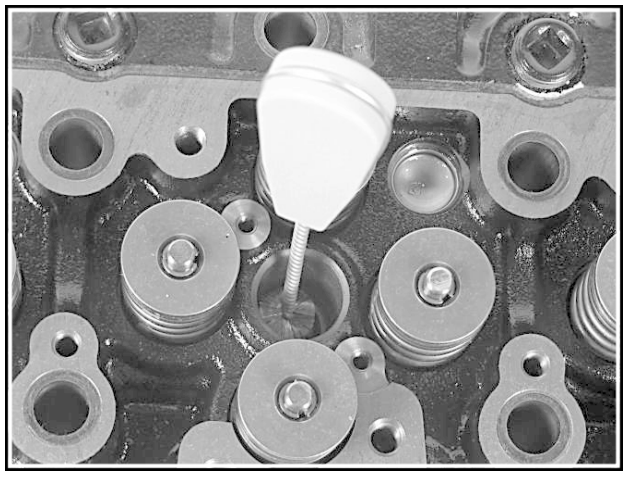
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5. If the injector protrusion was out of specification, check the thickness of the injector sealing washer. The sealing washer thickness MUST be **2.5 mm** +/- **0.05 mm**.



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6. If the sealing washer is the correct thickness, check if the injector bore is clean and free or debris or if more than one sealing washer is stacked in the injector bore.



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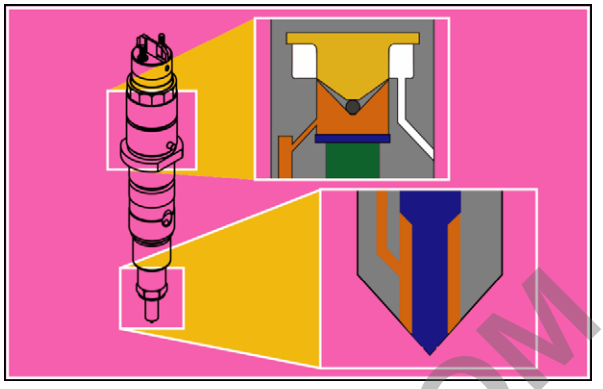
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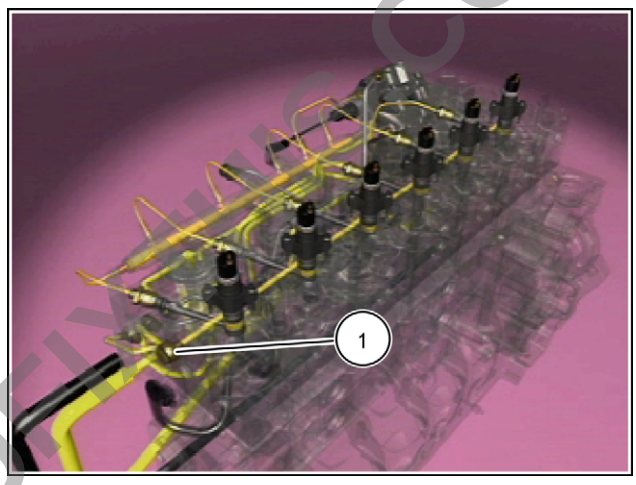
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To end injection, the ECM deenergizes the coil which seats the valve ball. The pressure above the control chamber and the force of the spring causes the needle to seat in nozzle and end injection.



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Fuel flowing out the return from the injector flows back to the fuel drain block to the drain line check valve **(1)**.

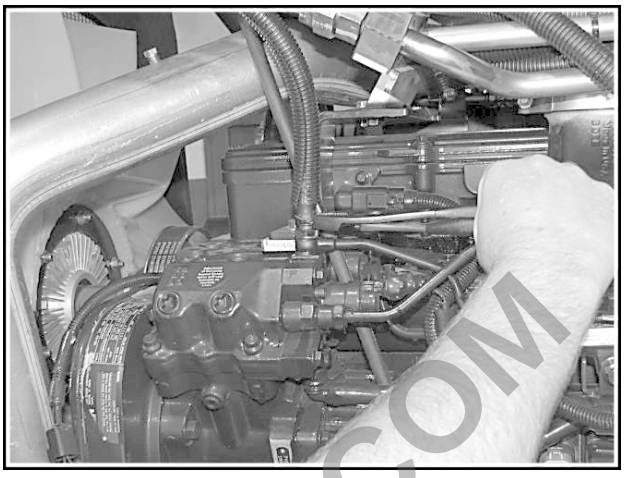


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26. Reinstall the fuel connector at the regulator valve housing. Connect the line to the fuel cooler at the housing fitting.



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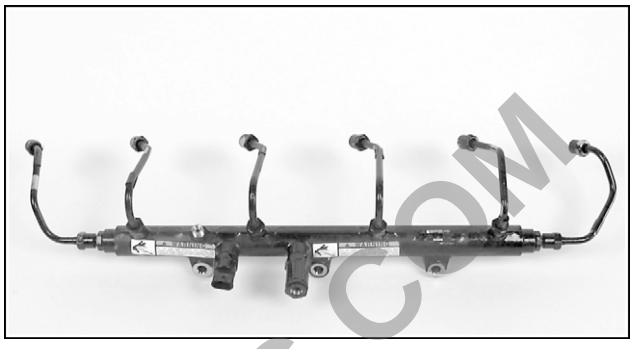
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High pressure common rail Common rail - Visual inspection (B.20.A.30.25 - F.40.A.10)

Prior operation: High pressure common rail Common rail - Remove (B.20.A.30.25 - F.10.A.10)

1. Inspect the fuel rail for damage or signs of fuel leakage. See **Sensing system Pressure sensor - Remove (B.20.A.95.81 - F.10.A.10)** for sensor replacement.

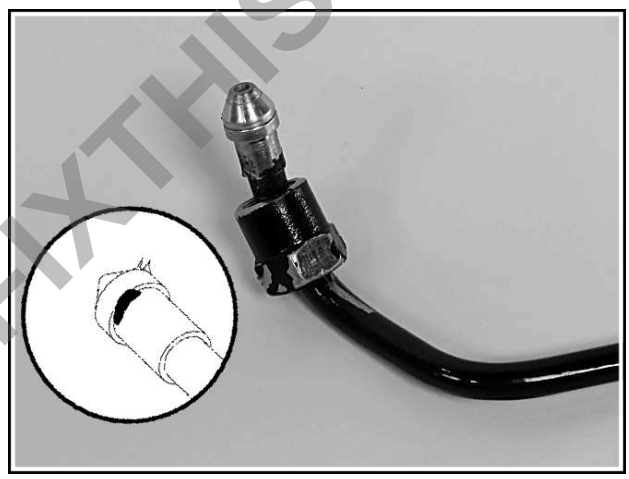


RCPH05CDC889AAA 1

2. Check the ferrules of the supply lines to the fuel connectors for burrs or foreign material.

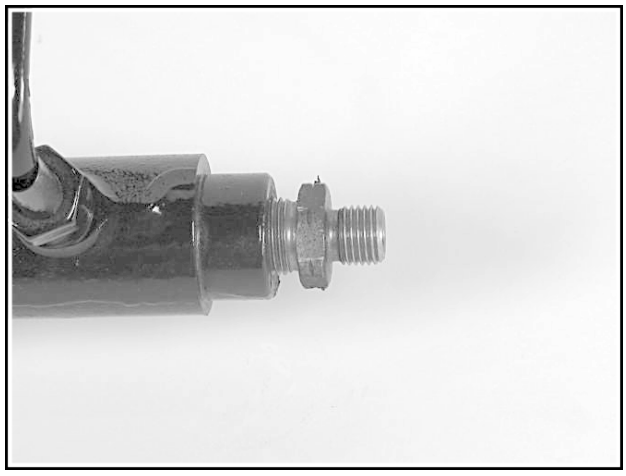
   Inspect the sealing surface of the cone for deformation that would prevent reuse.

   Check for cracks or deformation.



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3. If a high pressure fitting at the ends of the rail shows signs of leakage, see **High pressure common rail Common rail - Disassemble (B.20.A.30.25 - F.10.A.25)**.



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Next operation: High pressure common rail Common rail - Install (B.20.A.30.25 - F.10.A.15)

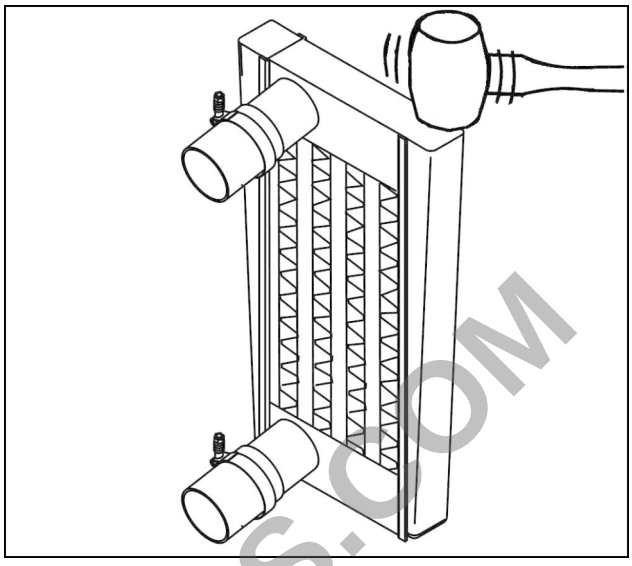
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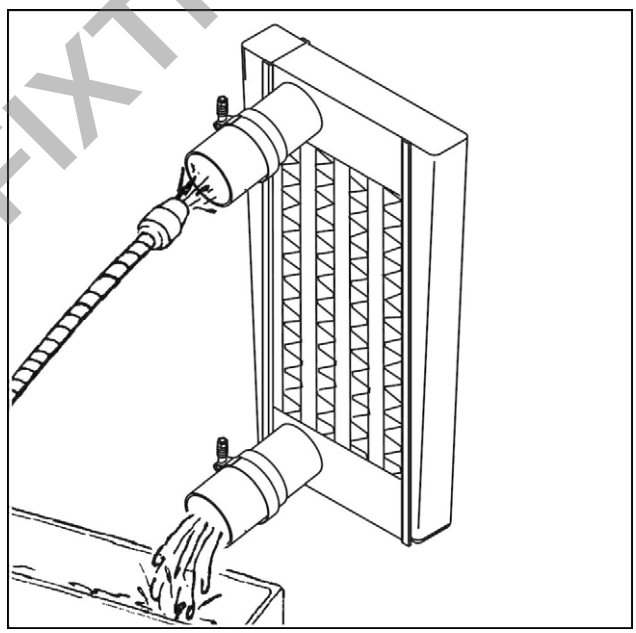
3. Shake the cooler, and lightly tap on the sides with a rubber mallet to dislodge trapped debris.



RCSC05CDC043AAA 3

4. Continue flushing until all debris and oil is removed – that is, when the solution flows clear as it emerges.

5. When solvent flushing is finished, wash the inside of the air cooler with hot soapy water to remove the solvent.

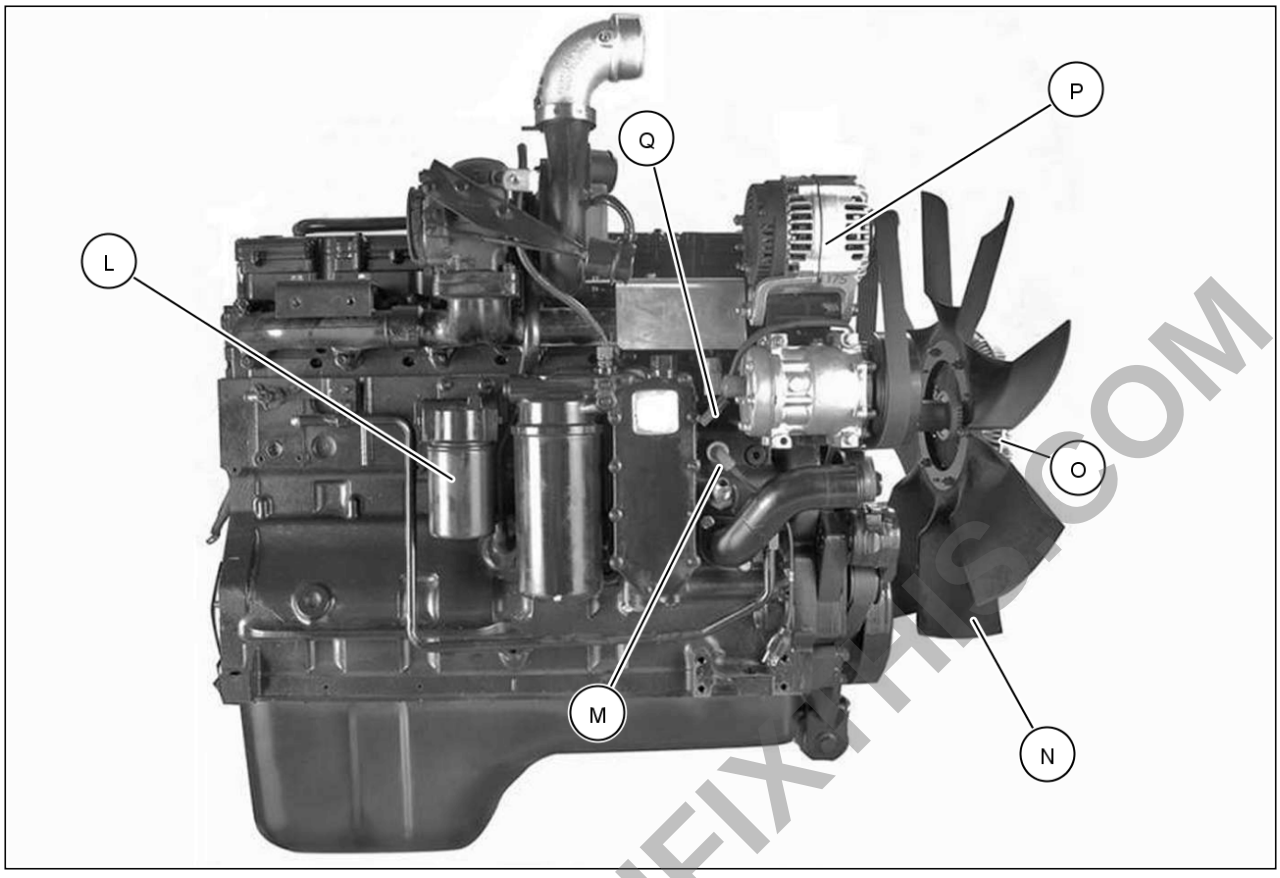


RCSC05CDC041AAA 4

6. Rinse thoroughly with clean water.

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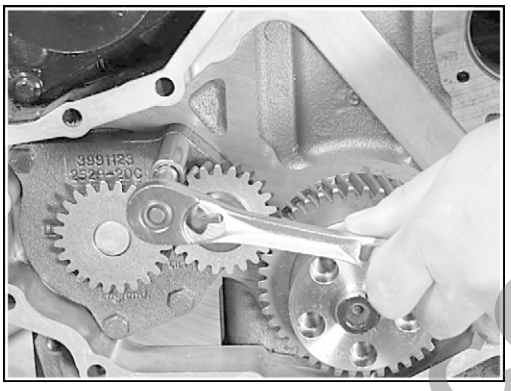
Engine right hand side

L. Water filter
M. Block heater
N. Fan
O. Viscous drive
P. Water outlet to radiator (located behind the alternator)
Q. Coolant temperature sensor

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Oil pump - Torque (B.60.A.20 - D.20.A.10)

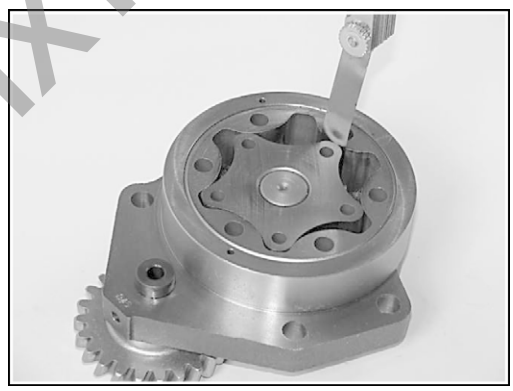
Component	N·m	Identification	lb-ft
Mounting cap screw	**24 Nm**	 RCPH05CDC405AAA 1	**18 lb ft**

Oil pump - Service limits (B.60.A.20 - D.20.A.20)

Tip clearance

Reference: **Oil pump - Assemble (B.60.A.20 - F.10.A.20)**

Minimum	**0.025 mm**	**0.001 in**
Maximum	**0.1778 mm**	**0.007 in**

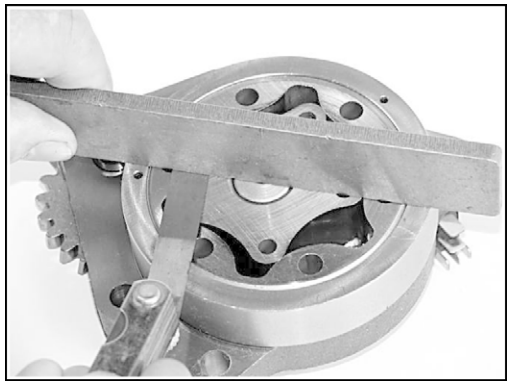


RCPH05CDC413AAA 1

Drive and planetary to port plate clearance

Reference: **Oil pump - Assemble (B.60.A.20 - F.10.A.20)**

Minimum	**0.025 mm**	**0.001 in**
Maximum	**0.127 mm**	**0.005 in**



RCPH05CDC412AAA 2

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Oil filter bypass valve - Visual inspection (B.60.A.27 - F.40.A.10)

Prior operation: Oil filter bypass valve - Remove (B.60.A.27 - F.10.A.10)

1. Use solvent to clean the adapter and the bypass valve.

⚠ 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

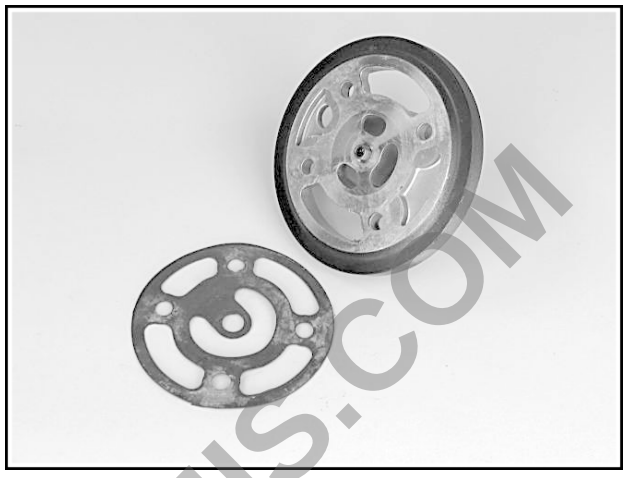
⚠ WARNING ⚠

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

2. Dry with compressed air.

⚠ WARNING ⚠

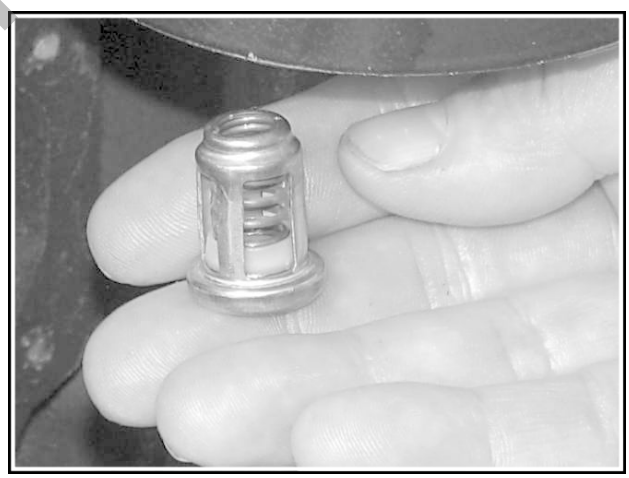
Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury. M994



RCPH05CDC317AAA 1

3. Inspect the adapter for cracks or other damage.

   Inspect the valve seat for damage. Check that the valve fully closes.



RCPH05CDC321AAA 2

Next operation: Oil filter bypass valve - Install (B.60.A.27 - F.10.A.15)

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