

ENGINE SERVICE (Cont'd)
(Mitsubishi 742)

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**MITSUBISHI
(742)**

ENGINE SERVICE (Cont'd)
(Deutz 741)

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TROUBLESHOOTING

Chart

The following troubleshooting chart is provided for assistance in locating and correcting problems which are most common. Many of the recommended procedures must be done by authorized Bobcat Service Personnel only.

PROBLEM	CAUSE
Slow cranking speed.	1, 2, 3, 4
Engine will not start.	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
Rough idle.	9, 13, 14, 15, 16
Abnormal combustion.	9, 11, 14, 17, 18, 19, 20, 21
Engine noise.	8, 14, 22, 23, 24, 25, 26, 27, 28, 29
Acceleration insufficient.	5, 9, 11, 31, 32
Power insufficient.	5, 8, 9, 11, 12, 13, 14, 15, 17, 18, 21, 26, 31, 33, 34
Too much fuel consumption.	8, 9, 11, 12, 13, 14, 15, 16, 18, 26, 32
Too much engine oil consumption.	26, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45
Excessive engine vibration.	9, 11, 17, 31, 34, 45, 46
Overheating.	9, 11, 13, 20, 30, 47, 48, 49, 50
High Oil Pressure.	4, 51, 52

KEY TO CORRECT THE CAUSE

- | | |
|---|---|
| <ol style="list-style-type: none"> 1. Battery capacity low. 2. Bad electrical connections. 3. Faulty starter motor. 4. Incorrect grade of oil. 5. Burnt valve. 6. Intake manifold gasket leaking. 7. Carburetor mounting loose. 8. Piston, rings & cylinder worn. 9. Cylinder head gasket leaking. 10. Faulty electrical wiring. 11. Faulty ignition system. 12. Fuel system problem. 13. Restriction in the air cleaner. 14. Valve clearance not correct. 15. Worn valves and seats. 16. Worn valve stems or guides. 17. Valve stuck. 18. Weak valve springs. 19. Carbon accumulated in combustion chamber. 20. Restriction in the water jacket 21. Carburetor mixture too lean. 22. Worn or damaged bearings. 23. Connecting rod bent. 24. Piston or piston pin worn. 25. Burnt piston. 26. Piston rings damaged. | <ol style="list-style-type: none"> 27. Excessive camshaft end play. 28. Crankshaft thrust bearing worn. 29. Timing belt worn. 30. Water pump or fan belt faulty. 31. Poor compression. 32. Carburetor accelerator pump faulty. 33. Overheating. 34. Cold running. 35. Oil pan drain plug is loose. 36. Oil pan bolts are loose. 37. Oil pan gasket is faulty. 38. Timing gear cover is loose or gasket is broken. 39. Crankshaft front seal leaking. 40. Crankshaft rear seal leaking. 41. Valve cover gasket is leaking. 42. Fuel pump loose or faulty gasket. 43. Oil filter mounting loose. 44. Plugged oil return hole. 45. Piston rings stuck. 46. Faulty engine mounting. 47. Exhaust pipe restriction. 48. Faulty thermostat. 49. Plugged radiator. 50. Coolant level low. 51. Switch is defective. 52. Pressure relief sticking closed. |
|---|---|

VALVE CLEARANCE

Adjustment

NOTE: Always set the valve clearance after the cylinder head bolts are tightened to the correct torque.

Warm the engine until it is at operating temperature.

Valve clearance [A].

Intake Valve 0.006 inch (0,15 mm) Hot
Exhaust Valve 0.010 inch (0,25 mm) Hot

Stop the engine. Remove the valve cover.

Position the piston at T.D.C.

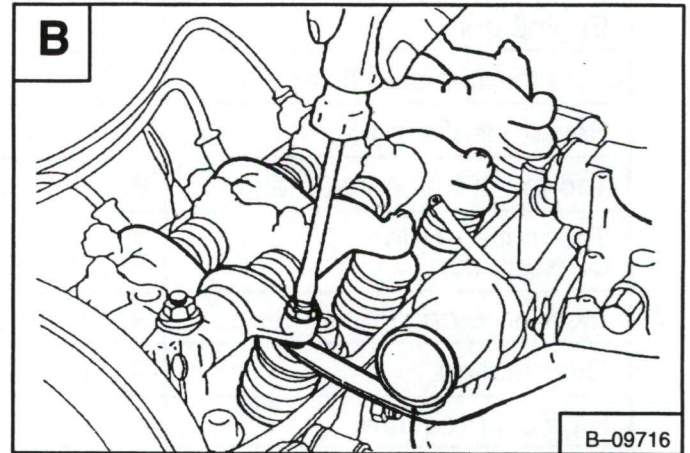
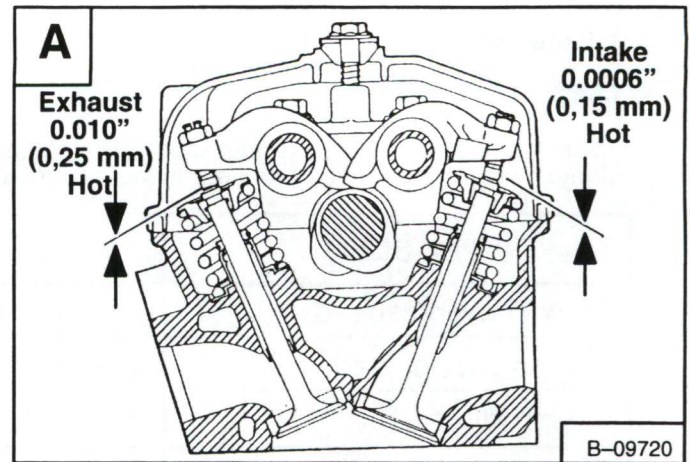
Loosen the lock nut.

Adjust the valve clearance by turning the adjusting bolt and measuring with a feeler gauge [B].

Tighten the lock nut.

Repeat the procedure for each set of valves.

Start the engine, run at idle speed and check the clearance again. Make adjustment as needed.



ENGINE COMPRESSION

Checking

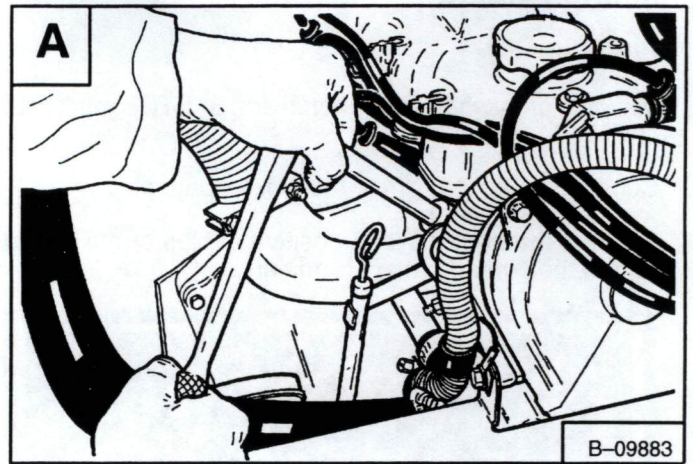
The tool listed will be needed to do the following procedure:

OEM1073 – Compression Gauge & Hose

The engine must be at operating temperature.

Remove the spark plugs [A].

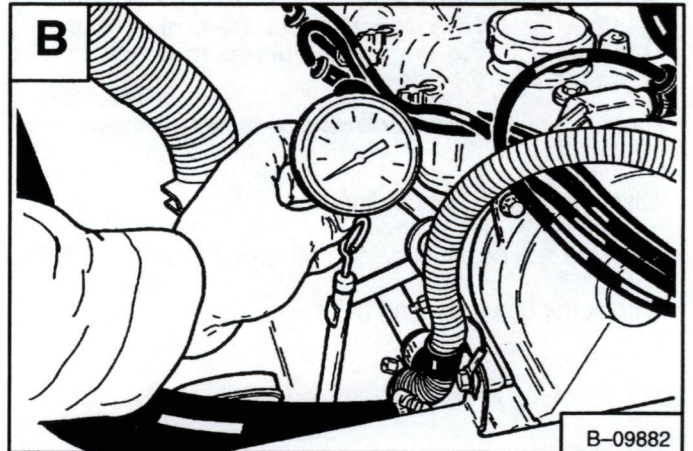
Installation: Tighten the spark plugs to 18–22 ft.-lbs. (24–30 Nm) torque.



Connect a compression gauge [B].

The engine should be turning at about 250 RPM.

The compression should be about 150 PSI (1024 kPa) with no more than 10% difference between cylinders.



IGNITION TIMING

Procedure

Mark the crankshaft pulley notch and 5° BTDS mark with chalk [A].

Connect the timing light to the No. 1 spark plug wire.

Connect the negative and positive cables of the timing light to the correct battery terminals.



WARNING

When the engine is running during service, the steering levers must be in neutral and the parking brake engaged. Failure to do so can cause injury or death.

W-2006-0284

Disconnect the vacuum line.

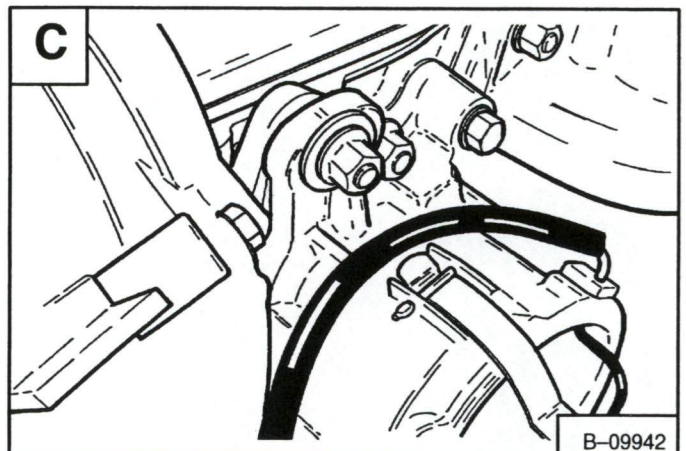
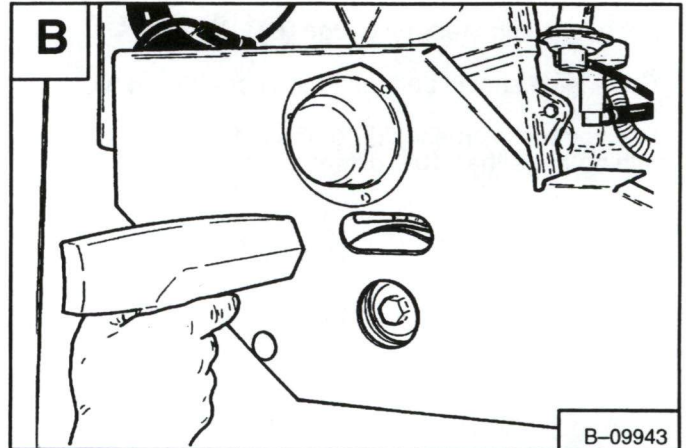
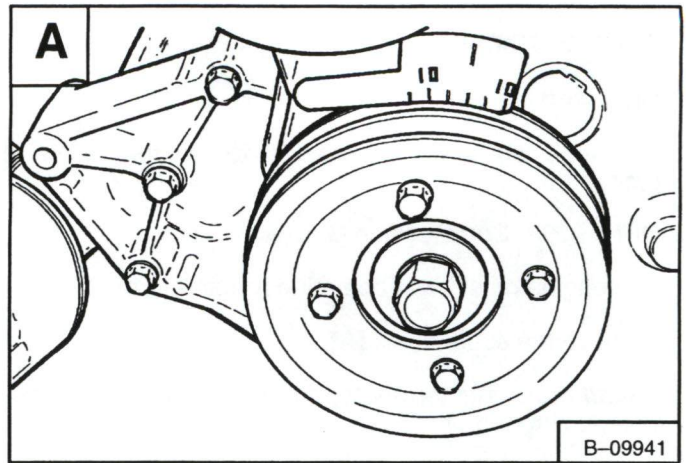
Start the engine. Run the engine speed at 600–650 RPM.

Check the timing setting [B].

If the timing is not correct, loosen the distributor mounting nut [C].

Turn the distributor until the timing is set at 5° BTDC.

At 2800 RPM and vacuum line off, the timing should advance 10°.



DISTRIBUTOR

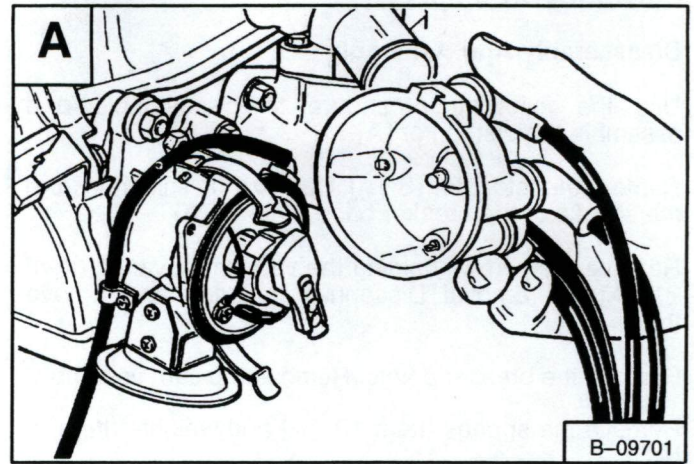
Removal And Installation

Turn the crankshaft until No. 1 piston is at T.D.C. on compression stroke.

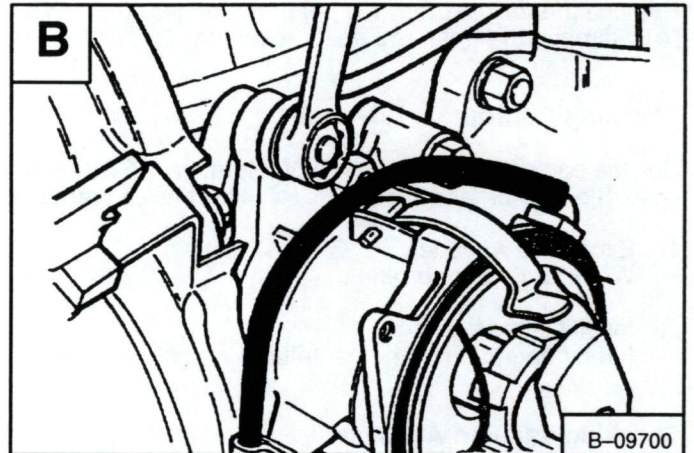
Disconnect the negative battery cable.

Remove the distributor cap [A].

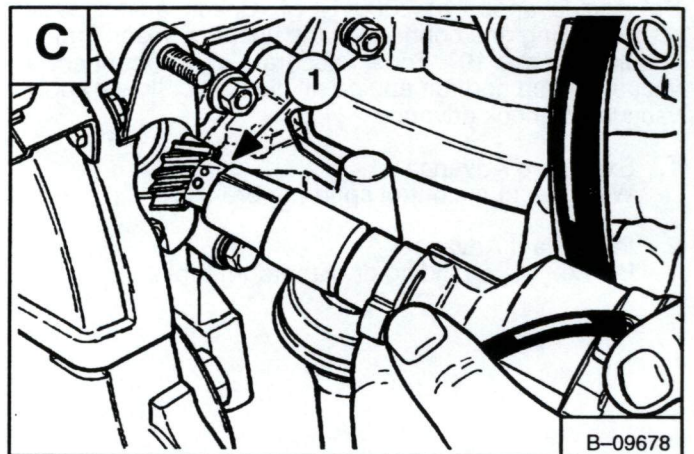
Disconnect the vacuum hose.



Remove the distributor mounting nut [B].



Installation: Align the mating mark (Item 1) [C] on the distributor housing with the mark on the distributor gear.



Point Gap Adjustment

Remove the distributor cap.

Remove the rotor.

Turn the crankshaft until the points are wide open. Check the breaker point gap with a feeler gauge, if it is out of specifications, adjust as follows:

Breaker Point Gap 0.018–0.021 inch
(0,48–0,53 mm)

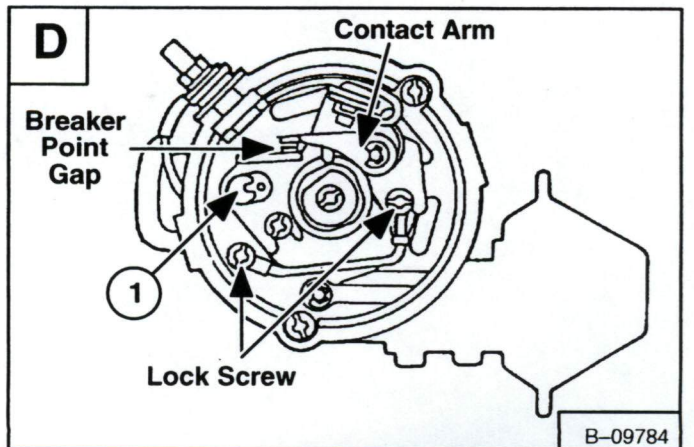
Loosen the two lock screws.

Put a screwdriver blade into the hole (Item 1) [D].

Adjust the points to the correct specifications.

Tighten the two lock screws.

NOTE: After the breaker points are adjusted, you must time the engine. (See Page 7B-4.)



DISTRIBUTOR (Cont'd)

Disassembly And Assembly

Use the following procedure to disassemble and assemble the distributor [A]:

Remove the rotor (Item 3) [A]. Remove the snap ring from the spindle of the breaker base (Item 7) [A].

Remove the screws holding the vacuum advance (Item 21) [A] and removal. Disconnect the wires and remove the terminal.

Remove the breaker points. Remove the cam assembly.

Remove the springs (Item 10) [A] and weights (Item 9) [A].

Remove the roll pin (Item 19) [A] from the gear (Item 20) [A]. Remove the gear and shaft assembly.

Checking Centrifugal Advance

Run the engine at the idle low RPM. Remove the vacuum hose. Slowly increase the engine RPM to check advance.

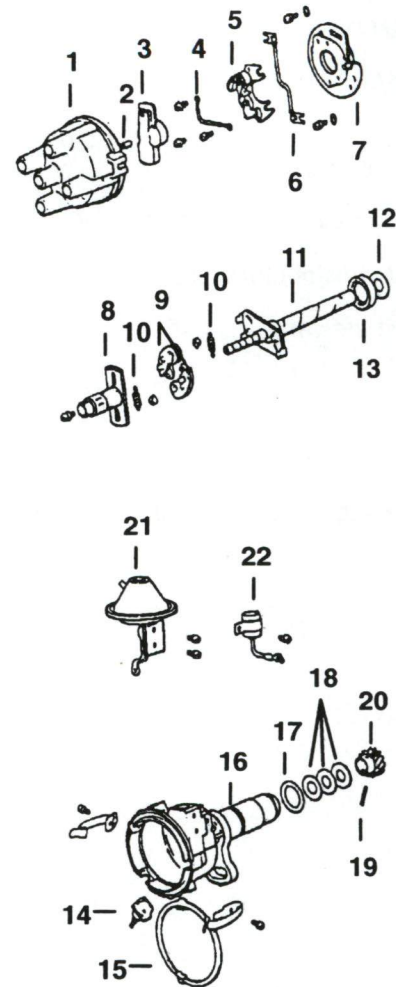
1. Excessive Advance
Weak Springs or broken.
2. Insufficient Advance
Faulty operation of the centrifugal weights or cam.

Checking Vacuum Advance

Set engine speed at 2800 RPM. Check advance by disconnecting and connecting the vacuum hose. Timing should advance 10°. For an accurate check, connect a vacuum pump and run engine at idle RPM. Slowly apply vacuum to check advance.

1. Excessive Advance
Weak vacuum control spring or broken.
2. Insufficient Advance
Breaker plate binding or diaphragm broken.

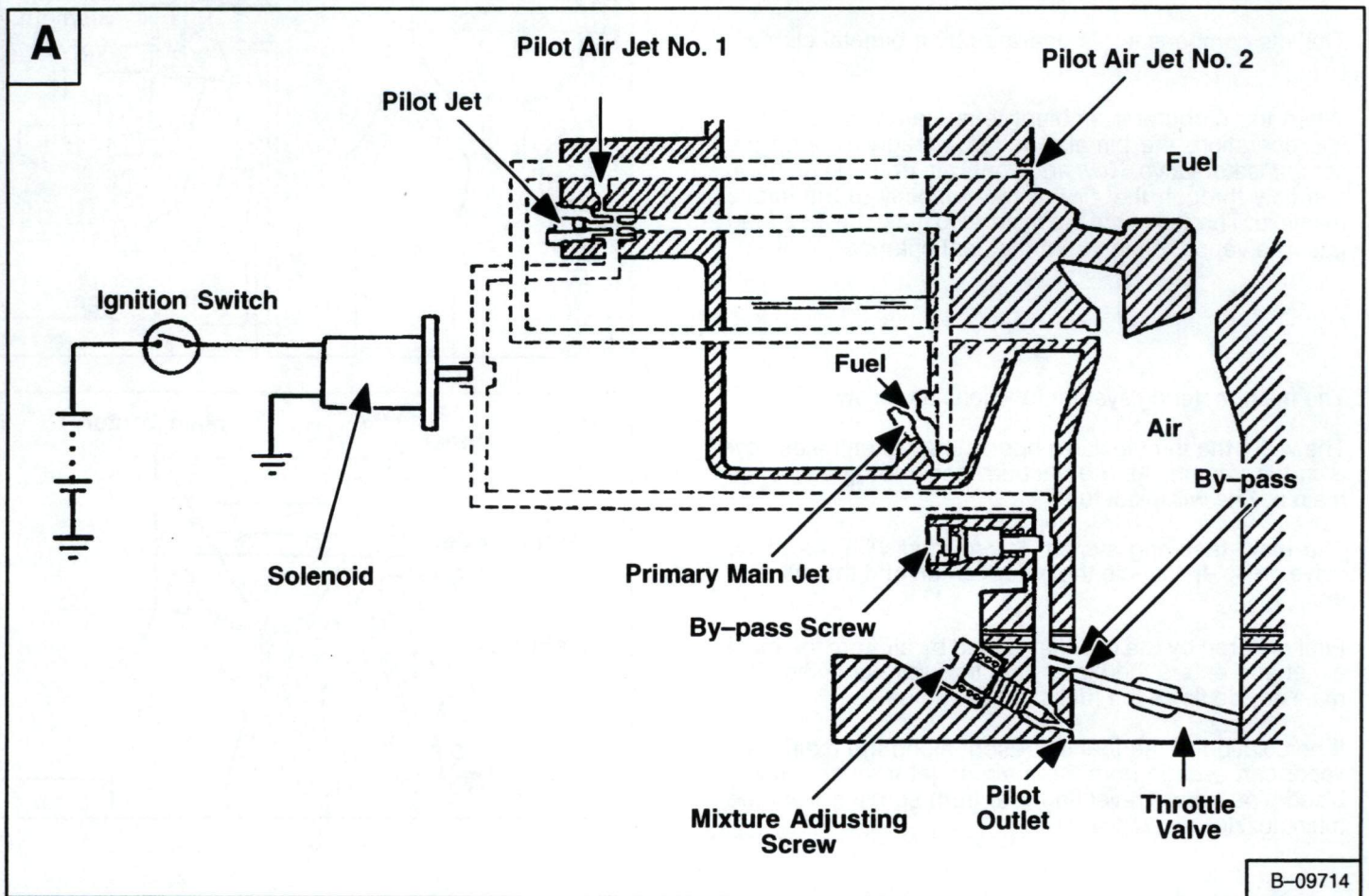
A



- | | |
|-------------------|--------------------|
| 1. Cap | 12. Washer |
| 2. Carbon Contact | 13. Oil Seal |
| 3. Rotor | 14. Terminal |
| 4. Wire | 15. Packing |
| 5. Arm Support | 16. Housing |
| 6. Wire | 17. O-ring |
| 7. Breaker Base | 18. Washer |
| 8. Cam | 19. Roll Pin |
| 9. Weight | 20. Gear |
| 10. Spring | 21. Vacuum Control |
| 11. Shaft | 22. Condenser |

B-09824

CARBURETOR



Description

The low-speed system provides air-fuel mixture for smooth low-speed engine operation for light-load performance [A].

Fuel from the float chamber is sent through the main jet and fuel passage to the pilot jet where the fuel is metered.

At the same time, air is fed through the venturi air orifice and pilot air jet No. 2 to the pilot air jet No. 1 where the air is metered then, air is mixed with the fuel.

The flow of air-fuel mixture is adjusted by the by-pass screw and enters the air horn through the by-pass hole and pilot outlet. It mixes with a small amount of air that goes past the closed or slightly open throttle valve. The final mixture flows into the cylinders.

The mixture adjusting screw is provided for adjusting air-fuel mixture necessary for idle.

The by-pass screw is for adjusting the flow of fuel to the by-pass hole which provides mixture for engine operation from *off idle* to a medium load operation.

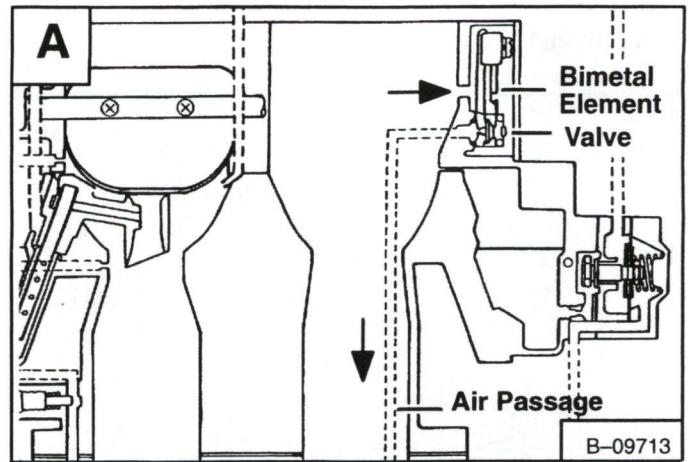
The fuel shutoff solenoid, in the low-speed system, functions as follows: When the key switch is ON it opens the valve to open the fuel line. When the key switch is OFF it closes the fuel feed line and prevents spontaneous running of the engine.

CARBURETOR (Cont'd)

Description (Cont'd)

The idle compensator is operated by a bimetal element [A].

When the carburetor ambient temperature rises during idle operation, the bimetal bends enough to open the compensator valve. Now additional air, from the air horn, can flow through the air passage directly to the intake manifold. This leans out the mixture to make up for added gasoline vapor coming from the float chamber.



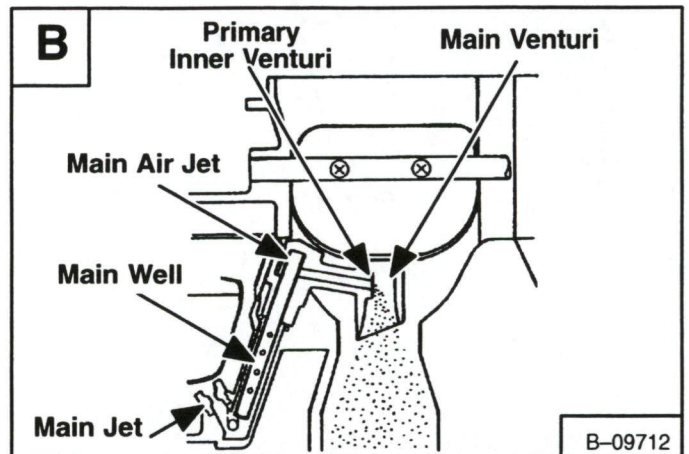
The main metering system functions as follows [B]:

The wider the throttle valve opens, the faster the air flow is in the venturi. As the vacuum becomes greater, the main nozzle will inject fuel.

The main metering system is provided with the bleed valve press-fitting into the inner venturi and the main air jet.

Fuel metered by the main jet is bled by air from the main air jet and enters the bleed pipe through the holes. The main nozzle flows the fuel into the engine.

If percolation of the fuel is present along the main well, vapor can escape from the main air jet through outside bleed pipe, thus preventing fuel from spurting from the main nozzle.



CARBURETOR (Cont'd)

Description (Cont'd)

The enrichment system does the following functions [A]:

This system provides additional fuel to the main metering system during high-speed large torque operation. The diaphragm is actuated by intake manifold vacuum and spring to open or close the fuel feed line.

During partial throttle operation, the manifold vacuum is applied to the vacuum chamber and acts on the diaphragm to close the valve against spring force.

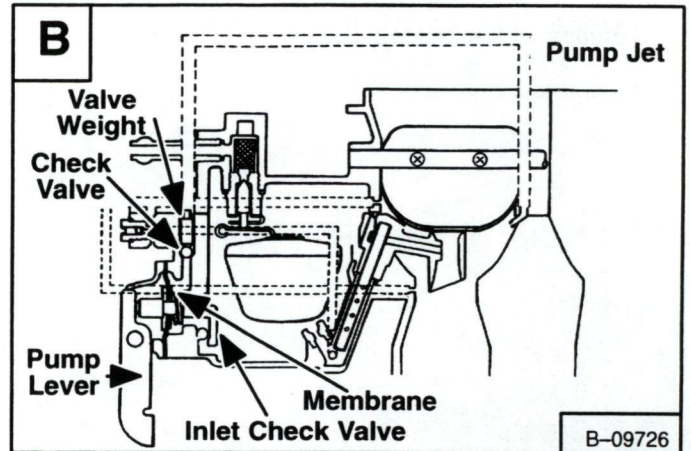
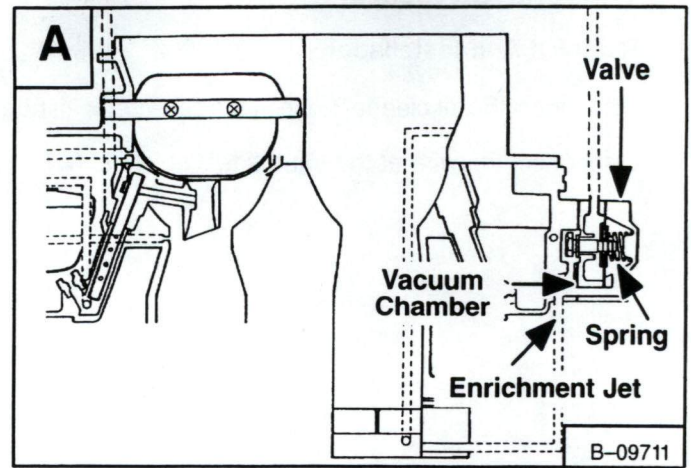
When the throttle is opened, manifold vacuum decreases. This allows the diaphragm spring to open the valve. Now, more fuel from the float chamber can flow through the valve into the enrichment jet.

The accelerator-pump system does the following functions [B]:

Rapid opening of the throttle, requires a sudden demand for additional fuel.

Fuel from the inlet check valve is sent to the pump nozzle through the outlet check valve by movement of the diaphragm. The diaphragm is pushed by the pump lever linked to the throttle valve.

When the engine is decelerated, the diaphragm is pushed back by the spring and the chamber is refilled with fuel.

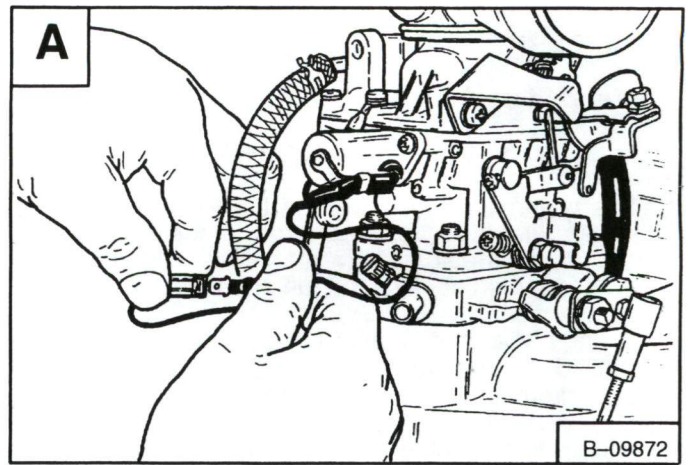


CARBURETOR (Cont'd)

Removal And Installation

Disconnect the air cleaner hose at the carburetor air horn.

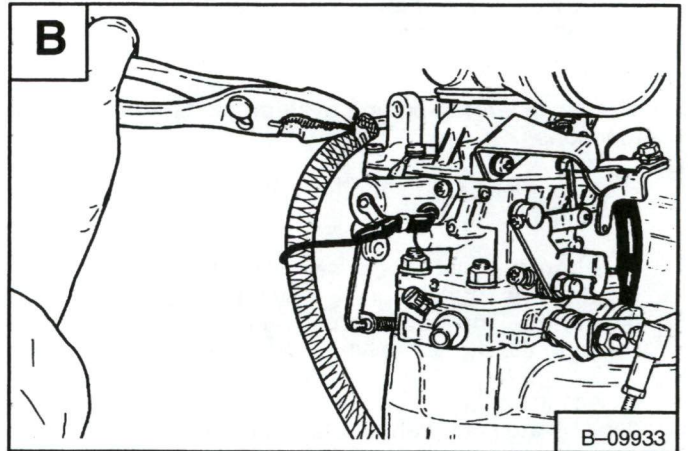
Disconnect the wire at the shutoff fuel solenoid [A].



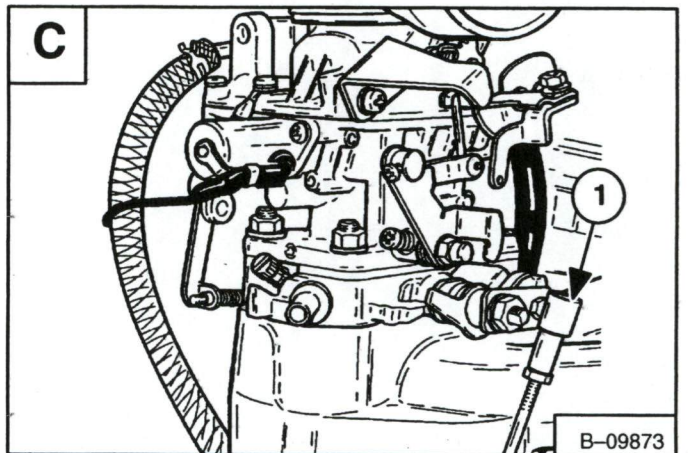
Disconnect the choke cable.

Disconnect the fuel line [B].

Disconnect the vacuum hose.

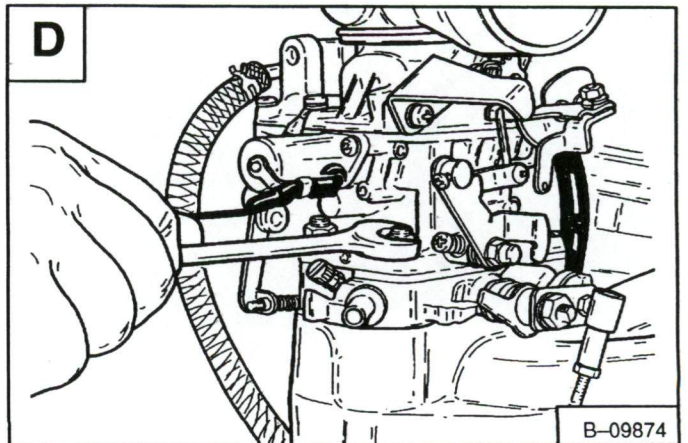


Disconnect the throttle linkage (Item 1) [C].



Remove the four mounting nuts [D].

Lift the carburetor from the intake manifold.



CARBURETOR (Cont'd)

Disassembly And Assembly

Disassemble and assemble the carburetor as shown [A].

Use the correct tools to prevent burrs or scratches.

Keep the parts neatly and in order to prevent wrong assembly.

Do not remove the inner venturi unless it is necessary.

Do not remove the by-pass screw unless it is necessary.

Do not disassemble the throttle shaft or remove the plug in the throttle plate.

Inspection

Clean the parts thoroughly with carburetor solvent.

Use air pressure to blow fuel passages and other parts dry.

Check the needle valves for correct contact, replace as needed.

Check the screen diaphragm and pilot screw seats for damage.

Check the throttle valve for wear and damage and be sure the plug in the throttle plate is tight.

Check the linkage for correct function.

Check the acceleration pump for correct function as follows:

Fill the pump chamber with fuel, operate the throttle lever and check for fuel spraying condition from the accelerator nozzle.

Push the connecting rod of the depression chamber, plug the vacuum passage with a finger, release the connecting rod and check for leakage from the diaphragm.

Check the float for being deformed, leakage, damage to the lip, wear of the float lever pin hole and the float lever bracket.

Adjustment

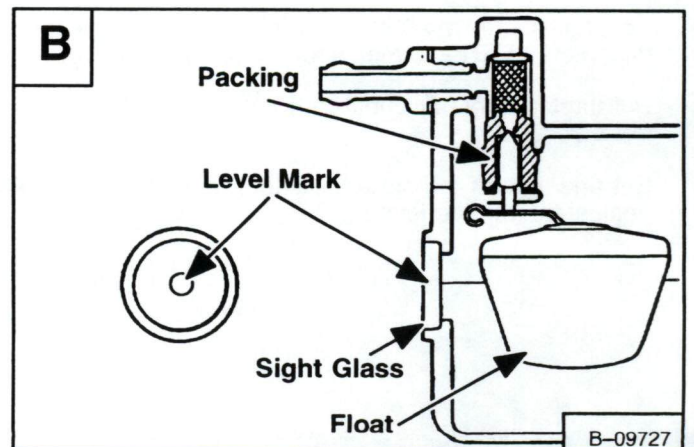
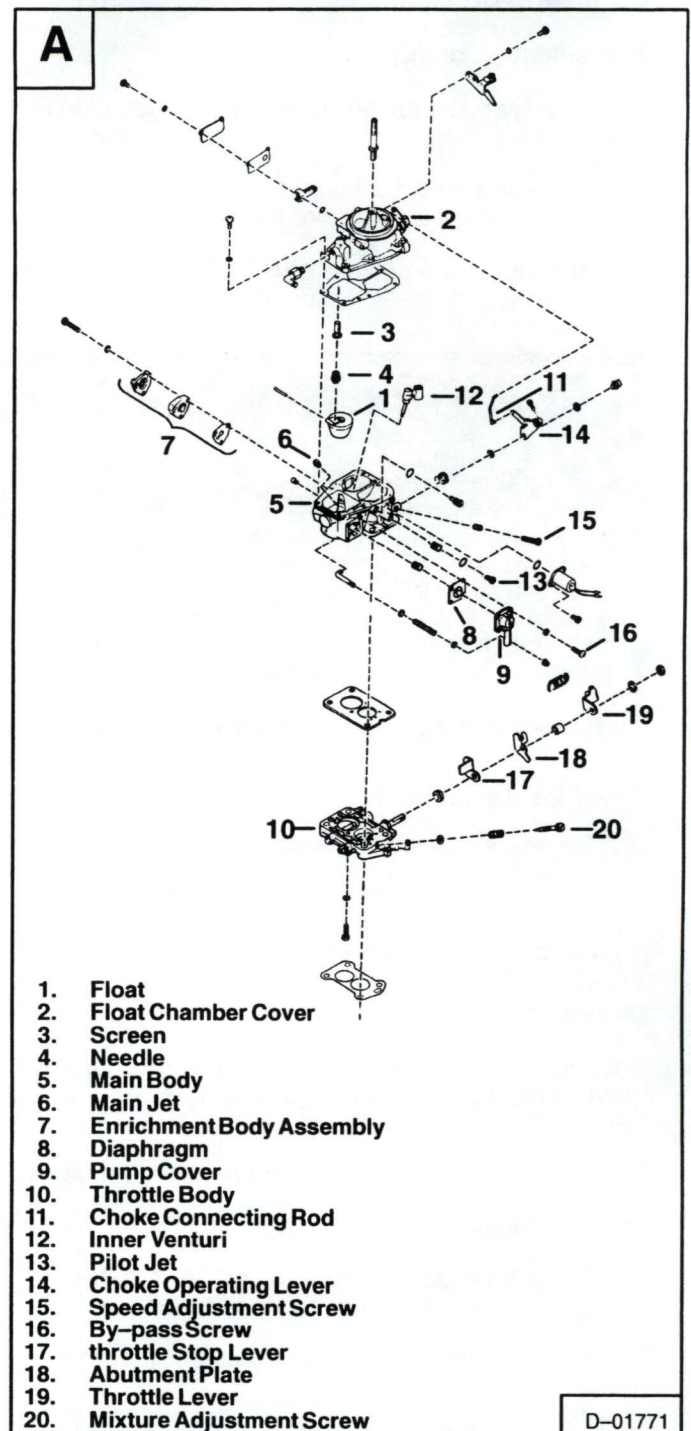
If the float level is out of alignment with the level mark, adjust the float by adding or removing the number of packings at the needle valve seat [A].

a slight difference of the float level from the level mark does not effect the carburetor or engine performance, it is normal if the float is in the circle of the level mark.

WARNING

When the engine is running during service, the steering levers must be in neutral and the parking brake engaged. Failure to do so can cause injury or death.

W-2006-0284



CARBURETOR (Cont'd)

Adjustment (Cont'd)

Set the engine idle speed (Item 1) [A] to 850–950 RPM at operating temperature.

Turn the idle fuel adjustment (Item 2) [A] in until the engine RPM decreases. Make a note of this position.

Turn the idle fuel adjustment (Item 2) [A] out until the engine RPM decreases. Adjust the idle fuel adjustment between the two positions.

WARNING

When an engine is running in an enclosed area, fresh air must be added to avoid concentration of exhaust fumes. If the engine is stationary, vent the exhaust outside. Exhaust fumes contain odorless, invisible gases which can kill without warning.

W-2050-1285

Governor Adjustment

NOTE: Adjust engine timing. (See Page 7B-4.)
Loosen three governor mounting bolts.
Adjust governor belt tension to 1/4 inch movement at middle of belt. Keep governor level and tighten the bolts.

Disconnect throttle rod (Item 1) [B].

Hold carburetor linkage (Item 3) [B] and governor linkage (Item 4) [B] against their stops and tighten the screws (Item 2) [B].

Check the governor throttle lever for maximum travel.

Start the engine.

Check that the engine idle speed is at 700–750 RPM while holding governor lever against the idle stop.

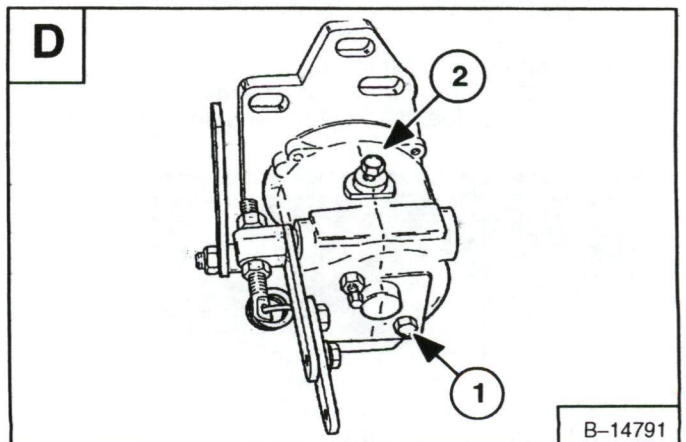
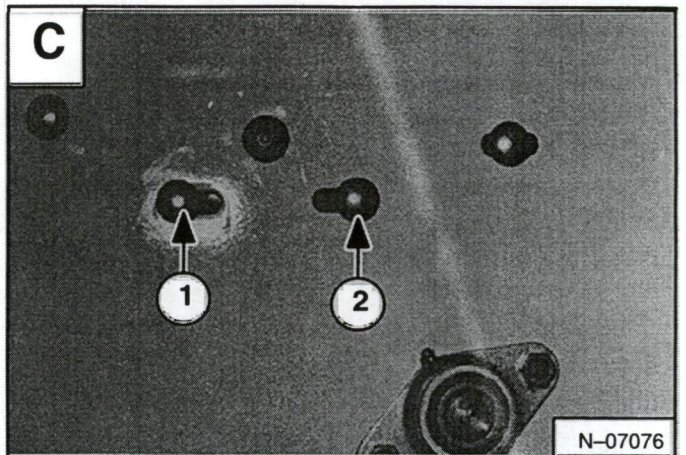
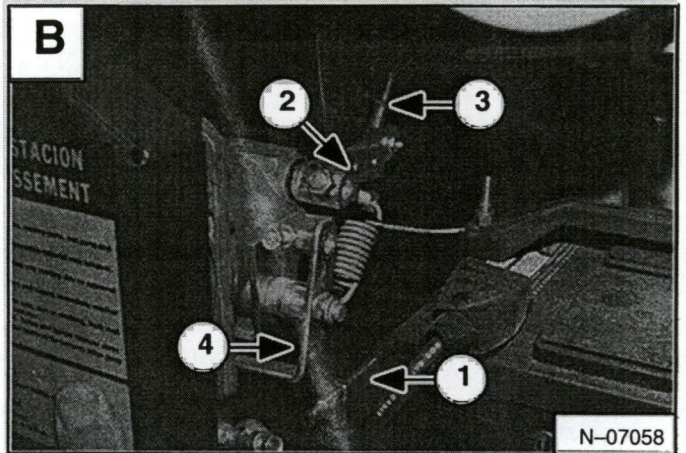
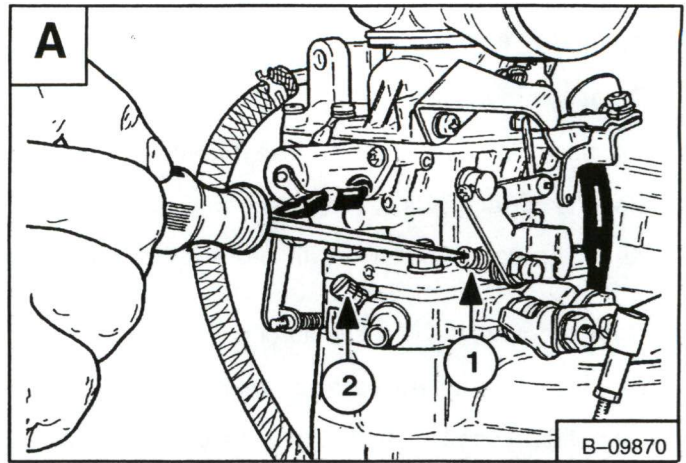
Set the throttle lever fast position stop bolt (item 1) [C] at rear of slot.

Push throttle lever fully forward.

Set engine RPM at 2900–2975 RPM by adjusting the ball joint (Item 3) [B] and high speed stop on the governor.

Pull throttle lever back until carburetor lever is against the idle stop screw.

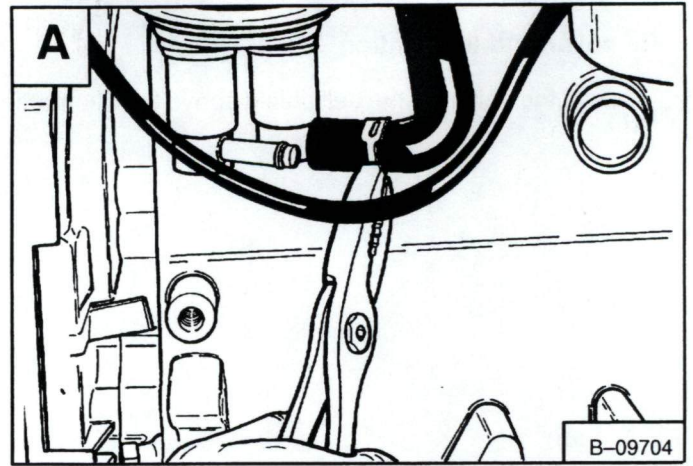
Set and tighten the slow position stop bolt (Item 2) [C] against the throttle lever.



FUEL PUMP

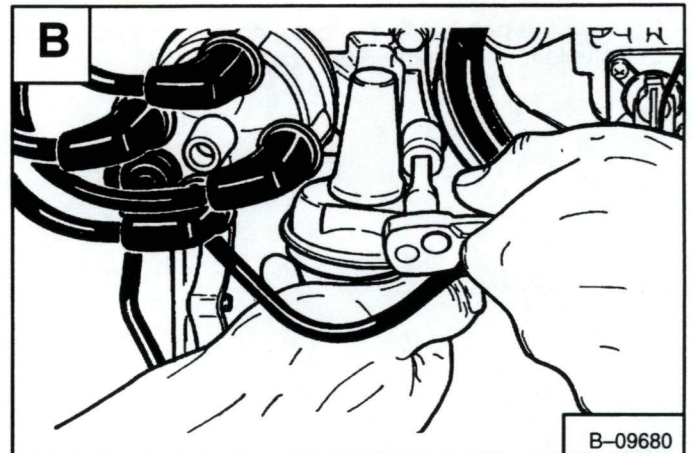
Removal And Installation

Disconnect the fuel lines from the fuel pump [A].



Remove the three bolts from the fuel pump [B].

Installation: Put Threebond 4A Sealant between the cylinder head and gasket.



Remove the fuel pump from the cylinder head [C].

Inspection

Check the rocker arm for smooth operation. Also check the spring for being weak and the pin for wear.

Check the pump body and cover for cracks and damage.

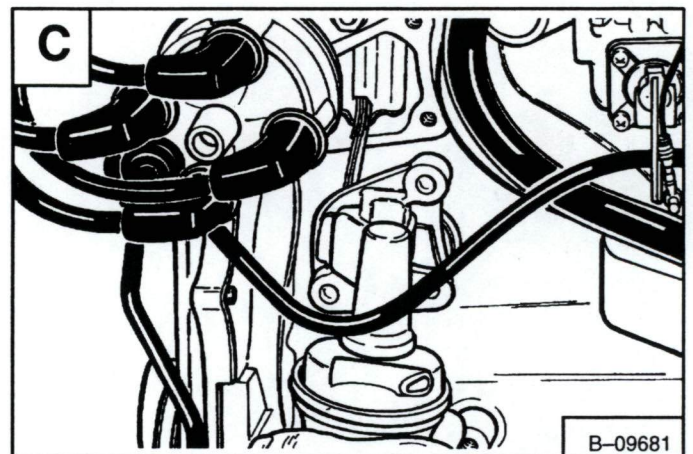
Check The Fuel Pump

Disconnect the outlet hose from the fuel pump.

Connect a gauge to the port.

Start the engine and measure the delivery pressure. If not within specifications, replace as needed.

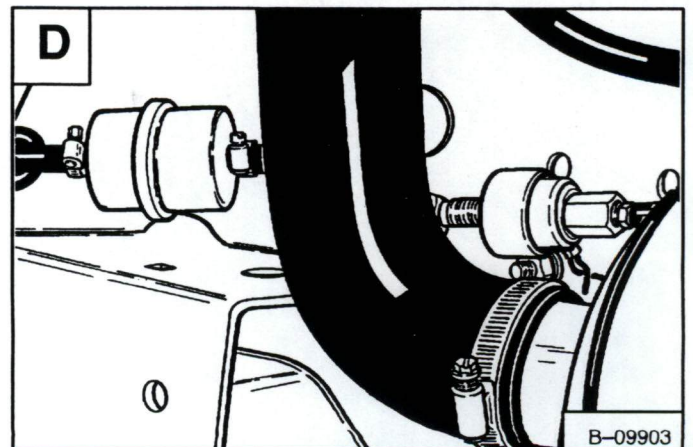
Delivery 2.11 qts. (2 L) @ 5000 RPM
Closed Delivery Pressure . . 3.7-5 PSI (25,5-34,5 kPa)



Fuel Filter

The fuel filter is located in front of the air cleaner [D].

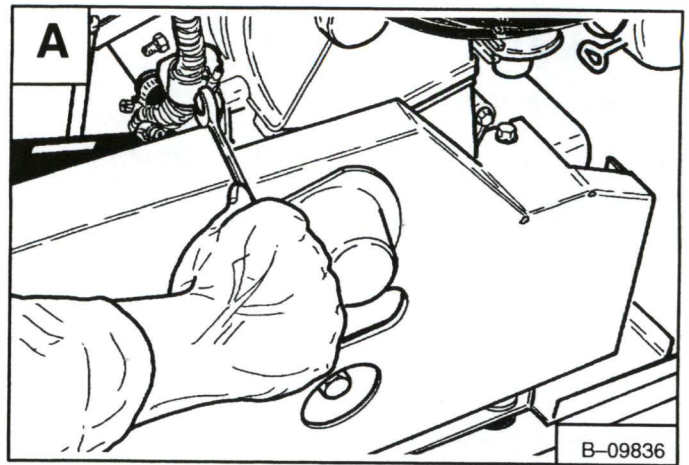
Change the fuel filter every 500 hours of loader operation.



ENGINE BELT SHIELD

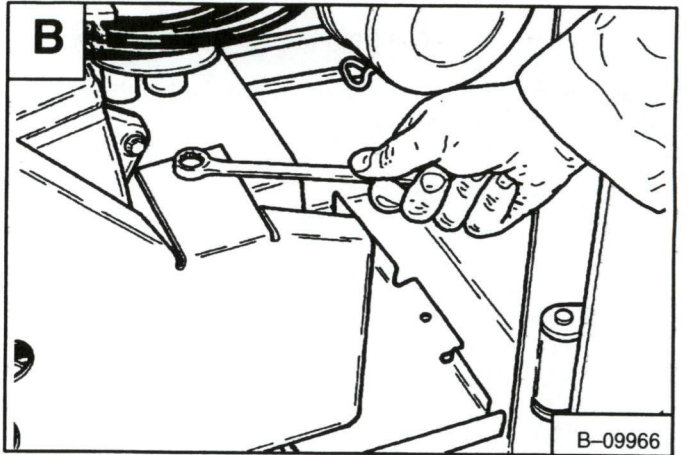
Removal And Installation

Remove the bolt from the belt shield above the alternator [A].

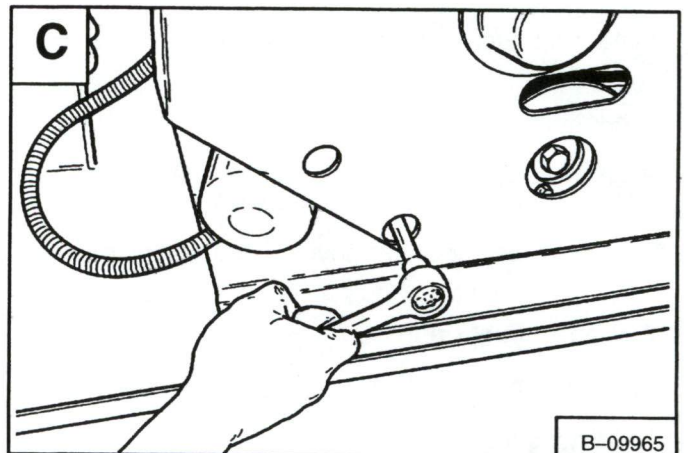


Remove the bolt from the governor bracket [B].

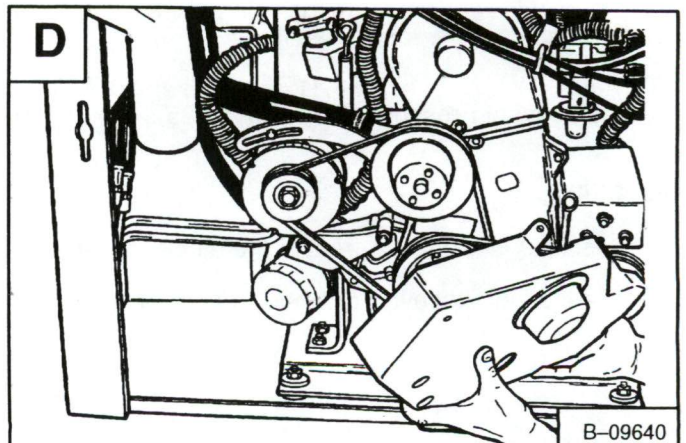
Remove the bolt below the governor which fastens the belt shield to the engine block.



Remove the bolt from the alternator mounting bracket [C].



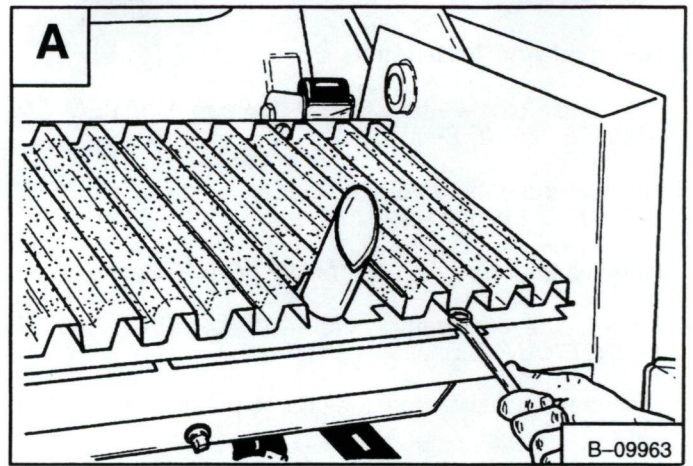
Remove the belt shield from the engine [D].



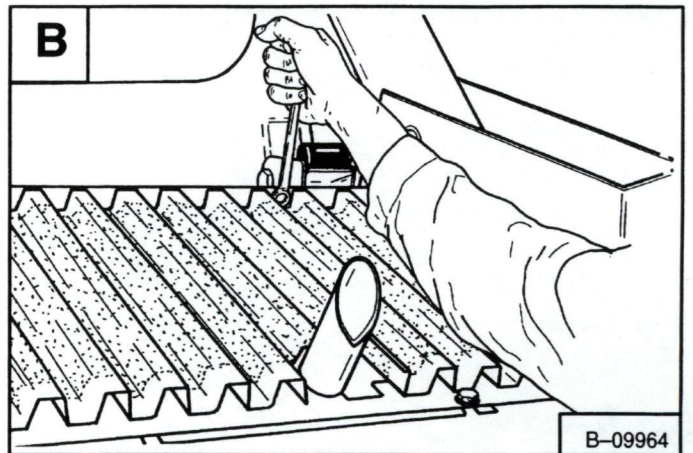
REAR GRILL

Removal And Installation

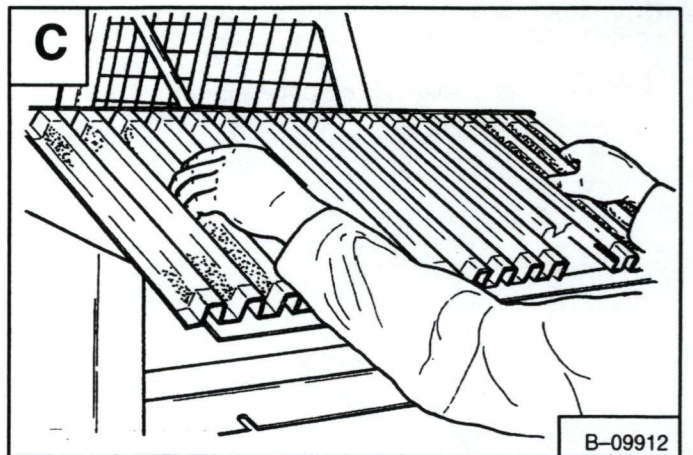
Remove the bolts along the bottom edge of the grill [A].



Remove the bolts along the top edge of the rear grill [B].



Lift the rear grill up and remove the grill from the loader [C].



ENGINE

Removal And Installation

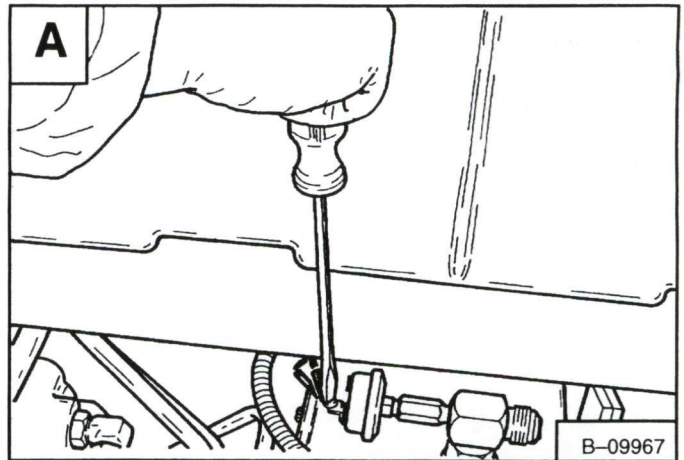
Lift and block the loader. (See *PREVENTIVE MAINTENANCE* Section 1.)

Remove the battery from the loader. (See *ELECTRICAL SYSTEM* Section 6.)

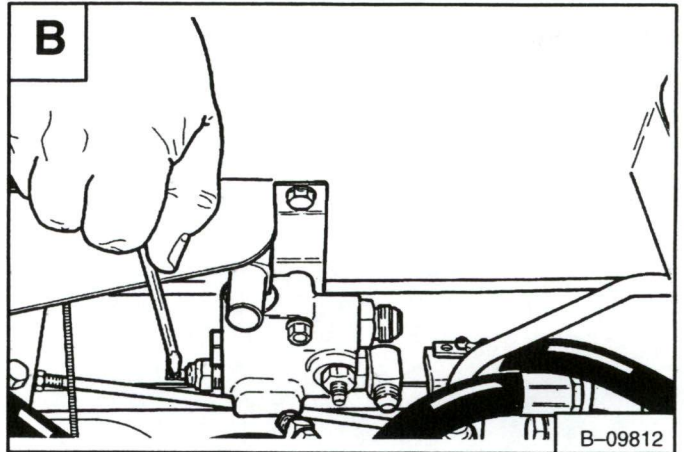
Remove the rear grill. (See *MAIN FRAME* Section 5.)

Raise the operator cab. (See *PREVENTIVE MAINTENANCE* Section 1.)

Disconnect the wire from the charge pressure switch **[A]**.

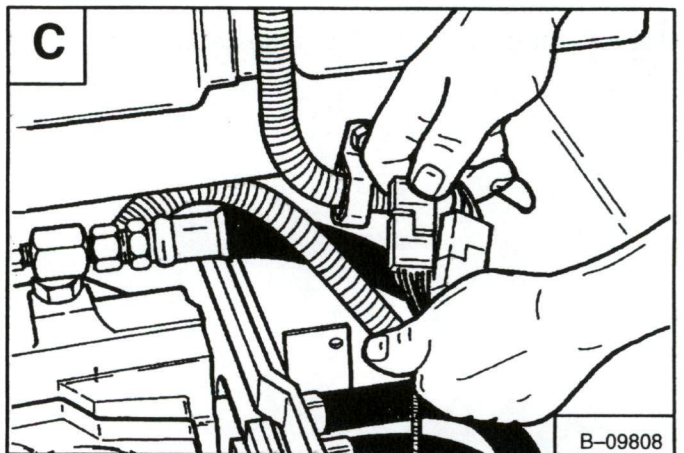


Disconnect the wire from the port block **[B]**.

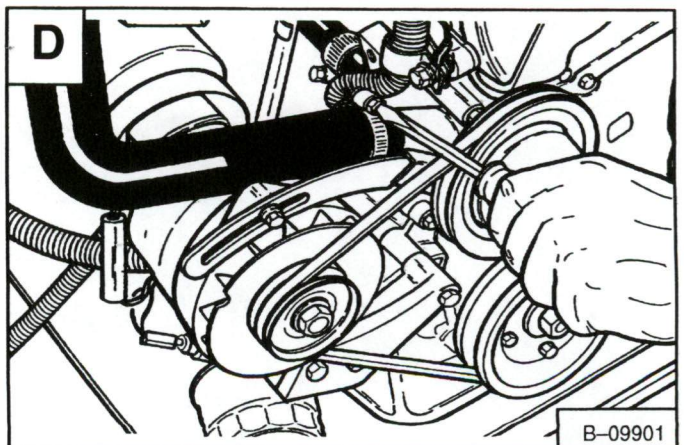


Disconnect the electrical connectors from the electrical harness **[C]**.

Remove the belt shield. (See page 7B-14.)



Remove the radiator hose from the water pump **[D]**.



ENGINE (Cont'd)

Removal And Installation (Cont'd)

Drain the coolant into a container [A].

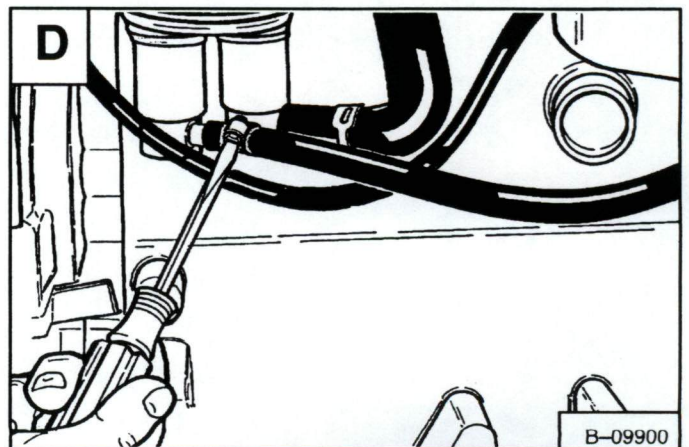
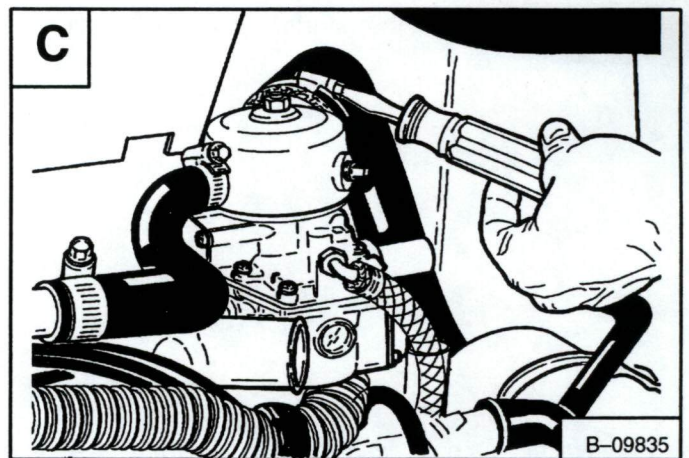
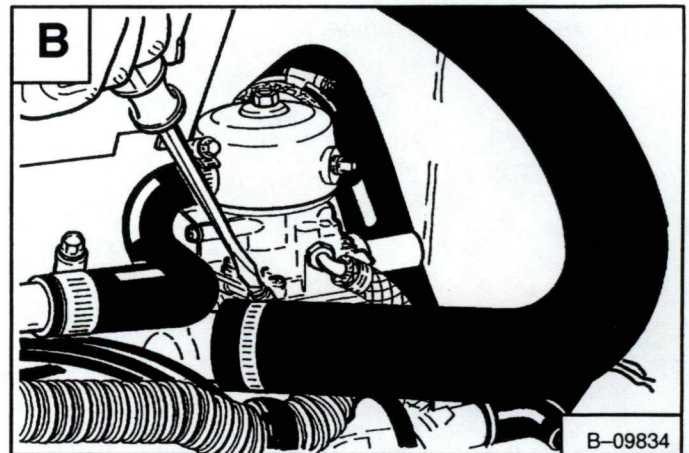
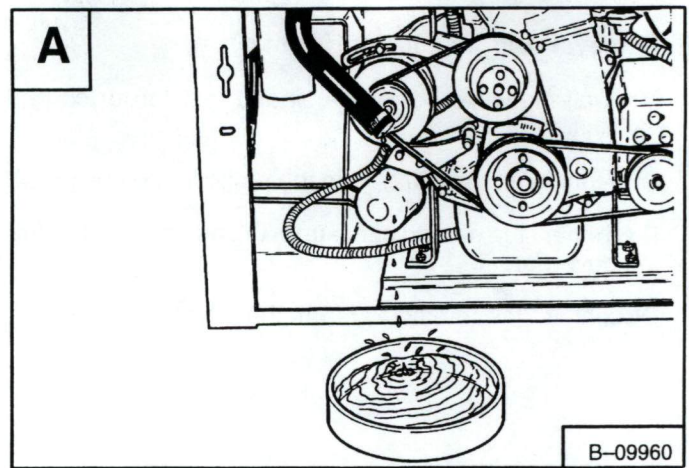
Installation: Make sure to pre-mix the water (50%) and ethylene glycol (50%) before adding it to the cooling system.

Remove the radiator hose from the thermostat housing [B].

Disconnect the air cleaner hose [C].

Turn the fuel shutoff to the OFF position on the fuel tank.

Disconnect the fuel line from the fuel pump [D].



ENGINE (Cont'd)

Removal And Installation (Cont'd)

Mark all the wires from the coil and resistor for correct installation.

Disconnect all the wires from the resistor and coil [A].

Disconnect the ground cable from the engine block behind the governor.

Disconnect the throttle rod from the governor.

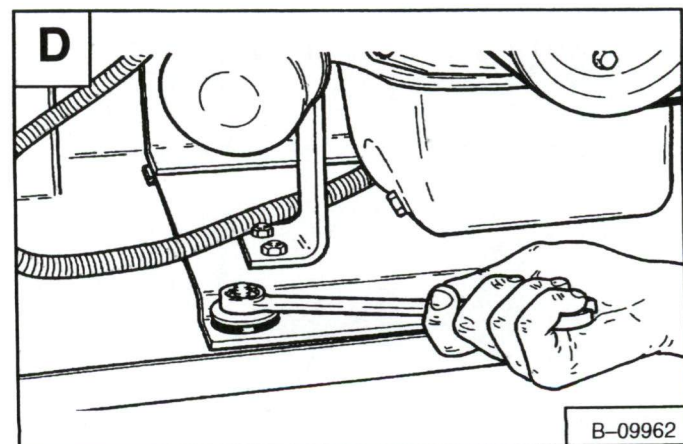
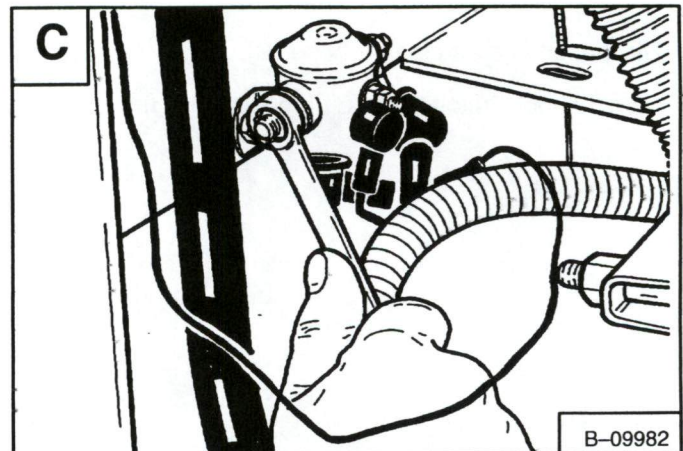
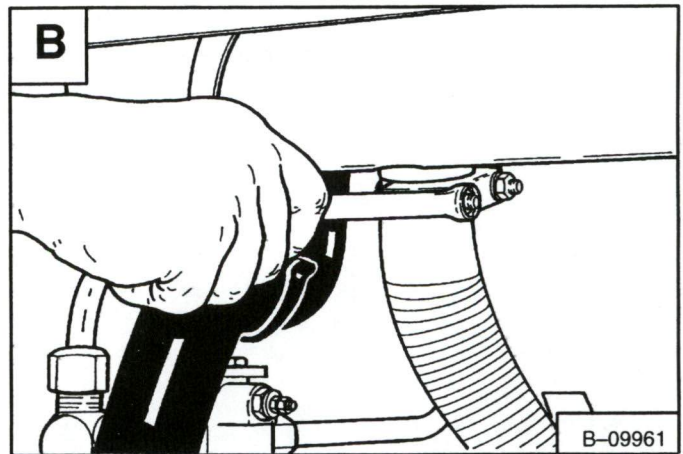
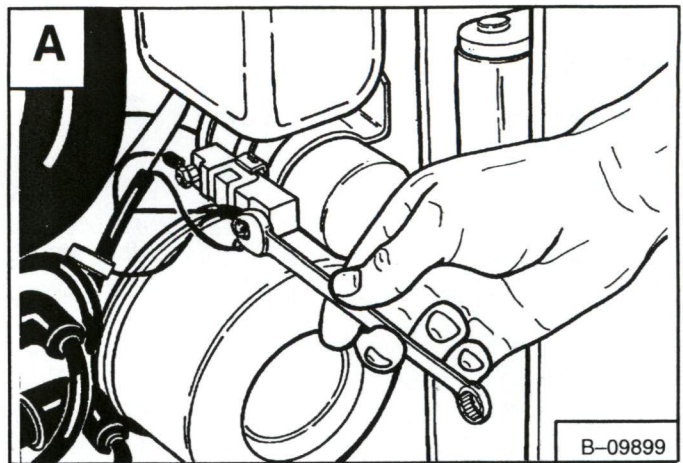
Remove the clamp from the exhaust pipe [B].

Disconnect the exhaust pipe.

Disconnect the wires from the starter solenoid [C].

Mark the wires at the starter solenoid for correct installation.

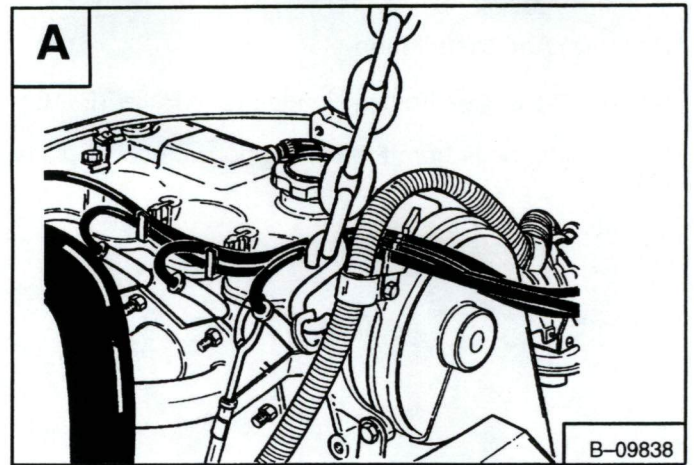
Remove the four bolts, washers and nuts from the engine mounting plate [D].



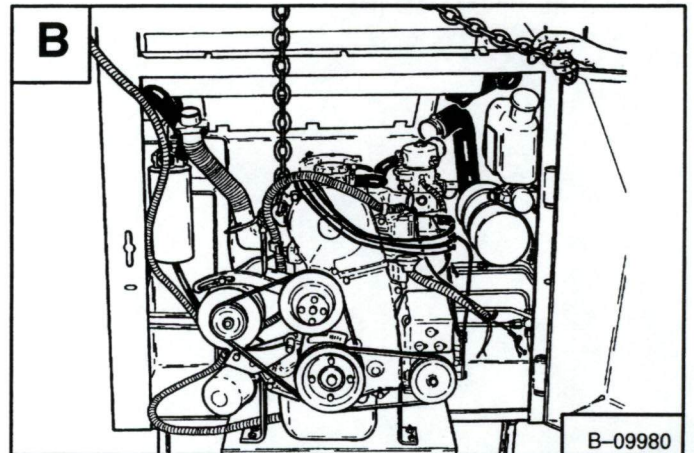
ENGINE (Cont'd)

Removal And Installation (Cont'd)

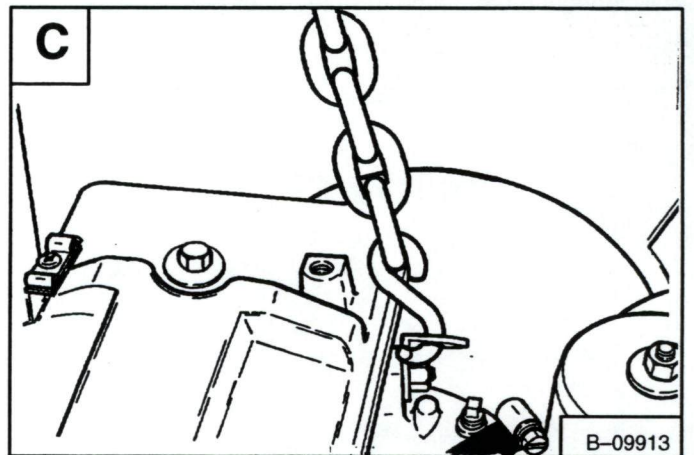
Hook one end of the chain hoist into the lift hook on the water pump end of the engine [A].



Lift the engine a small amount and slide it toward the rear of the loader until the engine mounting plate is just over the rear edge of the loader frame [B].

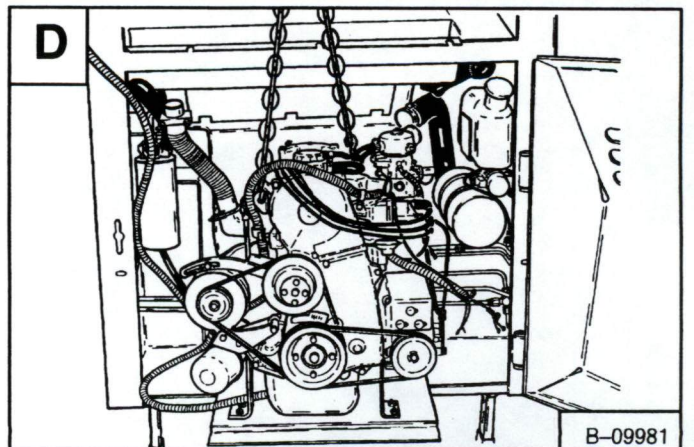


Lower the chain hoist. Connect the other end of the chain hoist to the lift hook on the flywheel end of the engine [C].



Lift the engine. Slide it out of the loader frame [D].

Installation: Move the engine into the loader until the u-joint is in the blower housing. Have a second person reach behind the blower housing (at the hydrostatic pumps) and guide the u-joint on the splines of the hydrostatic pump shaft.

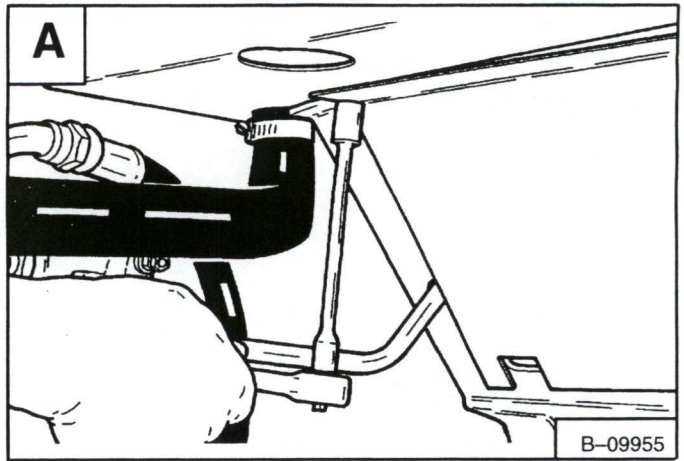


OIL COOLER AND BLOWER HOUSING

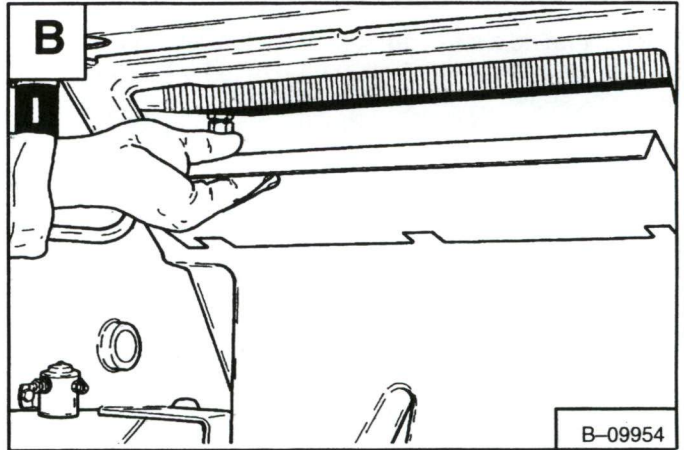
Removal And Installation

Remove the engine from the loader. (See Page 7B-16.)

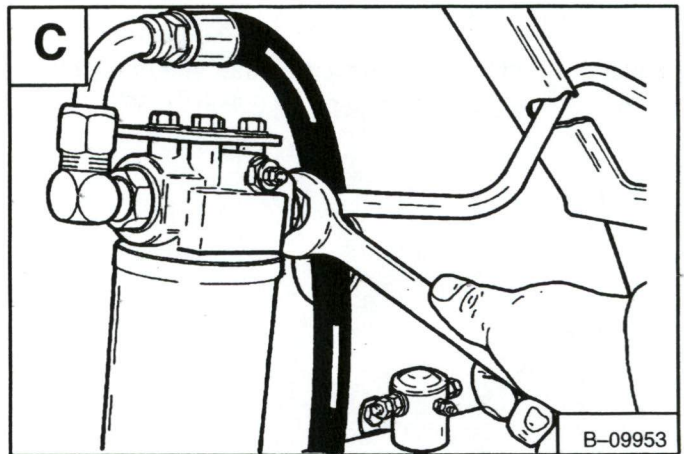
Remove the bolts from the blower housing cover plate [A].



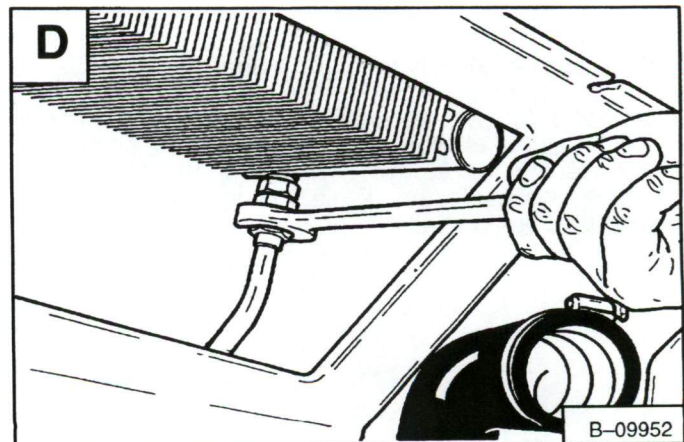
Remove the cover plate [B].



Disconnect the tubeline from the filter housing [C].



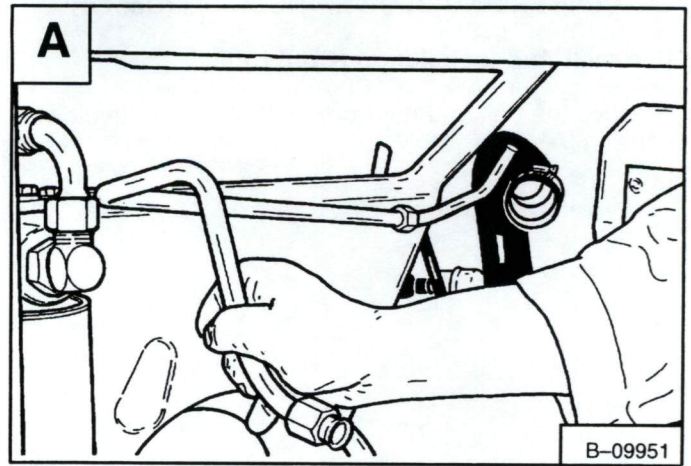
Disconnect the tubeline from the oil cooler [D].



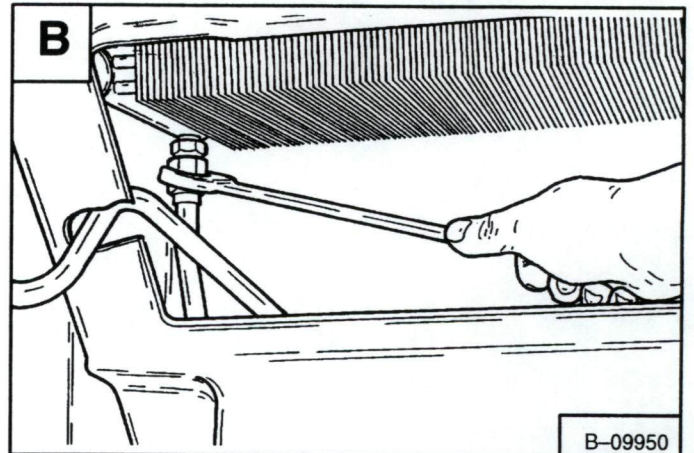
OIL COOLER AND BLOWER HOUSING (Cont'd)

Removal And Installation (Cont'd)

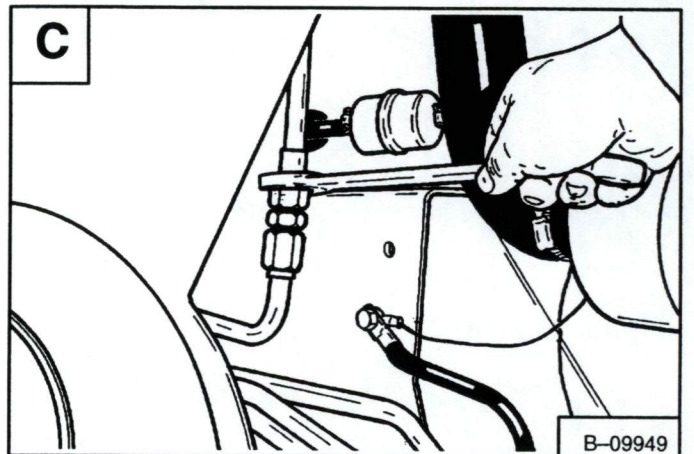
Remove the tubeline from the blower housing [A].



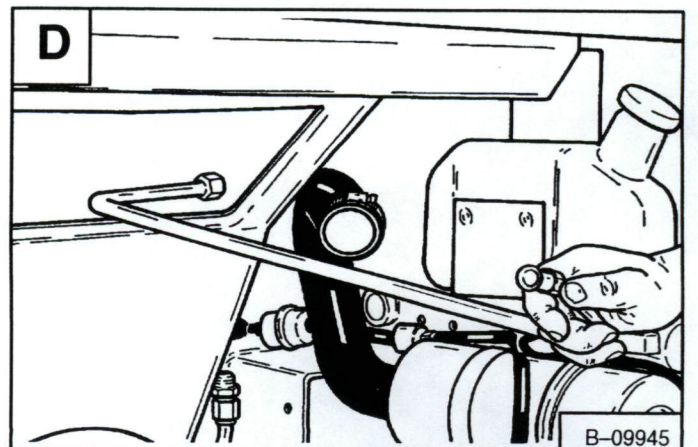
Disconnect the other tubeline from the oil cooler [B].



Disconnect the tubeline beside the blower housing [C].



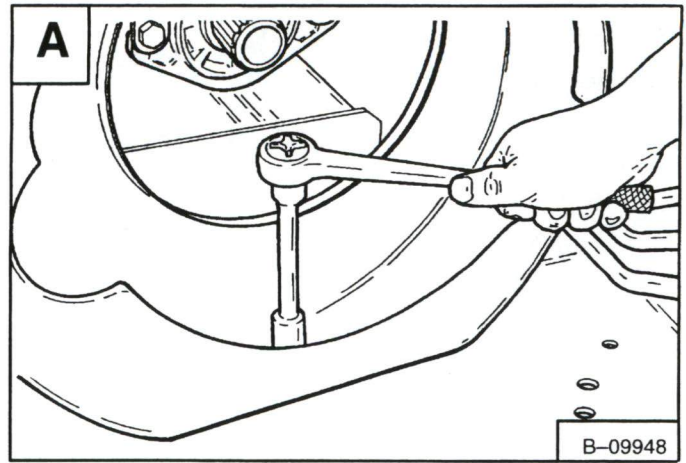
Remove the tubeline from the blower housing [D].



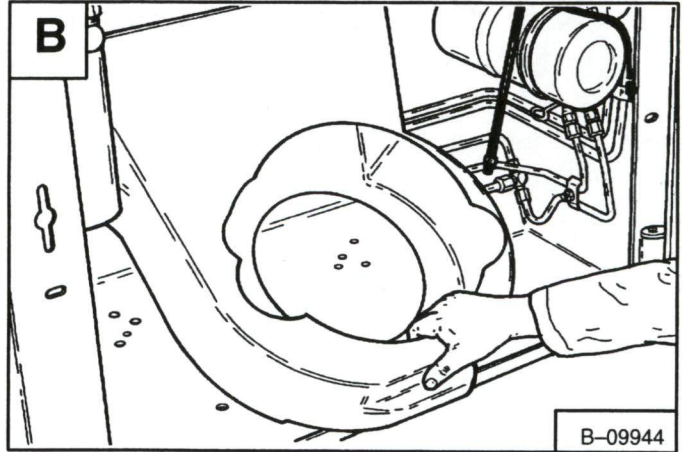
OIL COOLER AND BLOWER HOUSING (Cont'd)

Removal And Installation (Cont'd)

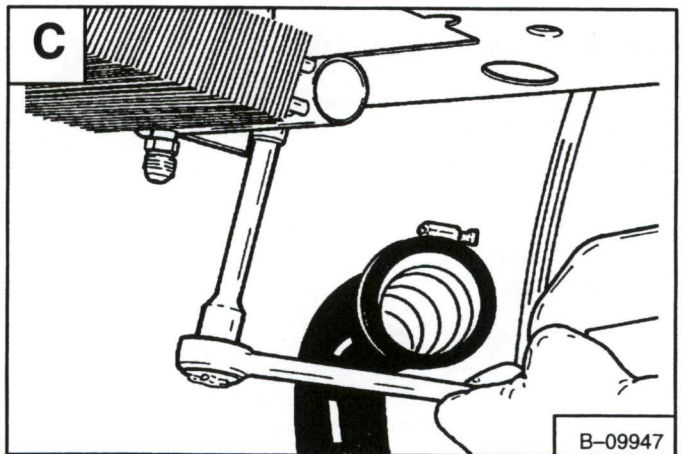
Remove the bolt and nut from the bottom of the blower housing [A].



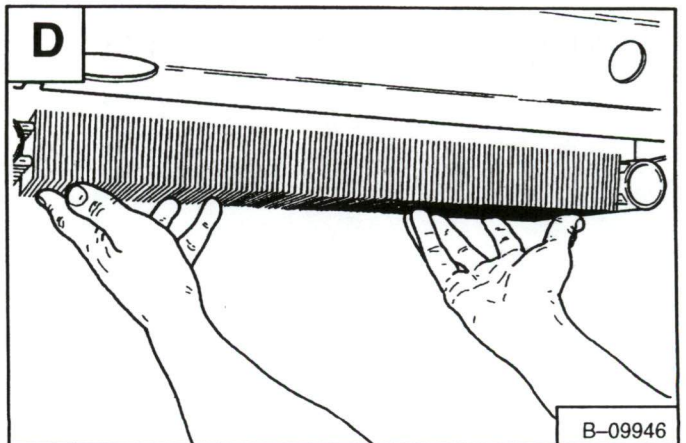
Remove the blower housing from the loader [B].



Remove the nuts from both sides of the oil cooler [C].



Lower and remove the oil cooler from the loader [D].



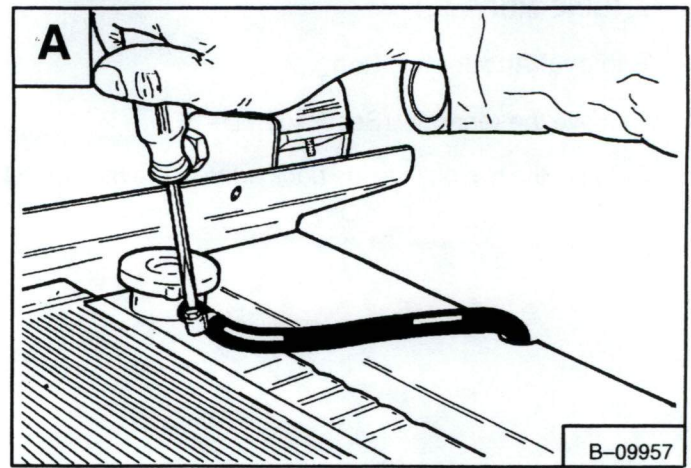
RADIATOR

Removal And Installation

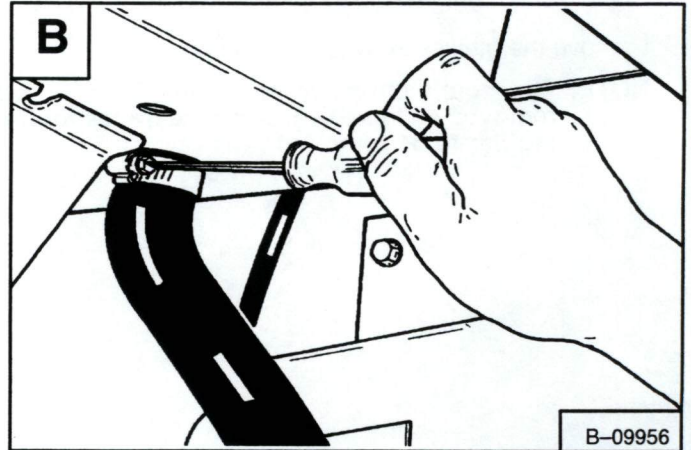
Remove the oil cooler and blower housing from the loader. (See Page 7B-20.)

Remove the engine muffler. (See Page 7B-63.)

Disconnect the overflow hose from the radiator [A].

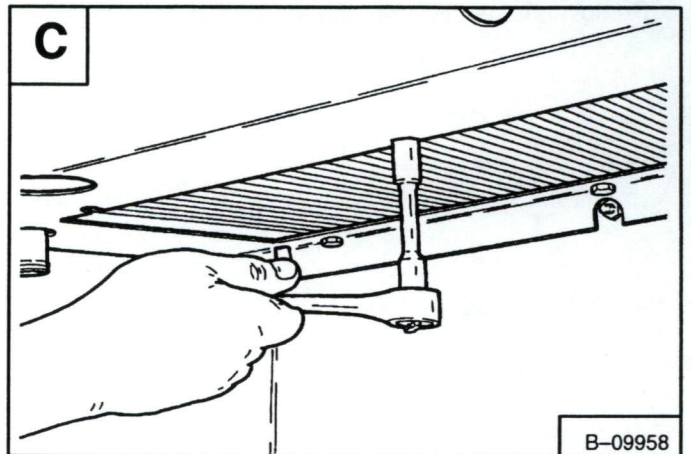


Remove both radiator hoses from the radiator [B].

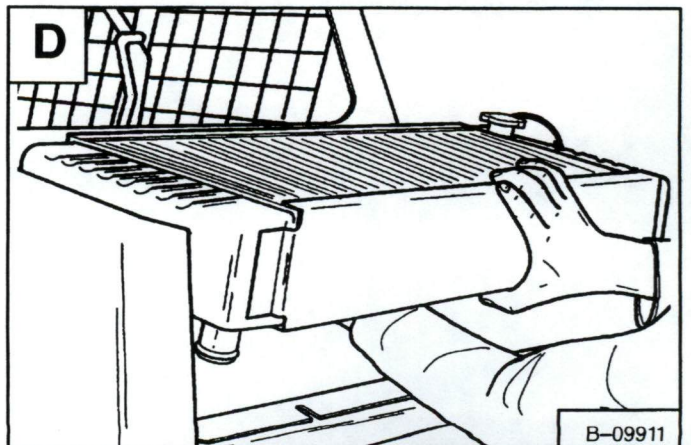


Remove the three bolts along the back edge of the radiator [C].

Remove the three bolts along the front edge of the radiator.



Lift the radiator from the loader [D].

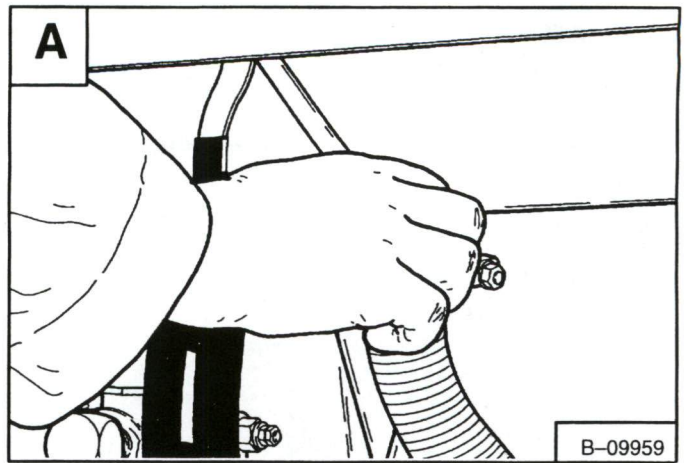


ENGINE MUFFLER

Removal And Installation

Remove the rear grill. (See Page 7D-15.)

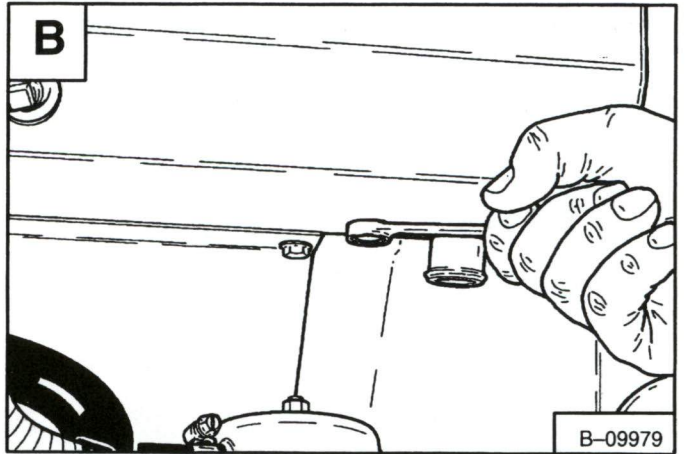
Remove the two bolts at the back edge of the muffler [A].



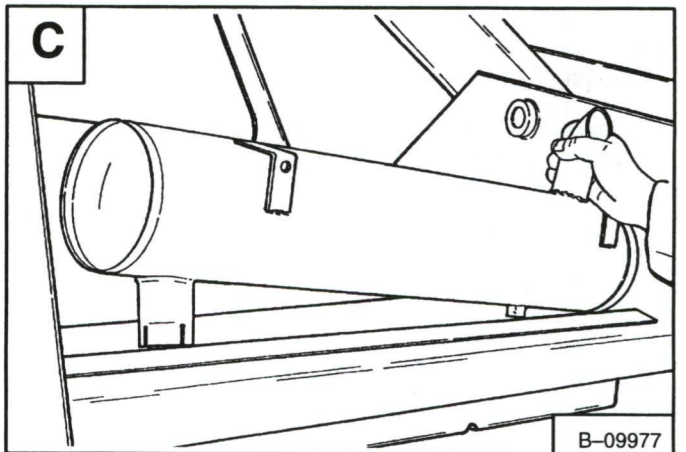
Remove the four bolts from the bottom of the muffler [B].

Remove the muffler exhaust pipe clamp.

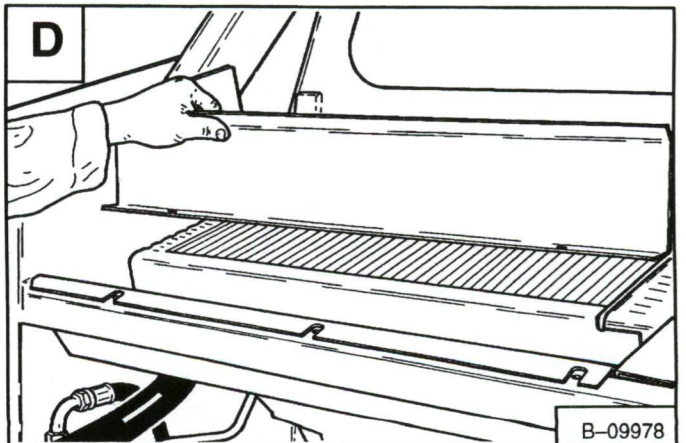
NOTE: The spark chamber plug may have to be removed so there is enough clearance for the muffler to be removed.



Remove the muffler from the loader [C].



Remove the plate between the muffler and the radiator.



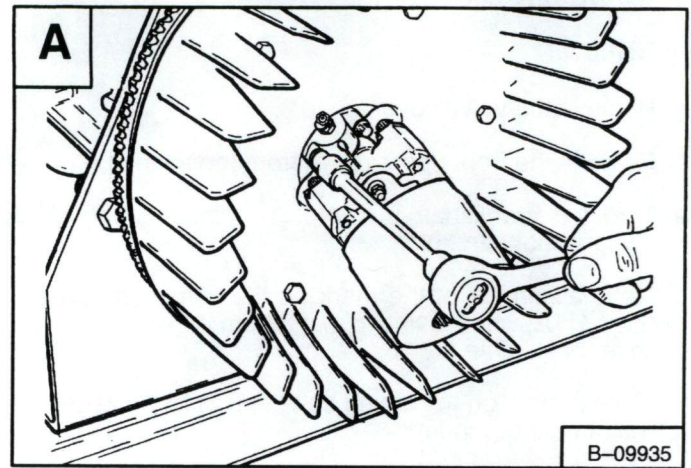
ENGINE FLYWHEEL AND U-JOINT

Removal And Installation

Remove the four bolts from the u-joint mounting flange [A].

Installation: Put LOCTITE on the bolt and tighten to 25–28 ft.-lbs. (34–38 Nm) torque.

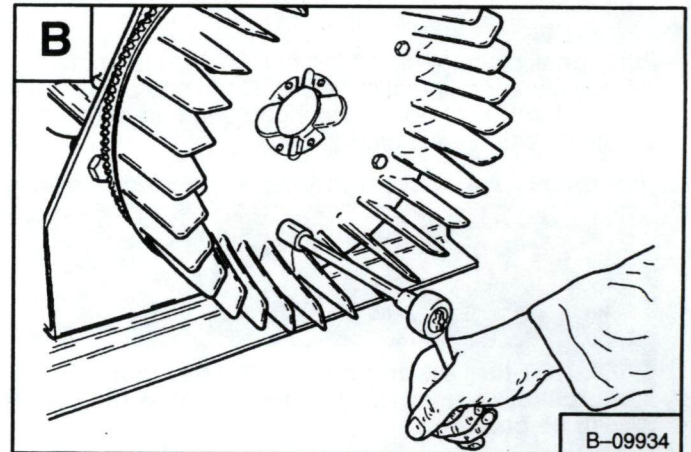
Remove the u-joint.



Remove the bolts from the cooling fan [B].

Installation: Tighten the bolts to 15–17 ft.-lbs. (2–23 Nm) torque.

Remove the cooling fan.



Remove the bolts from the flywheel [C].

Installation: Tighten the bolts to 55–60 ft.-lbs. (75–81 Nm) torque.

Remove the flywheel.

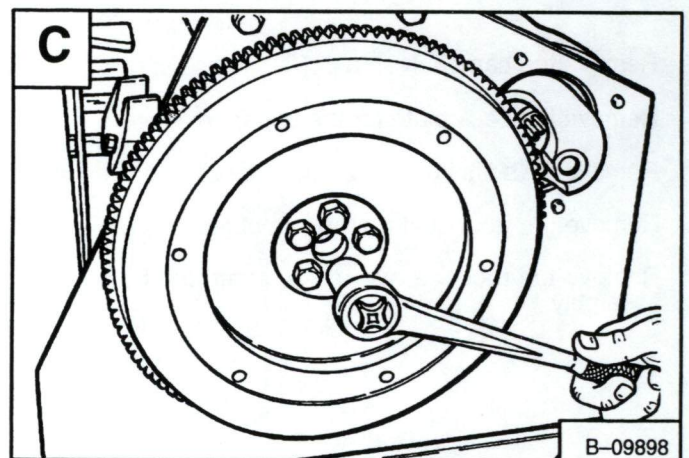
Flywheel Ring Gear

the ring gear on the flywheel is an interference fit. Heat the ring gear enough to expand it and hit the ring gear with a hammer, evenly, to remove it.

Clean the outer surface of the flywheel to give the ring gear a smooth fit.

Clean the new ring gear and heat it to a temperature of 450–500° F. (232–260° C.).

Fit the ring gear over the flywheel. Make sure the gear is on its seat correctly.



ROCKER ARMS

Removal

Remove the valve cover.

Remove the front upper cover from the timing belt.

Turn the crankshaft until No. 1 cylinder is at T.D.C. compression stroke.

Make alignment of the mark on the camshaft sprocket (Item 1) [A] with the timing mark (Item 2) [A] at the upper cover back plate.

Make a mark on the timing belt (item 3) [A] in alignment with the other marks.

Remove the camshaft bolt.

Put a small piece of old timing belt (item 1) [B] between the sprocket and sprocket holder. Do this to prevent the camshaft sprocket from lowering to such an extent that the timing belt comes off.

IMPORTANT

DO NOT turn the crankshaft after the camshaft sprocket is removed because engine timing will be changed.

I-2122-0297

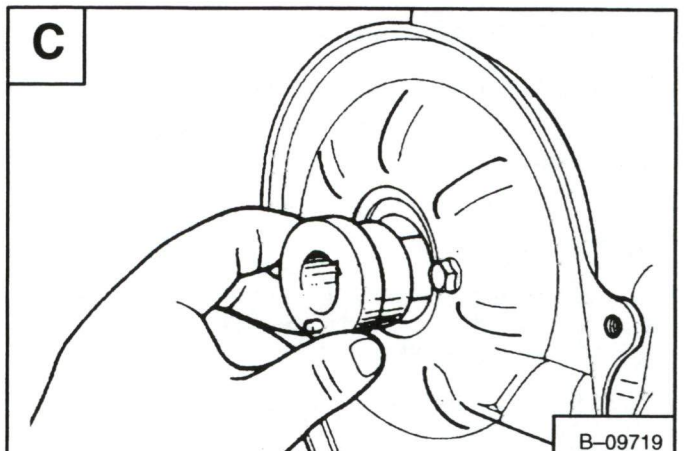
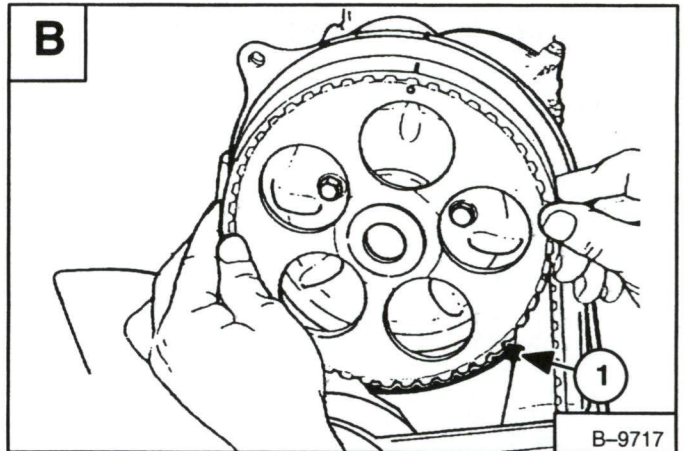
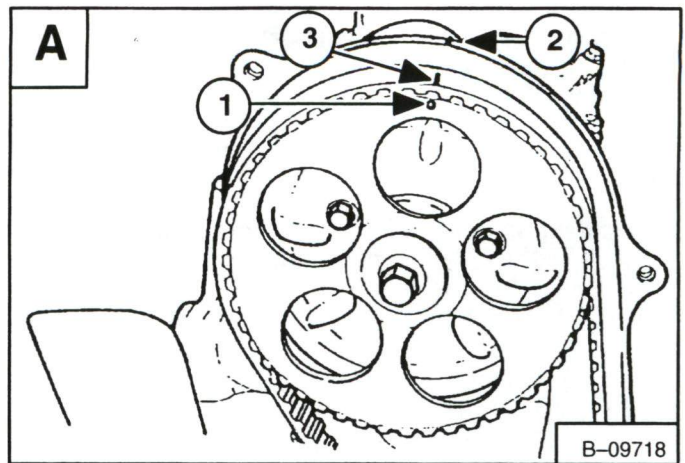
Remove the camshaft spacer [C].

Remove the back plate for the upper cover.

Remove the bolts from the bearing caps for the camshaft.

Remove the front seal from the camshaft.

Remove the rocker arms, rocker shaft and bearing cap assembly.

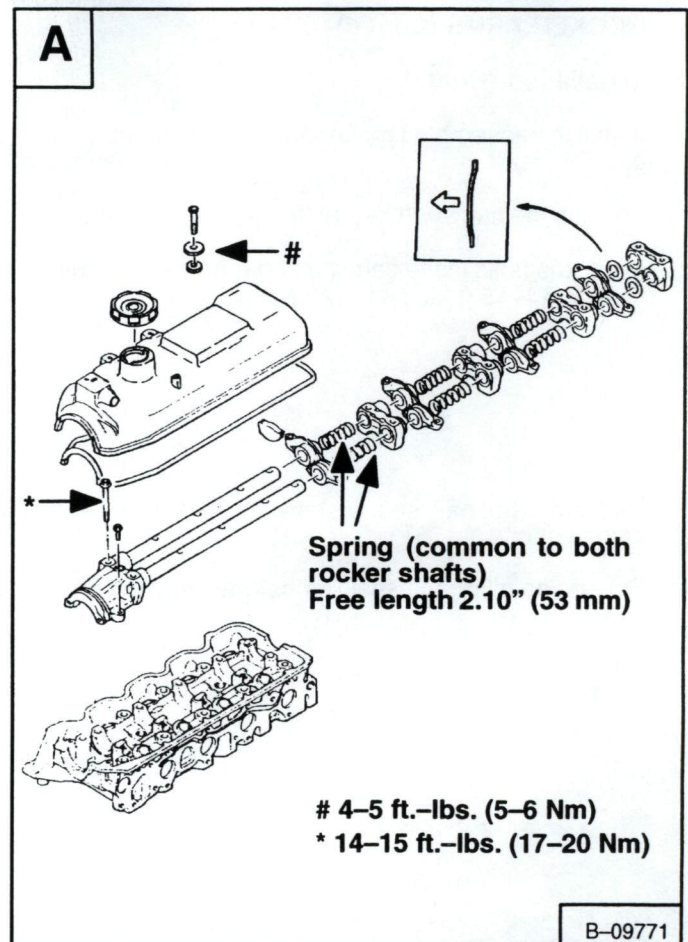


ROCKER ARMS (Cont'd)

Removal (Cont'd)

Mark the rocker arms for correct assembly.

Remove the bearing caps, wave washers, springs and rocker arms as shown [A].



Inspection

Check the rocker arm surface that contacts the cam lobe and the adjusting bolt ends that contact the valve stem [B].

If worn or damaged, replace the rocker arm.

Check the rocker arm shaft for damage. Replace the parts as needed.

Installation

The tool listed will be needed to do the following procedure:

MEL1299 – Camshaft Seal Tool

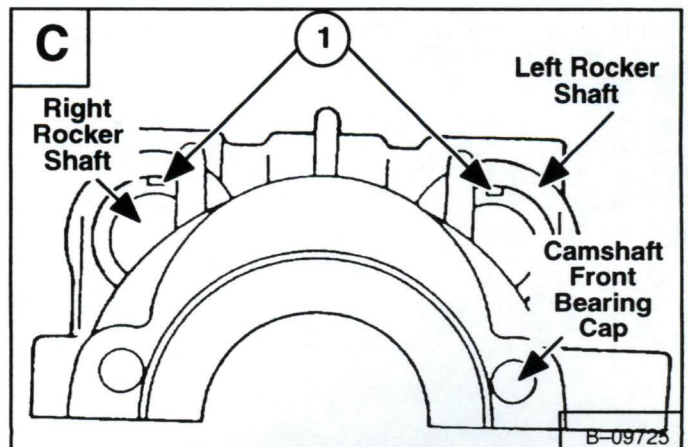
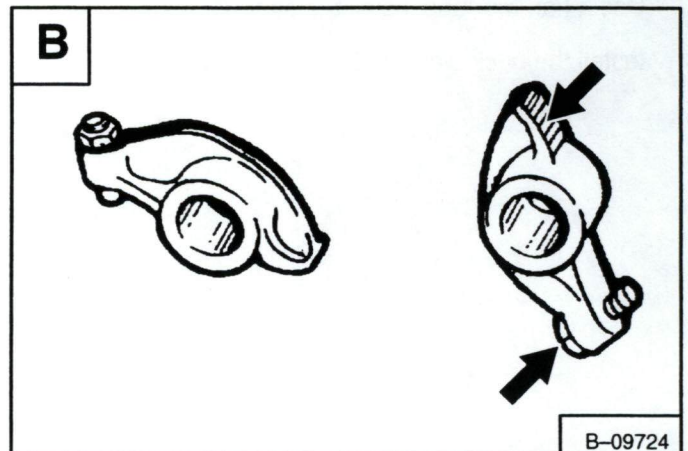
Install the right and left shafts into the front bearing cap. Temporarily install the bolts to hold the shafts.

Make sure the end slots (Item 1) [C] at the front of the shaft are in the up position.

Install the rocker arms, springs and bearing caps in the order shown [A].

Make sure to install the wave washer in the right direction [A].

After the rear bearing cap is installed, temporarily install the bolts to hold them in position.



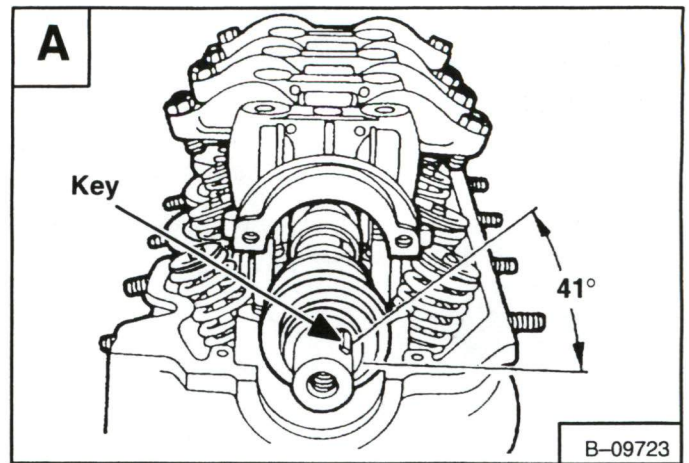
ROCKER ARMS (Cont'd)

Installation (Cont'd)

Install the assembled rocker arm shaft assembly into the cylinder head.

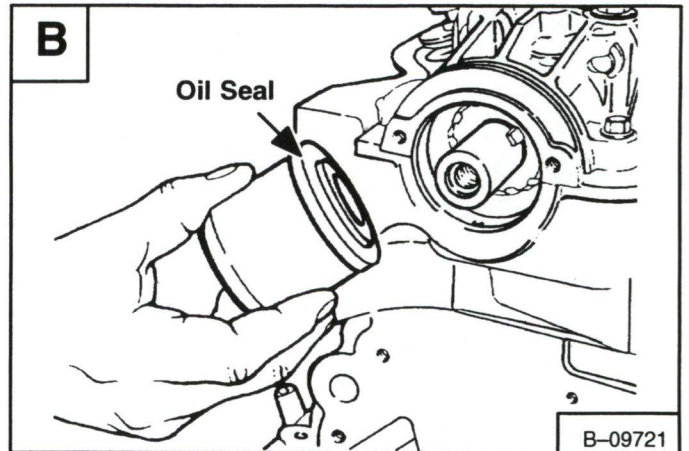
Position the camshaft key, at the front end, as shown [A].

Install the bolts in the camshaft bearing caps. Tighten the bolts to 14–15 ft.-lbs. (17–20 Nm) torque.



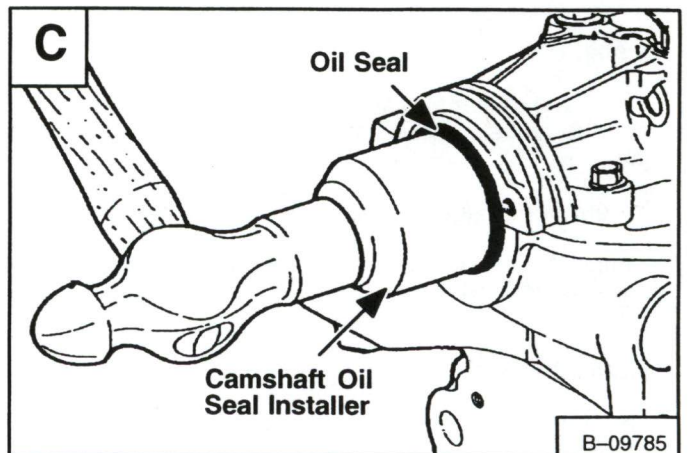
Use the camshaft seal installation tool and install the camshaft oil seal [B].

Put engine oil on the seal lips before installing the seal.

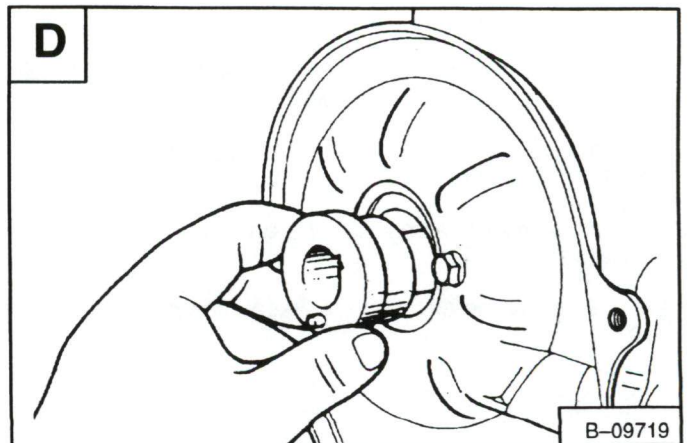


Use a hammer and install the seal [C].

Install the back plate for the upper cover.



Put oil on the outer surface of the camshaft spacer and install the spacer [D].



ROCKER ARM (Cont'd)

Installation (Cont'd)

Pull the camshaft sprocket up, and install it on the camshaft [A].

When the dowel pin hole on the camshaft sprocket does not align with the dowel pin at the end of the spacer, the camshaft can be turned by hitting the projections at the No. 2 camshaft journal [B].

NOTE: Make sure the crankshaft is not turned for correct alignment of the dowel pin and dowel pin hole.

Install the bolt at the camshaft sprocket and tighten to 36–43 ft.-lbs. (49–58 Nm) torque.

NOTE: Check to make sure the timing marks are still in alignment.

Install the upper front cover. Adjust the valve clearance.

Clearance (Cold)

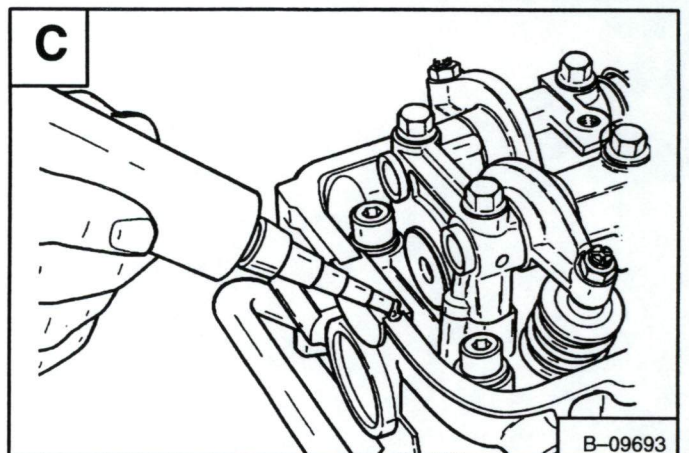
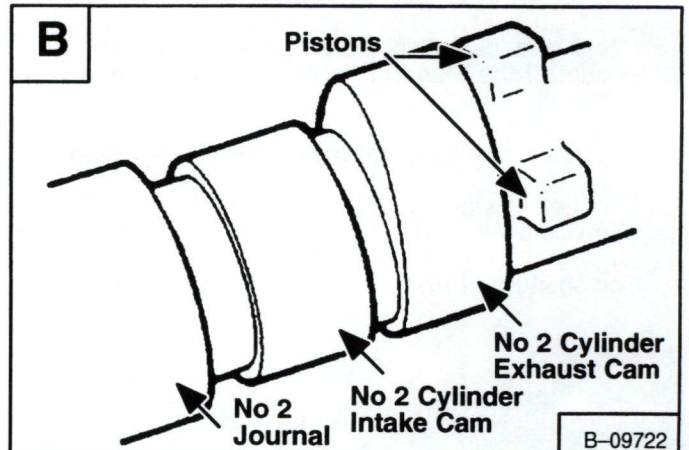
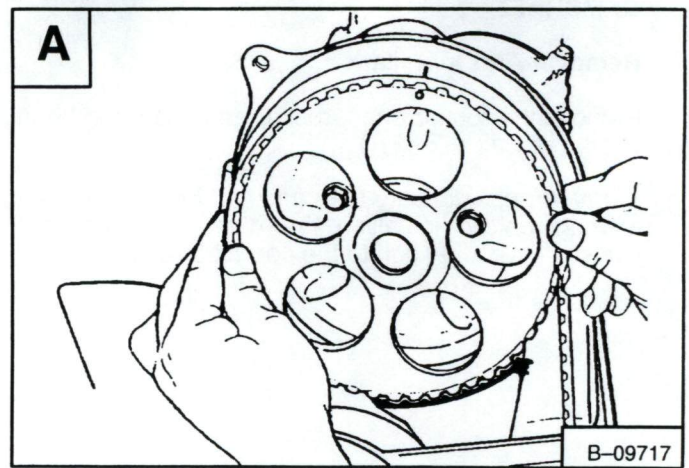
Intake	0.03 inch (0,08 mm)
Exhaust	0.07 inch (0,18 mm)

Temporarily install the valve cover. Start the engine, run until at operating temperature.

Set the valve clearance. (See Page 7D-2.)

Before installing the valve cover, put Sealant on the half plug at the cylinder head [C].

Install the valve cover and tighten the bolts to 4–5 ft.-lbs. (5–6 Nm) torque.

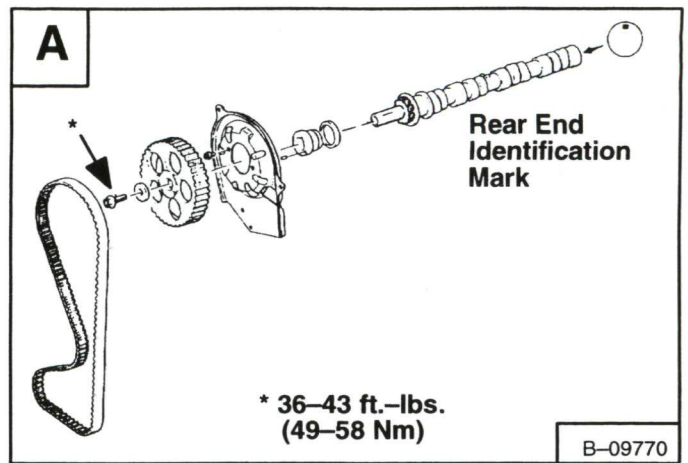


CAMSHAFT

Removal And Installation

Remove the rocker arms, rocker and shaft and bearing cap. (See Page 7B-27.)

Installation: Lubricate the camshaft lobes and bearing journals before installing the camshaft. Tighten the camshaft sprocket bolt to the correct torque [A].



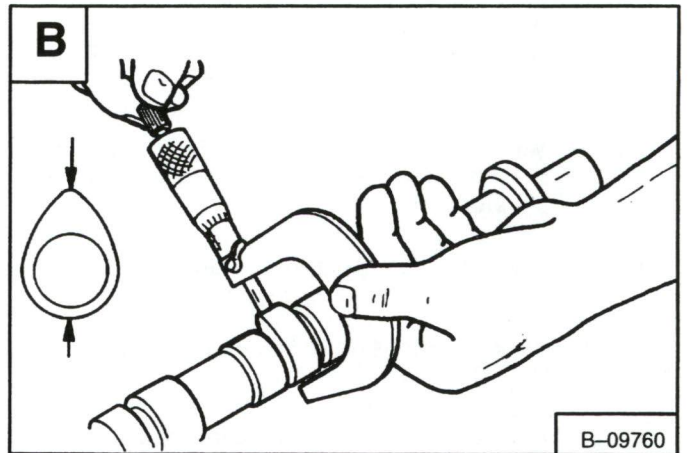
Inspection

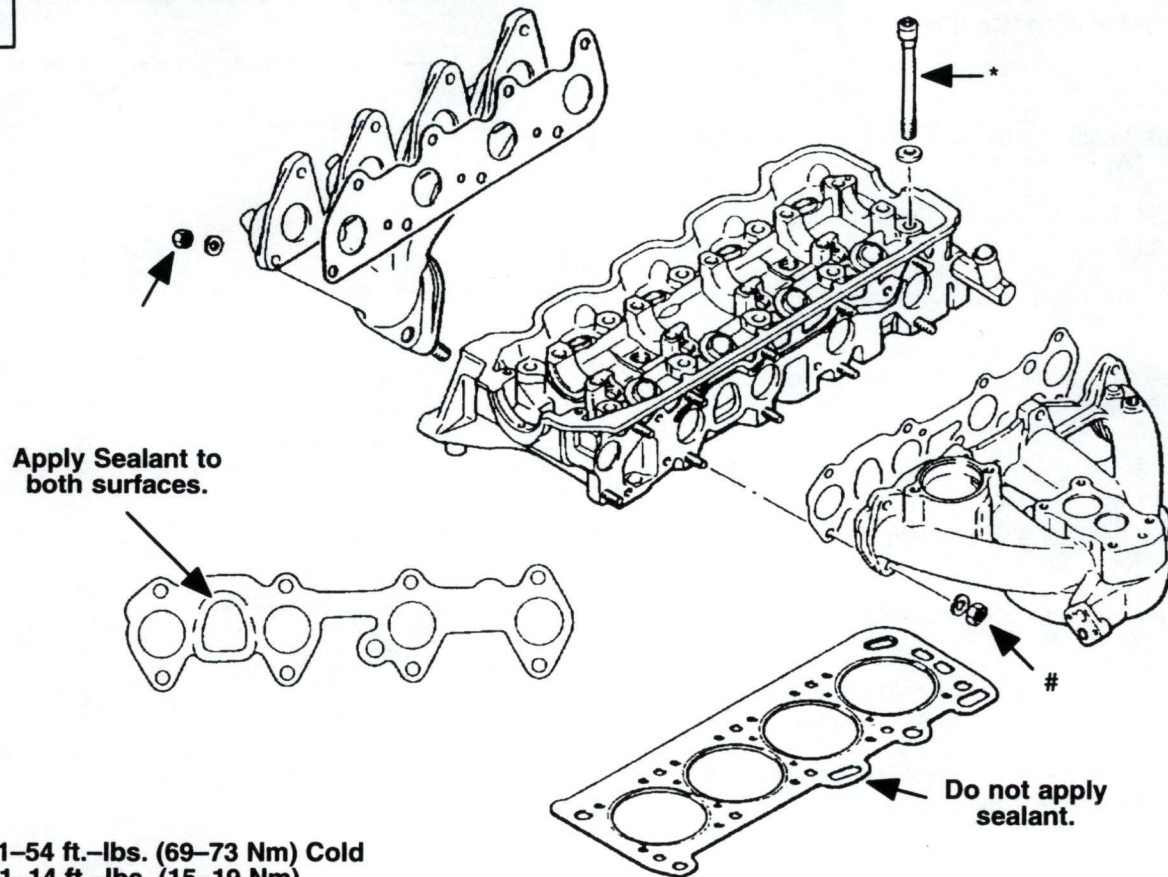
Check the camshaft journals for wear, scratches or seizure. If the journal is excessively worn, replace the camshaft.

Check the cam lobes for the correct specification [B].

Cam Lobe Height 1.4331 inch (36,4 mm)
Service Limit -0.020 inch (-0,5 mm)

Camshaft End Play 0.002-0.006 inch
(0,05-0,15 mm)



A

* 51-54 ft.-lbs. (69-73 Nm) Cold
11-14 ft.-lbs. (15-19 Nm)

B-09769

CYLINDER HEAD**Removal And Installation**

The tool will be needed to do the following procedure:

MEL1297 - Head Bolt Tool

Remove the coolant from the coolant system.

Disconnect the radiator hose. Remove the spark plug wires.

Remove the distributor. (See Page 7D-5.)

Remove the fuel pump. (See Page 7D-13.)

Remove the exhaust manifold.

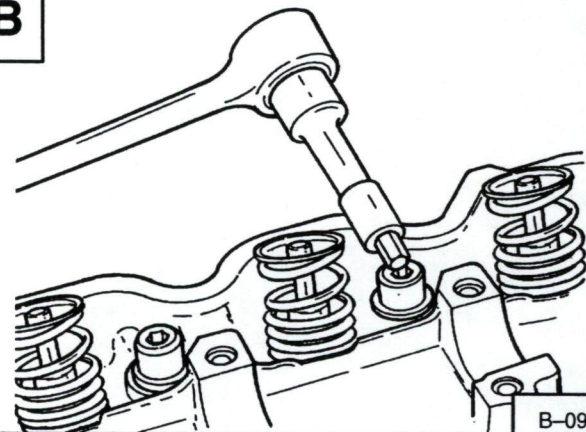
Remove the intake manifold and carburetor.

Installation: Put sealant on both surfaces around the water hole [A].

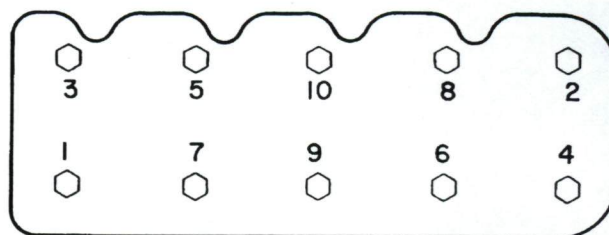
Remove the rocker arms, rocker shaft, bearing caps and camshaft. (See Page 7D-27.)

Use the special tool to remove the cylinder head bolts [B].

Remove the cylinder head bolts in the sequence shown to prevent cylinder head warpage [C].

B

B-09694

C**Removing Head Bolt Sequence**

B-09768

CYLINDER HEAD (Cont'd)

Removal And Installation (Cont'd)

Installation:

Tighten the bolts to 25 ft.-lbs. (34 Nm) torque in the sequence shown [A].

Tighten to 51-54 ft.-lbs. (69-73 Nm) torque in the sequence shown [A].

Remove the cylinder head. Remove the cylinder head gasket.

Installation: Use a new cylinder head gasket and do not use sealant on the gasket.

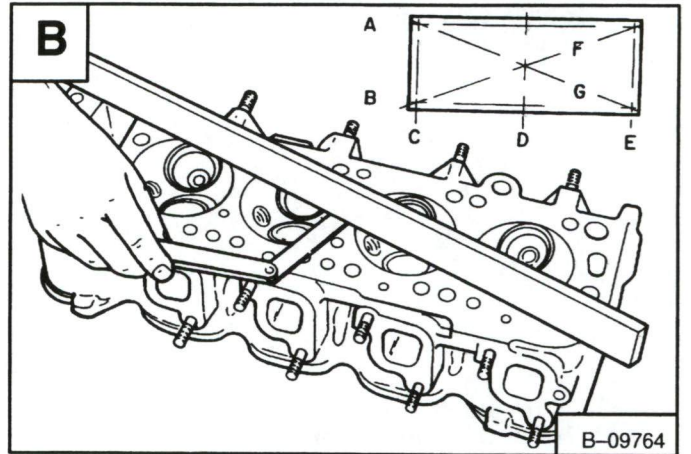
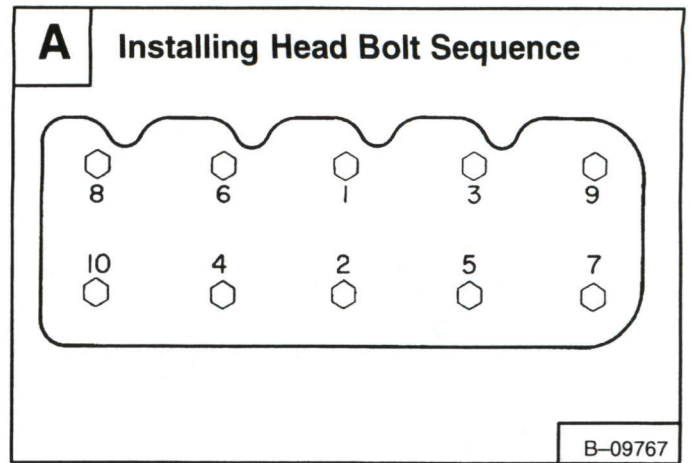
Inspection

Clean the cylinder head of all carbon deposits. Remove the valves. (See Page 7D-33.)

Check the cylinder head surface by using a straight edge in the direction of A, B, etc. [B].

Standard Dimension 0.002 inch (0,05 mm) or less
Service Limit 0.004 inch (0,1 mm)

If the cylinder head surface exceeds the service limit, either replace or grind the cylinder head.



VALVES

Removal

The tool listed will be needed to do the following procedure:

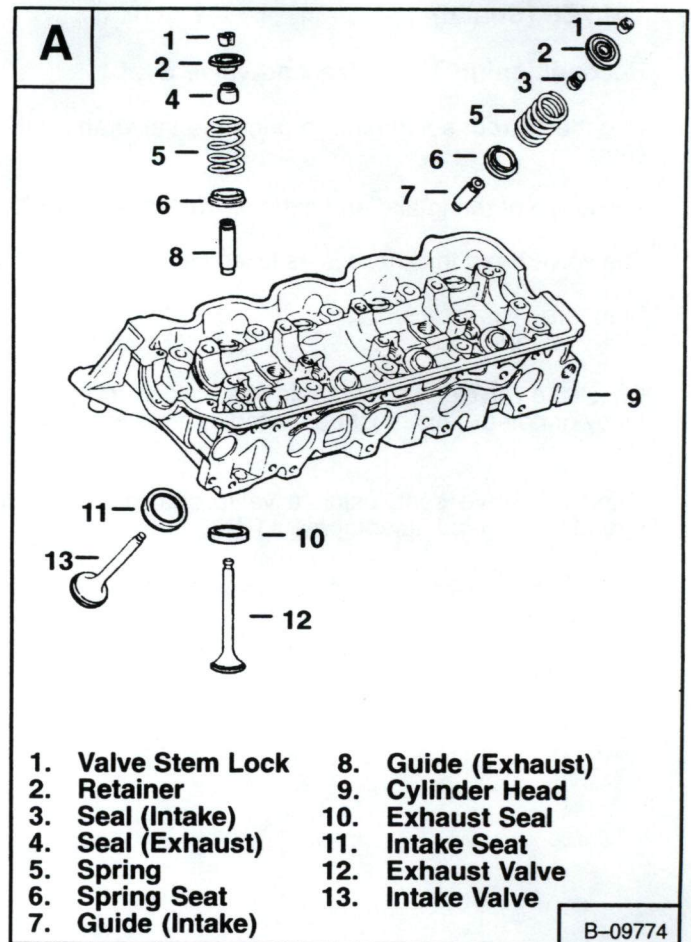
MEL1296 – Valve Stem Seal Installation

Remove the cylinder head from the engine block. (See Page 7D-31.)

Mark the valves so they will be returned to their original position when assembled.

Remove the valve spring locks, using a spring compressor [A].

Remove the spring retainer, spring, spring seat and valve [A].



Remove the valve stem seals with a plier and discard [B].

Before reassembly, check the valves, valve seats and guides.

Installation

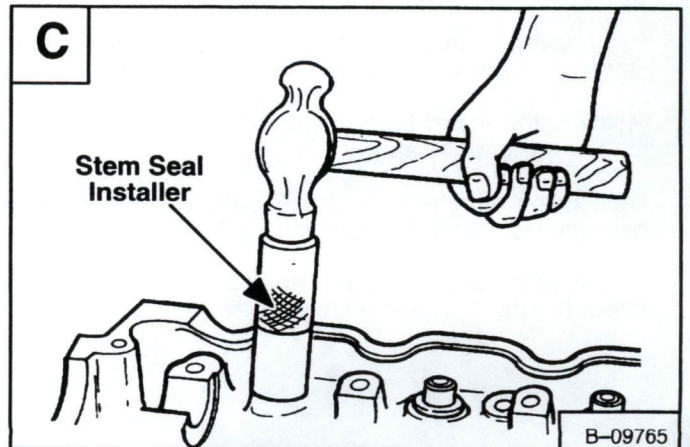
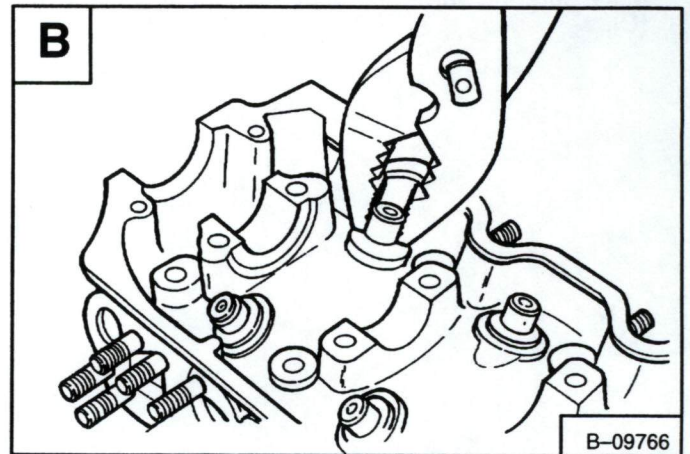
Make sure the cylinder head is clean.

Install the spring seal on the valve guide. Use the special tool, install the valve stem seal into position. DO NOT turn the seal when installing it.

The seal is installed in the specified position by the special tool. Incorrect installation of the seal will affect the seal lip I.D. and eccentricity, resulting in oil leakage down the valve guide.

Put oil on the valve stems and install. Install the valve springs and spring retainer. Use a spring compressor and install the valve spring locks.

Tap the valve stem with a hammer a small amount to seal the valve stem locks [C].



VALVES (Cont'd)

Reconditioning The Valve And Valve Seat

Use the correct equipment to grind the valve and valve seats.

The angle of the intake and exhaust valves is 45° [A].

The valve head thickness is as listed [A].

Standard 0.059 inch (1,5 mm)
 Service Limit 0.039 inch (1,0 mm)

Check the valve stem tip for being pitted, correct the stem tip by grinding. This must be limited to a minimum.

Grind the valve seat, using a valve seat cutter (hand operated) or grinding equipment [B].

Make sure the valve seat has the correct contact width [C].

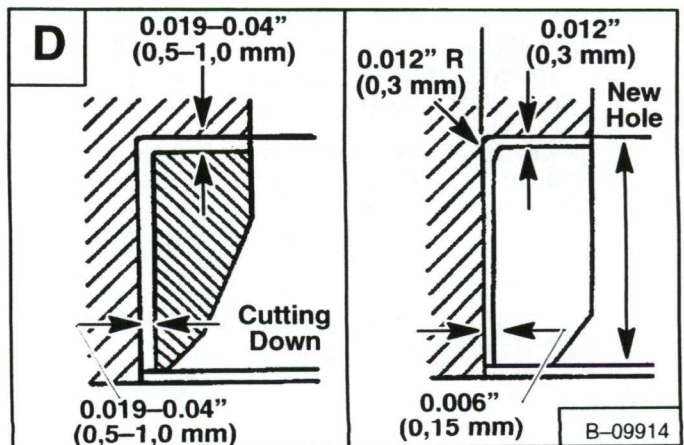
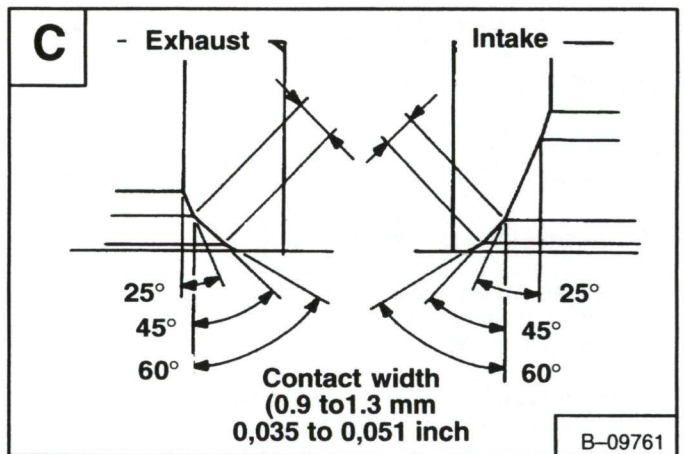
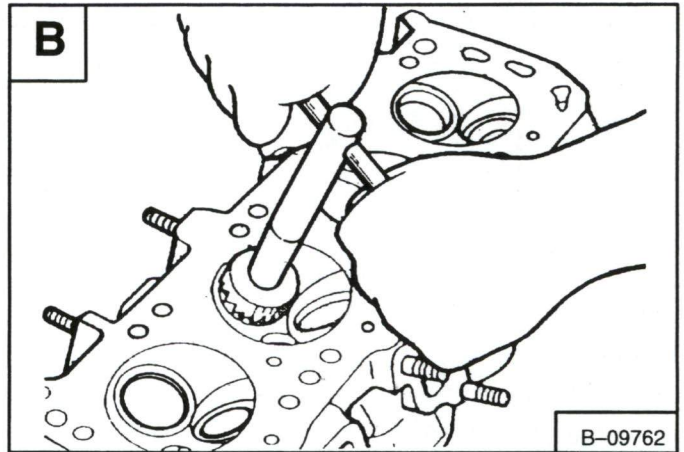
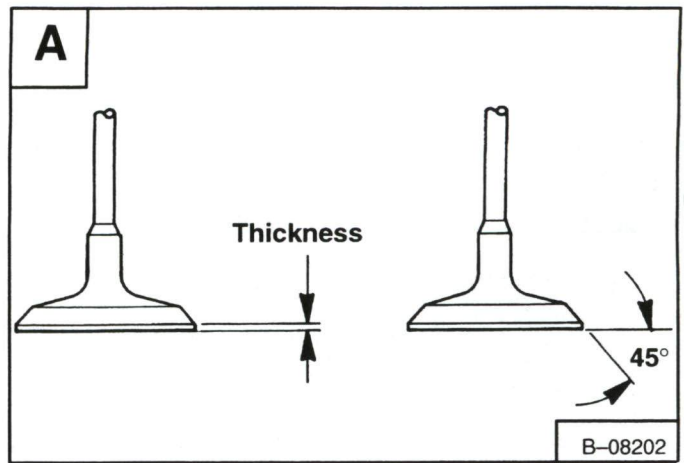
Valve Seat Inserts

Remove the valve seat insert which has been worn out by cutting down its wall thickness with a cutter as shown [D].

Machine the insert hole to the correct oversize with a cutter or reamer as shown [D].

Heat the cylinder head to 120°F. (50°C.) and press fit the oversize insert into the machined hole.

After installation, grind the insert to the correct angle and check the depth of the valve [C].



VALVES (Cont'd)

Valve Guide

The tool listed will be needed to do the following procedure:

MEL1298 – Valve Guide Installation & Removal

Check the valve guides for wear with a dial indicator [A].

If the movement is more than listed specifications, replace the valve guide.

Intake:

Standard 0.0012–0.0024 inch (0,03–0,06 mm)
Service Limit 0.004 inch (0,15 mm)

Exhaust:

Standard 0.0020–0.0035 inch (0,05–0,09 mm)
Service Limit 0.006 inch (0,15 mm)

NOTE: Make sure to check the valve stem for wear before replacing the valve guide.

Heat the cylinder head to a temperature of about 480°F. (250°C.). Use the correct tool and press the valve guide out of the cylinder head [B].

Check the specifications, Section 8 for the correct oversize valve guide.

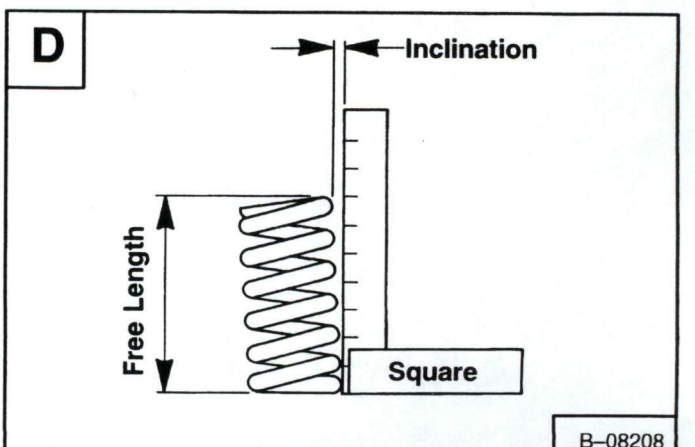
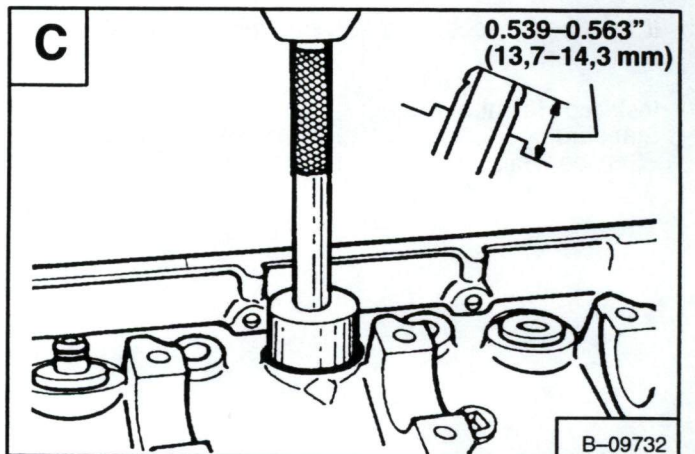
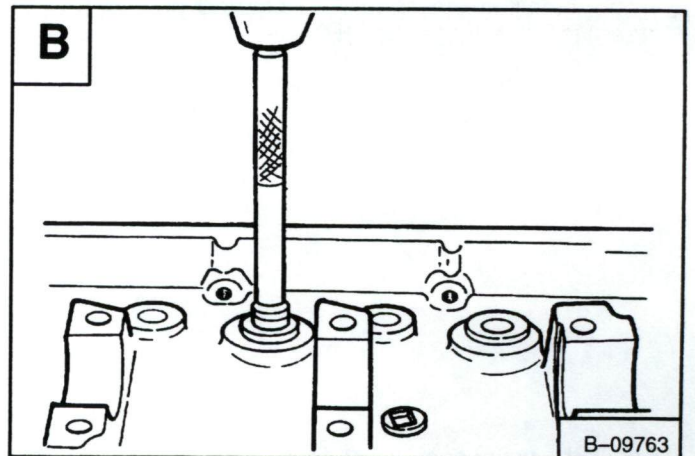
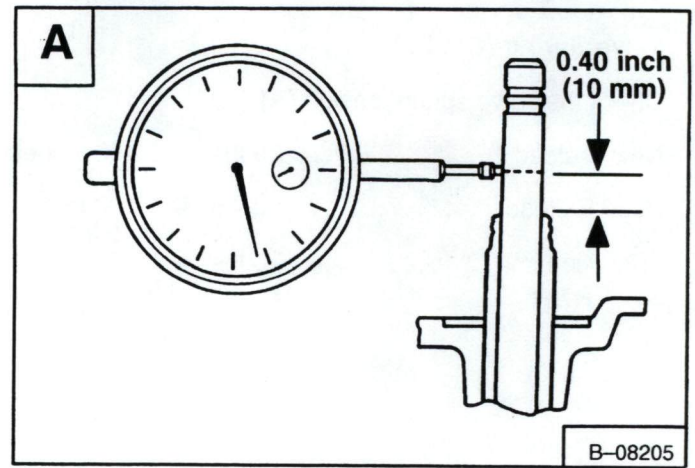
Ream each bore in the cylinder head to the correct size at normal temperature. Heat the cylinder head to about 480°F. (250°C.) and quickly press the valve guide into position using the correct special tool [C]. The correct tool, ensures the guide is pressed in the specified depth.

Valve Spring

Check the free length and inclination of the exhaust and intake springs [D].

New Free Length 1.811 inches (46 mm)
Service Limit -0.039 inch (-1,0 mm)

Inclination 1.5°
Service Limit 3°



VALVES (Cont'd)

Valve Spring (Cont'd)

Check the valve spring tension [A].

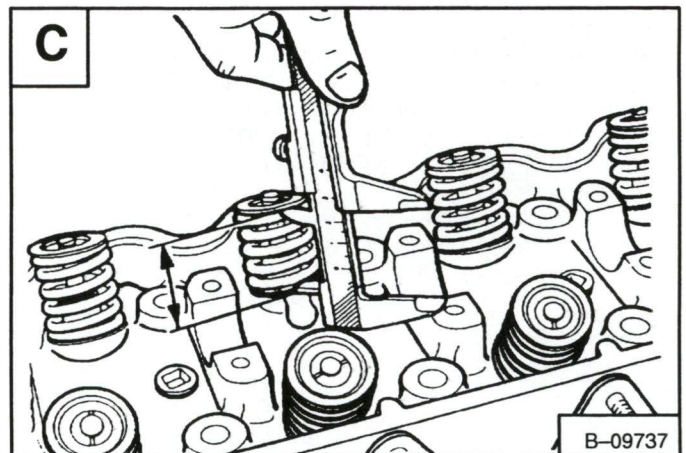
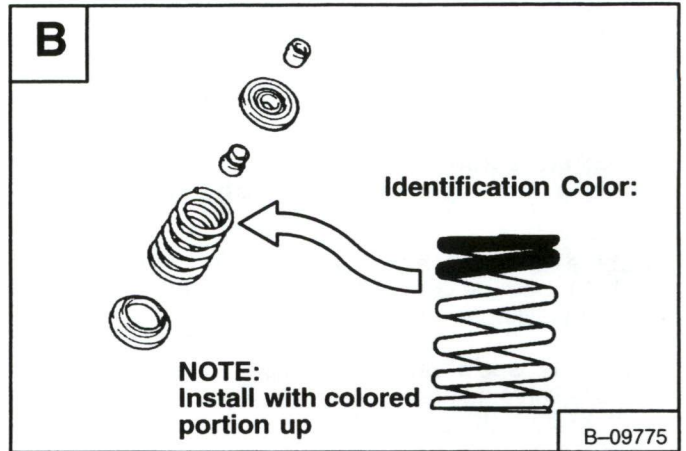
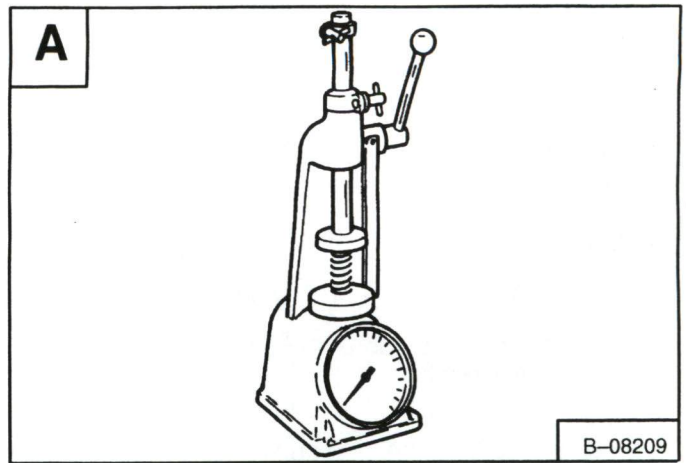
New Preload	29 lbs. @ 1.469 inches (129 N @ 37 mm)
Used Preload	83 lbs. @ 1.106 inches (369 N @ 28 mm)
Service Limit	76 lbs. @ 1.106 inches (338 N @ 28 mm)

The exhaust and intake valve springs are the same. When installing the spring the colored portion (red or green) is in the up position [B].

Check the valve seat insert depth [C].

If the depth exceed the service limit, replace the valve seat insert.

Installed Height of Spring:	
Standard	1.469 inches (37,3 mm)
Service Limit	+0.039 inch (+1,0 mm)



PISTON AND CONNECTING ROD

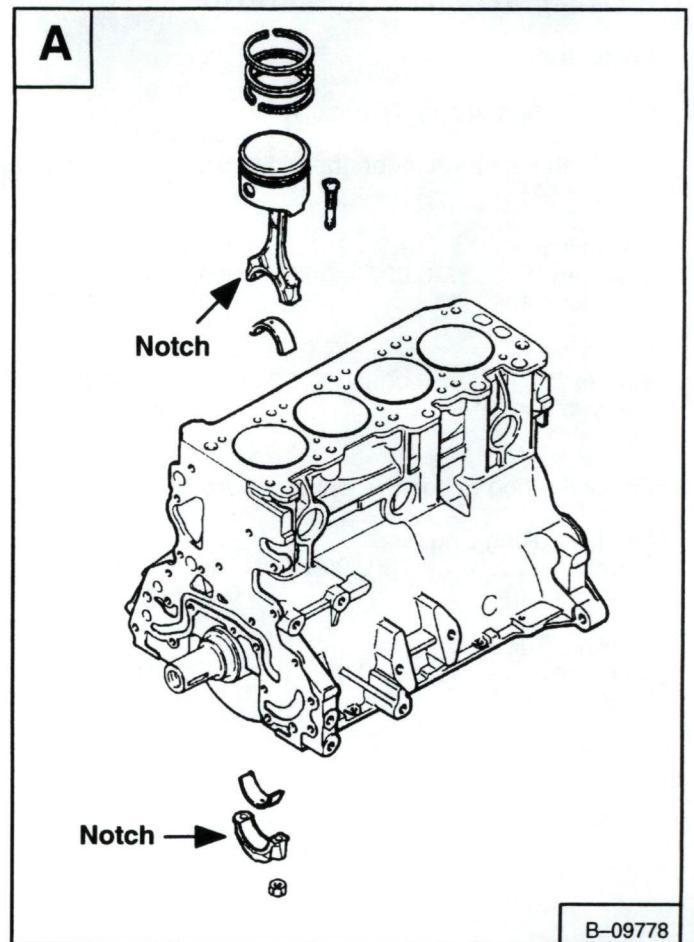
Removal

Remove the cylinder head. (See Page 7D-31.)

Remove the oil pan. (See Page 7D-52.)

Remove the ridge and carbon deposits at the top of the cylinder bore with a ridge reamer.

Make sure the piston has identification marks [A].



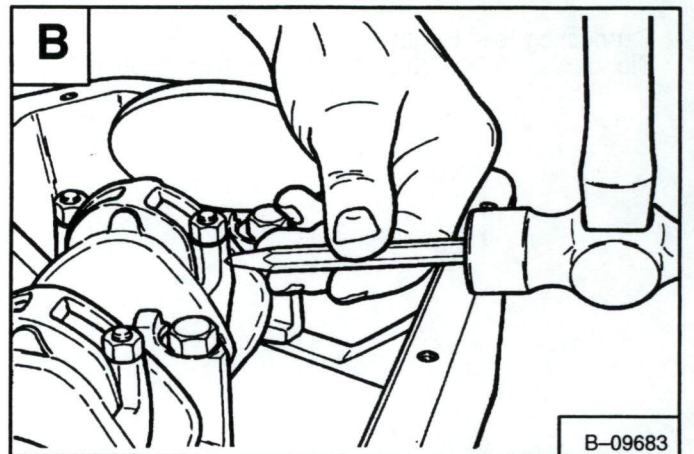
Rotate the crankshaft until a pair of connecting rods are at B.D.C. Make sure the connecting rod caps and the rods have identification marks [B].

Remove the nuts and remove the caps.

NOTE: If the bearings are to be used again, they must be marked so they will be returned to their original location.

Use a hammer handle, push the piston and rod assembly out of the engine block.

After the pair has been removed, rotate the engine crankshaft and remove the other pair of pistons.



Disassembly

Remove the rings from the pistons [C].

To remove the piston pin from the connecting rod, a special tool is needed. (See Page 7B-40 for the correct procedure for *Disassembly And Assembly*.)



PISTON AND CONNECTING ROD (Cont'd)

Inspection

Clean all the parts in clean solvent.

Check the clearance of the new rings in the piston grooves [A].

No. 1 Ring

Standard 0.0012–0.0028 inch (0,03–0,06 mm)
Service Limit 0.004 inch (0,1 mm)

No. 2 Ring

Standard 0.0008–0.0024 inch (0,02–0,06 mm)
Service Limit 0.004 inch (0,1 mm)

Check the ring gap in the cylinder bore [B].

No. 1 & 2 Ring End Gap:

Standard 0.008–0.016 inch (0,2–0,4 mm)
Service Limit 0.039 inch (1,0 mm)

Oil Ring Side Rail:

Standard 0.008–0.020 inch (0,2–0,5 mm)
Service Limit 0.39 inch (1,0 mm)

Check the connecting rod alignment [C].

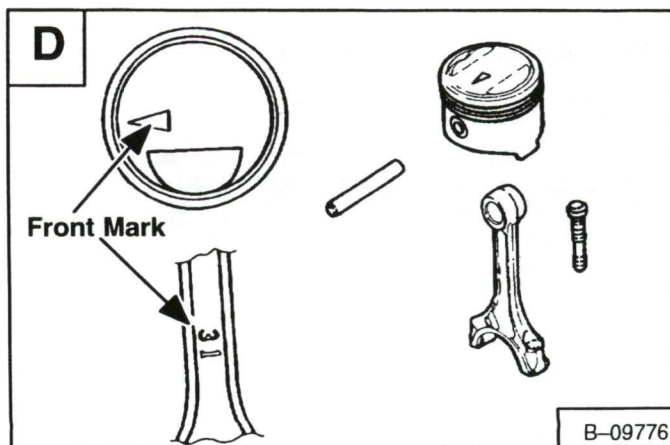
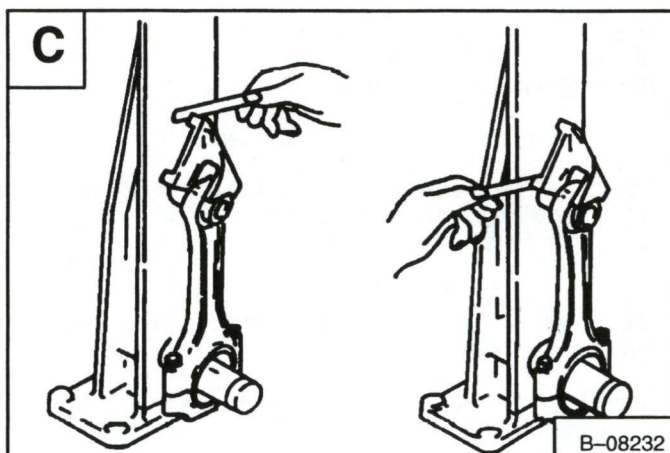
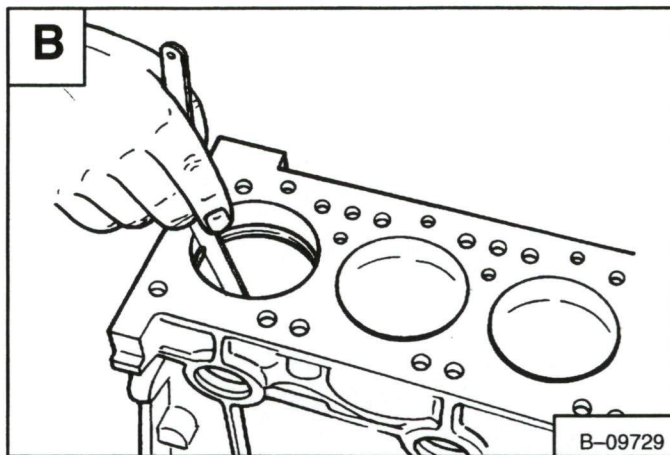
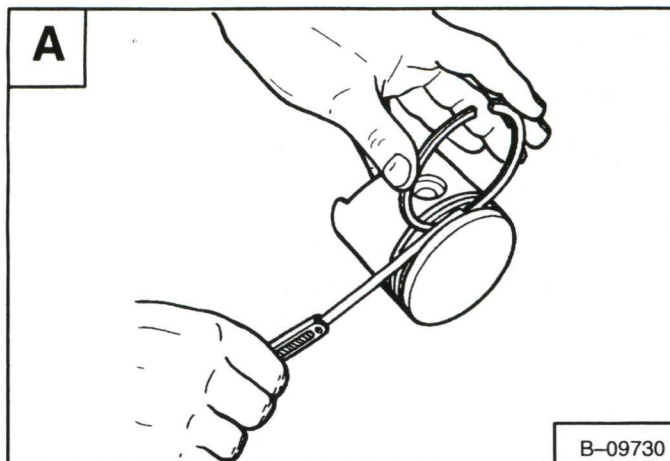
Connecting Rod Bend:

Standard .. 0.0020/3.937 inches or less (0,05/100 mm)

Assembly

When assembling the piston and connecting rod, make sure to align the marks on the piston and rod [D].

See Page 7B–41 for the correct procedure to press the piston pin into the connecting rod.



PISTON AND CONNECTING ROD (Cont'd)

Assembly (Cont'd)

Install the piston rings on the piston in the following sequence:

Install the three piece oil ring [A].

Install the No. 2 ring [B].

Install the No. 1 ring [B].

Installation

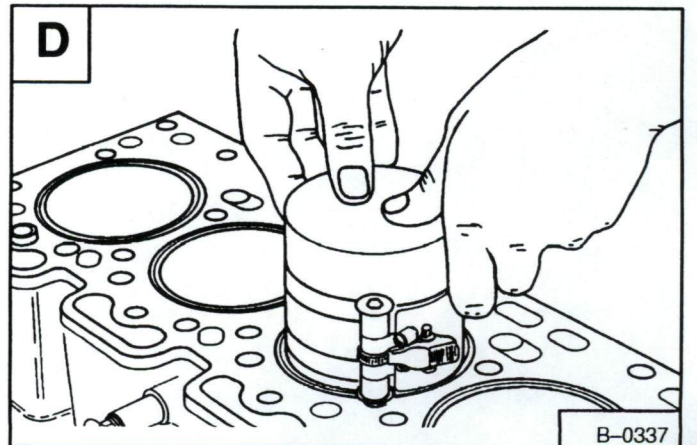
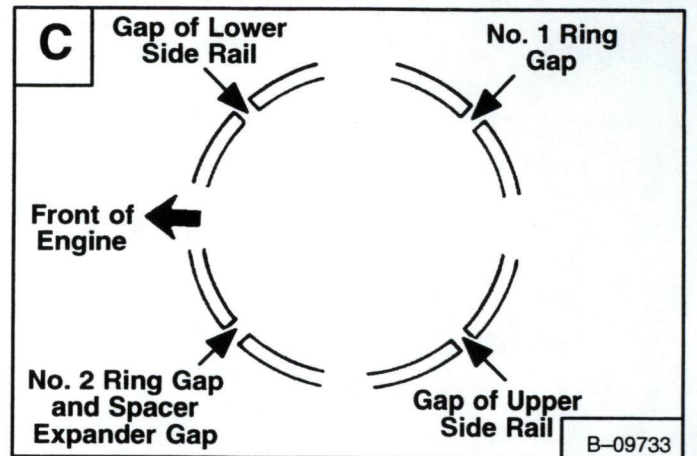
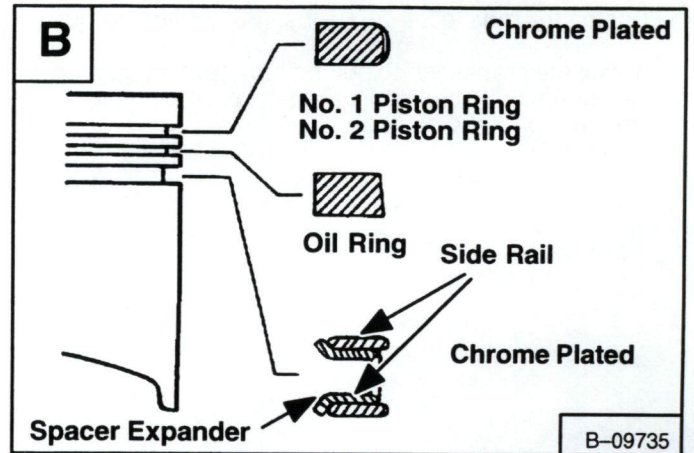
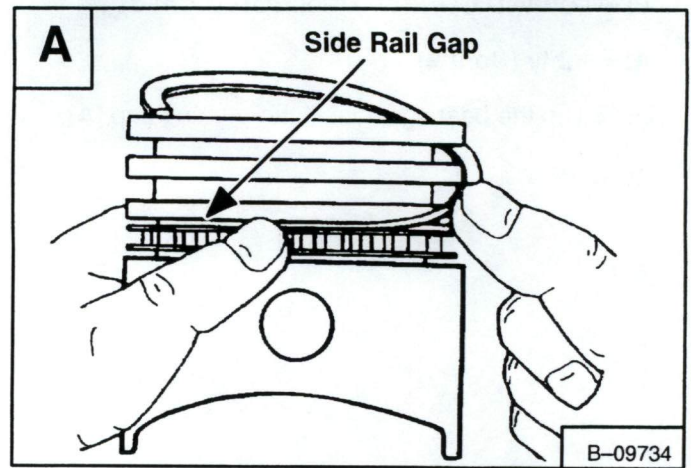
NOTE: Make sure the piston ring gaps are positioned as illustrated [C].

Put oil around the piston and piston rings.

Using a ring compressor tool, compress the rings on the piston.

Make sure the *mark* is toward the front of the engine block.

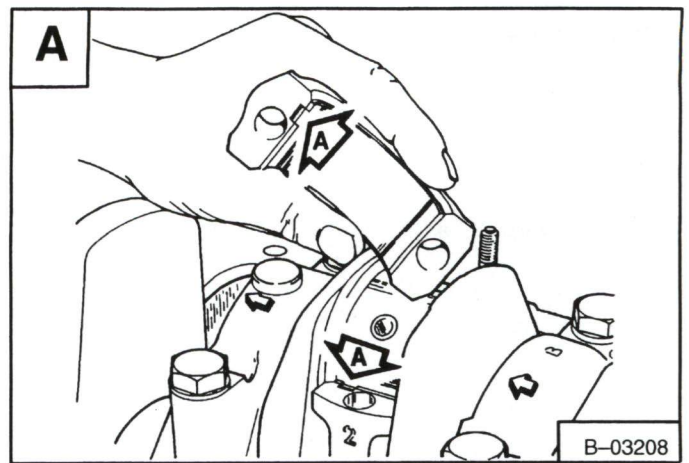
Install the piston and connecting rod assembly [D].



PISTON AND CONNECTING ROD (Cont'd)

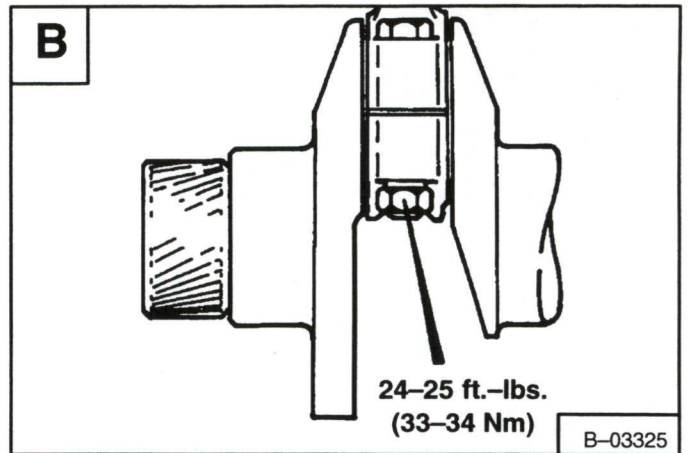
Assembly (Cont'd)

Put oil on the bearings. Install the bearing cap [A].



Tighten the nuts to 24–25 ft.-lbs. (33–34 Nm) torque [B].

Rotate the crankshaft to put the other pair of crankpins at the bottom dead center. Repeat the procedure and install the other pair of pistons.



PISTON PIN

Assembly Of The Tool

The tool listed will be needed to do the following procedure:

MEL1286 – Piston Pin Tool Set

Install the retaining ring (Item 1) [A] on the tube (Item 2) [A] (MEL1290).

Drive or press the tube into the base (Item 3) [A] (MEL1291).

Install the rear support (Item 4) [A] and wing nut (MEL1289).

NOTE: The rear support will have to be adjusted so the piston and connecting rod assembly are level in the anvil.

Install the anvil (Item 1) [B] on the tube (MEL1293).

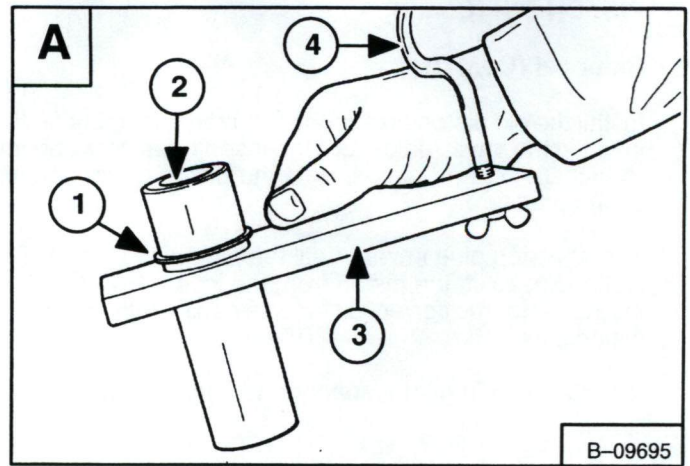
Install the insert (Item 2) [B] on the anvil (MEL1294-1).

Removal

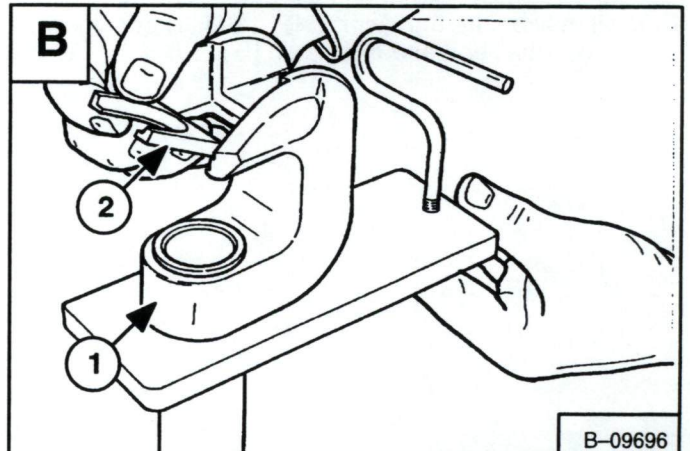
Before pressing the old pin from the piston and connecting rod assembly do the following, this will correctly set up the tool:

Install the stop plug (MEL1287) into the tube [C].

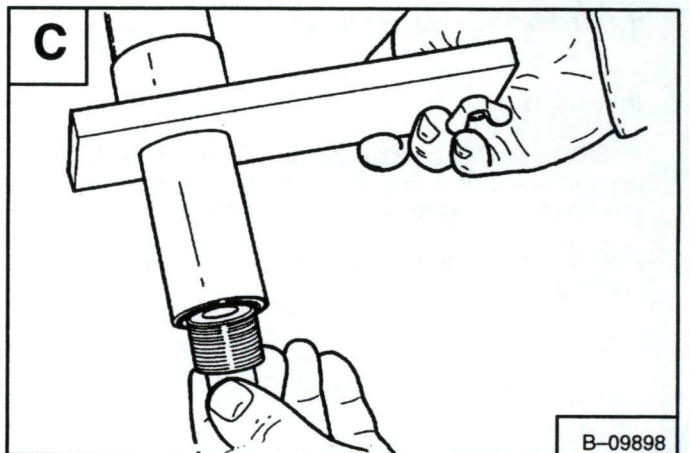
Install the spring (MEL1288) (Item 1) [D], spacer (MEL1294-3) (Item 2) [D] and pin guide (MEL1292) (Item 3) [D] into the tube.



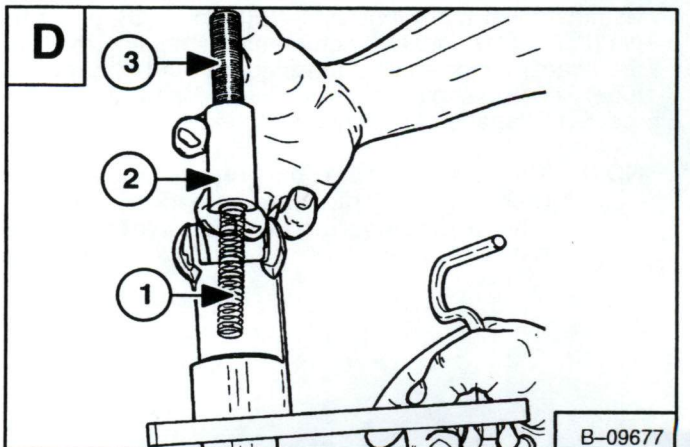
B-09695



B-09696



B-09898



B-09677

PISTON PIN (Cont'd)

Removal (Cont'd)

Install the old piston and connecting rod assembly on the insert in the anvil. Make sure the insert goes between the rod small end and piston. hold the piston down against spring pressure.

Turn the stop plug inward until the pin guide (Item 1) [A] just begins to lift the piston from the insert. Now the stop plug is set for the correct distance when installing the new piston pins.

Remove the pin guide, spacer and spring from the tube.

Install the piston and connecting rod assembly into the anvil, make sure the insert (MEL1294-1) goes between the rod small end and the piston [B].

Use the drive tool (MEL1294-2) (Item 1) [C] and press the pin from the rod and piston.

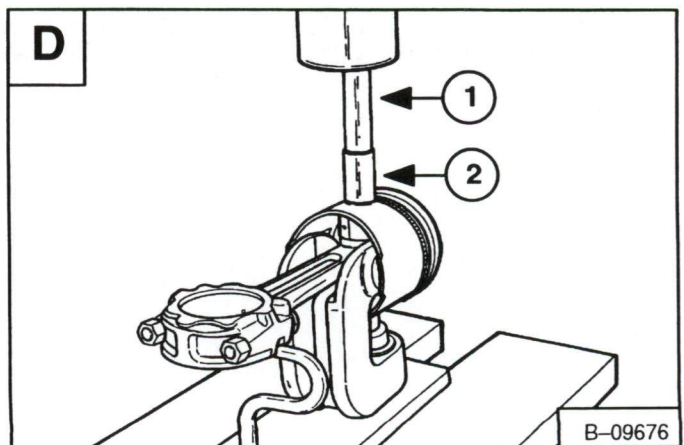
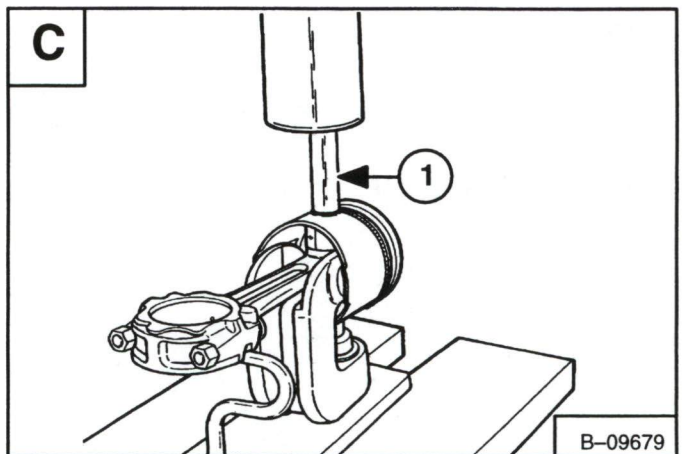
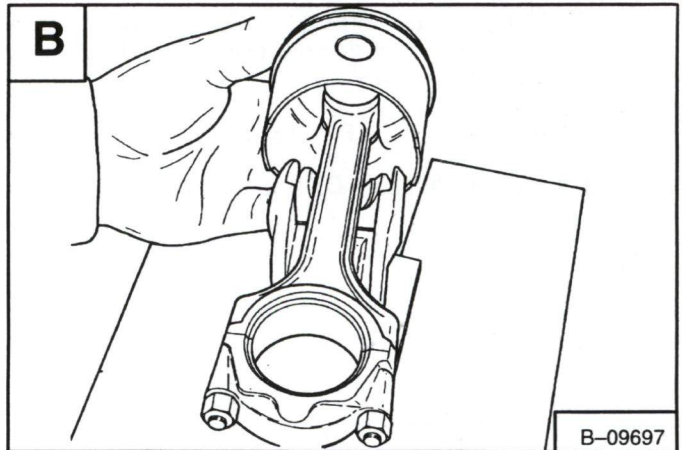
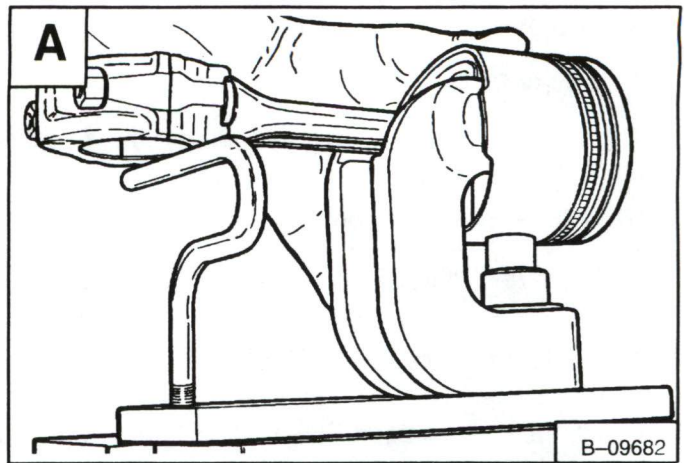
Installation

Install the spring, spacer and pin guide into the tube. The pin guide, under spring pressure, will pass up through the rod and piston in line until the new pin is installed.

Put oil on the piston pin before installing it into the piston and rod.

Use the driver tool (MEL1294-2) (Item 1) [D], press the pin (Item 2) [D] into the piston and connecting rod, until the spacer stops against the plug on the bottom of the tube. Check to see if the pin is centered in the connecting rod. Equal space at both sides of the piston pin.

NOTE: The piston must be free to move while pressing the pin into position, check it several times during installation of the piston pin.



CYLINDER LINERS

Checking

Check the cylinder bore with an inside micrometer. the checks must be made at parallel and right angles to the center line of the bore [A].

Measuring points are done approximately 0.35 inch (9 mm), 3.5 inches (90 mm) and 5.4 inches (137 mm) below the top of the cylinder bore.

Standard 3.0276 inches (76,8 mm)

Out-Of-Round and Taper:

Standard 0.0008 inch (0,02 mm) or less

Piston to Cylinder Wall Clearance:

Standard 0.0008–0.0016 inch (0,02–0,04 mm)

If the cylinder bores shown wear more than specified out-of-round or taper or if the bores are badly scooped or scored, the cylinder block must be re-bored and honed to oversize and O/S pistons fitted.

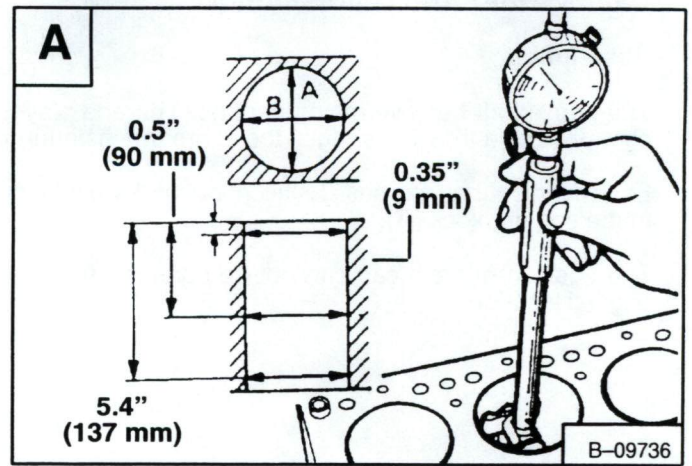
piston Service Size:

0.010 inch (0,25 mm) O.S.

0.020 inch (0,50 mm) O.S.

0.030 inch (0,75 mm) O.S.

0.039 inch (1,00 mm) O.S.



CRANKSHAFT AND MAIN BEARINGS

Description

The crankshaft has five main bearings. The end play is controlled by a thrust bearing at the center main bearing.

Each main bearing cap has identification marks in relation to the engine block [A].

The position of each cap can not be changed from the original location.

Removal

Remove the timing cover and timing belt. (See Page 7B-47.)

Remove the oil pan. (See Page 7B-51.)

Remove the crankshaft rear oil seal and case [B].

Remove the main bearing caps and bearings [C].

NOTE: If the main bearings are going to be used again, put a mark on them for correct installation.

Remove the crankshaft.

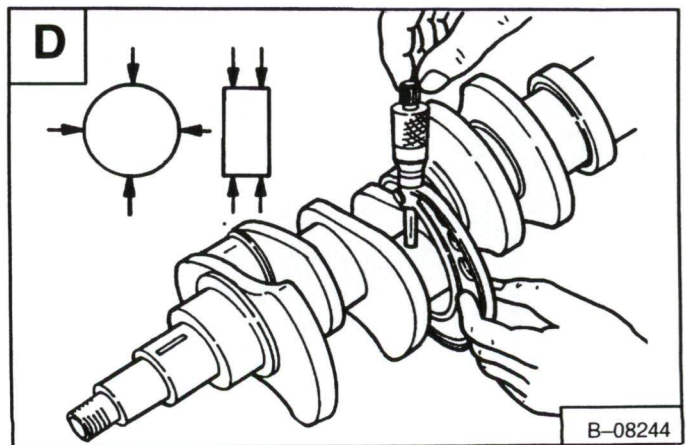
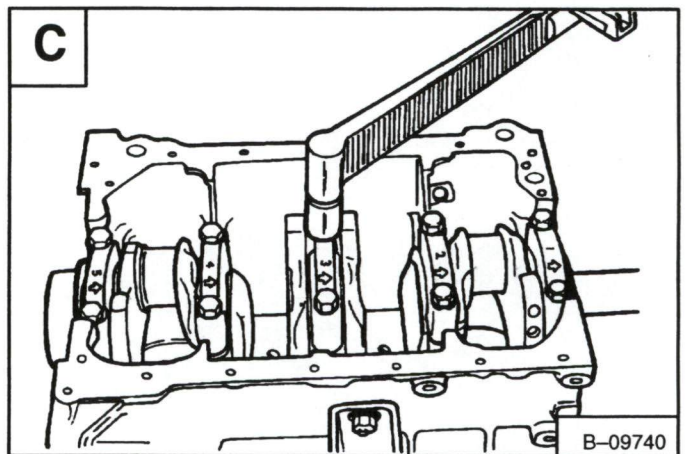
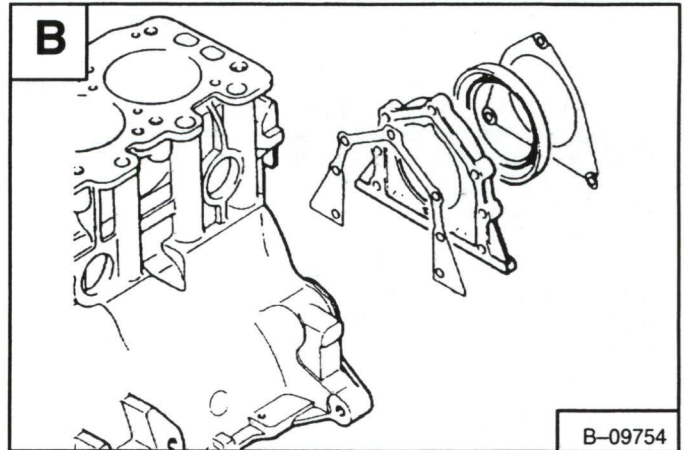
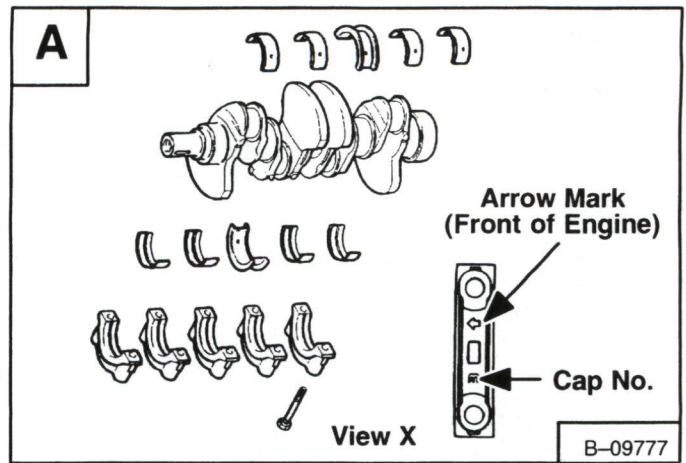
Checking

Check the crankshaft connect rod journals [D]:

Standard 1.7717 inches (45 mm)

Out-of-Round and Taper 0.0004 inch
(0,01 mm) or less

Oil Clearance ... 0.0004-0.0024 inch (0,01-0,06 mm)



CRANKSHAFT AND MAIN BEARINGS (Cont'd)

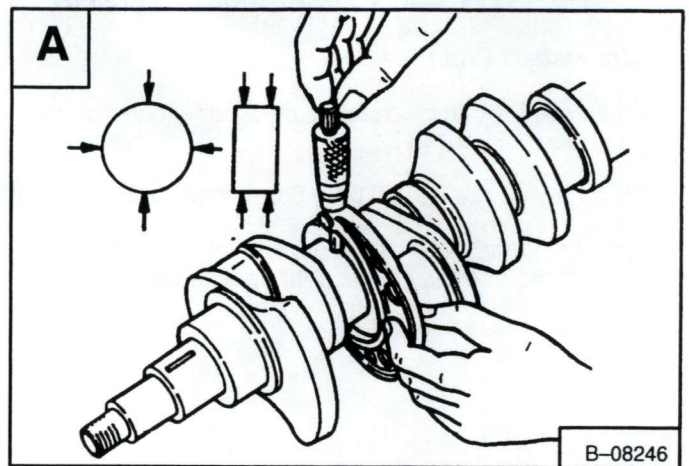
Checking (Cont'd)

Check the crankshaft main bearing journals [A]:

Standard 2.244 inches (56,99 mm)

Out-of-Round and Taper 0.0004 inch (0,01 mm)
or less

Oil Clearance ... 0.0008–0.0028 inch (0,02–0,07 mm)



Checking Oil Clearance (Plastic Gauge)

Remove all the oil from the crankshaft bearing journals to be checked.

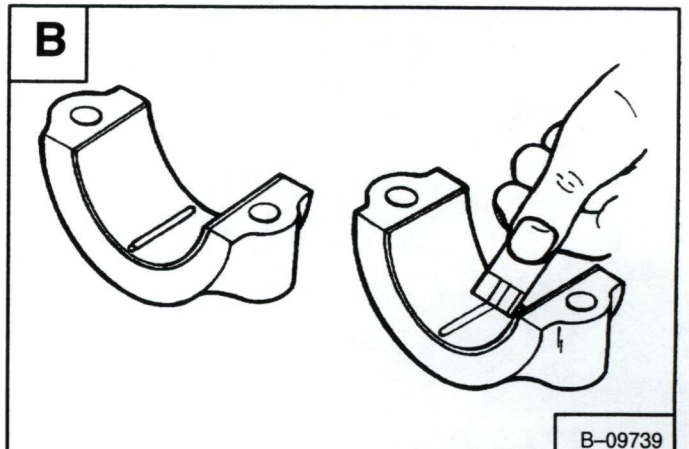
Cut plastic gauge to the width of the bearing [B].

Install the bearing cap. Tighten the bolts to 37–39 ft.-lbs. (50–53 Nm) torque.

DO NOT turn the crankshaft.

Remove the bearing cap. Measure the width of the plastic gauge [B].

If the clearance exceeds the limit, bearing must be replaced or undersize used.



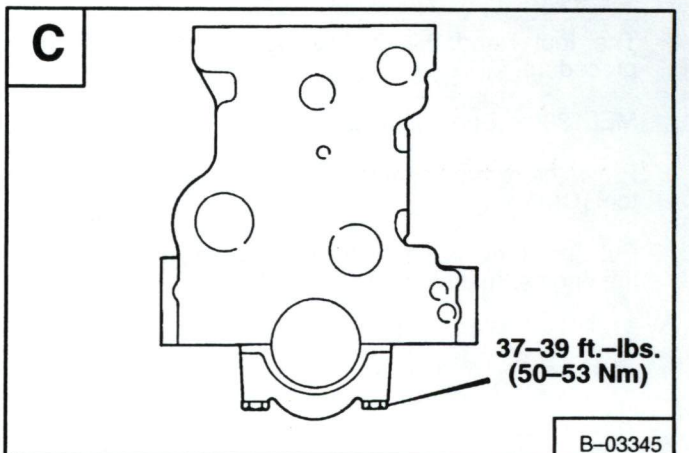
Installation

Install the upper bearings in the engine block.

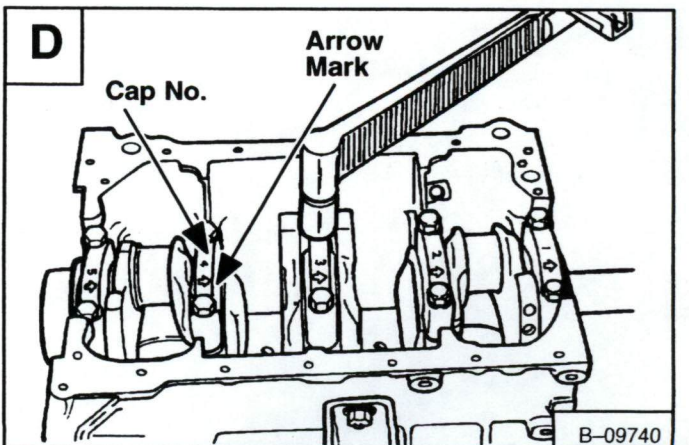
Put oil on the crankshaft journal.

Install the crankshaft.

Install the main bearing caps and tighten to specified torque [C].



Starting at the center bearing cap and moving toward each end of the crankshaft [D].



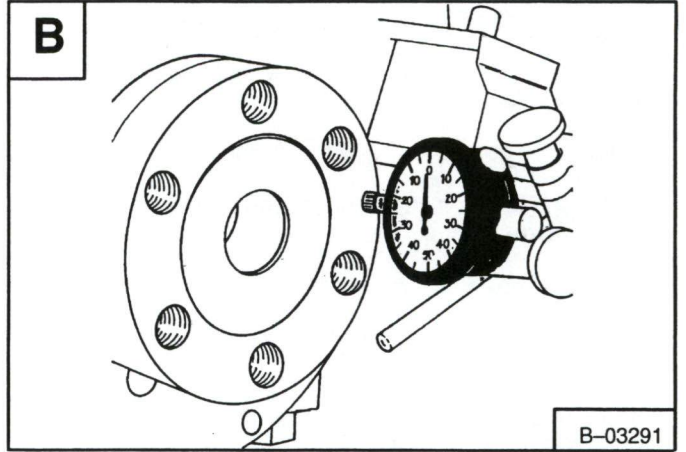
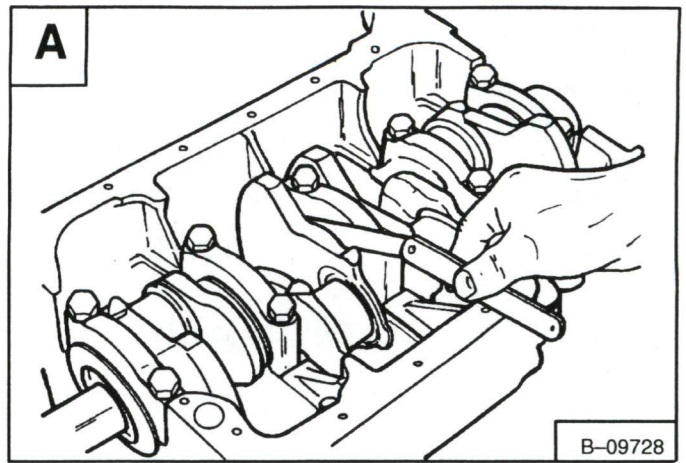
CRANKSHAFT AND MAIN BEARINGS (Cont'd)

Crankshaft End Play

The end play can be checked by either a feeler gauge [A] or a dial indicator [B].

End Play 0.002–0.007 inch (0,05–0,18 mm)

The fitting of oversize thrust bearing can be used to correct the end play if it is over specifications.



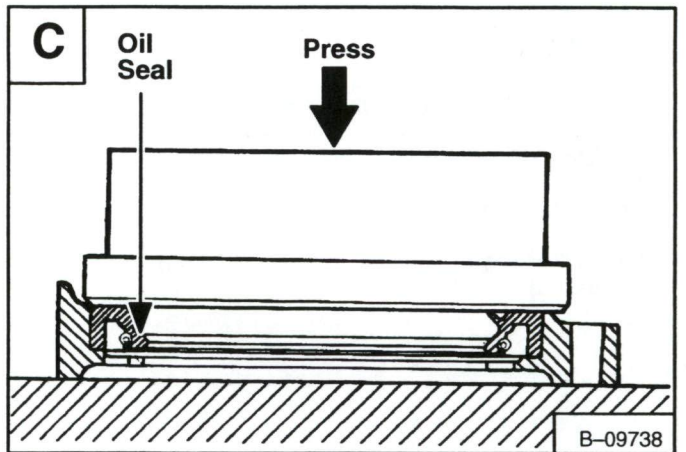
Rear Oil Seal

The tool listed will be needed to do the following procedure:

MEL1300 – Seal Installation Tool

Press the rear oil seal into the housing using the special tool [C].

Put oil on the seal lip. Install the housing and rear seal on the engine. Install the bolts and tighten.



TIMING BELT

Adjustment

It is not necessary to remove the timing belt covers for adjustment.

Check and adjust the belt tension every 500 hours of loader operation, use the following procedure:

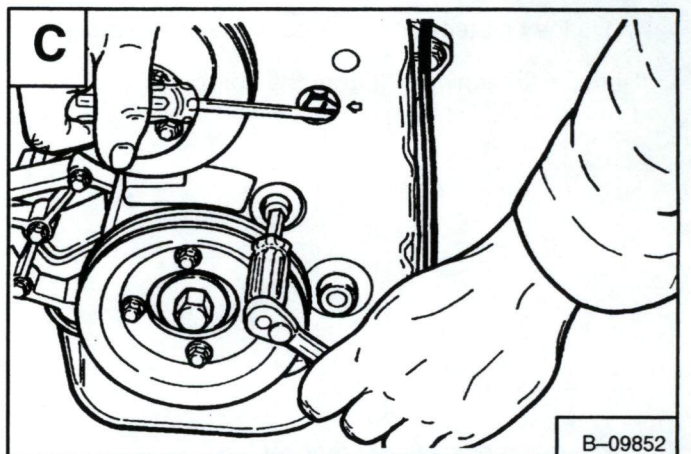
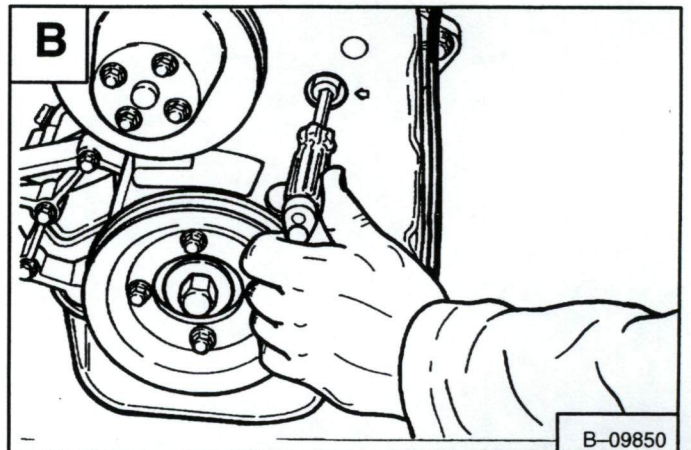
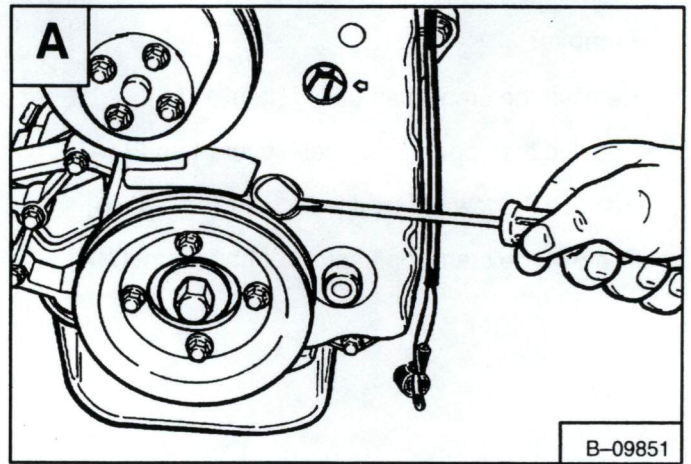
Remove the shield from the engine.

Remove the plugs (two) in the cover for the timing belt [A].

Loosen the top nut and bottom bolt [B].

Put a screwdriver into the top hole and push on the belt tensioner bracket to remove excessive slack from the timing belt [C].

Tighten the bottom bolt after the slack has been removed [C].



TIMING BELT (Cont'd)

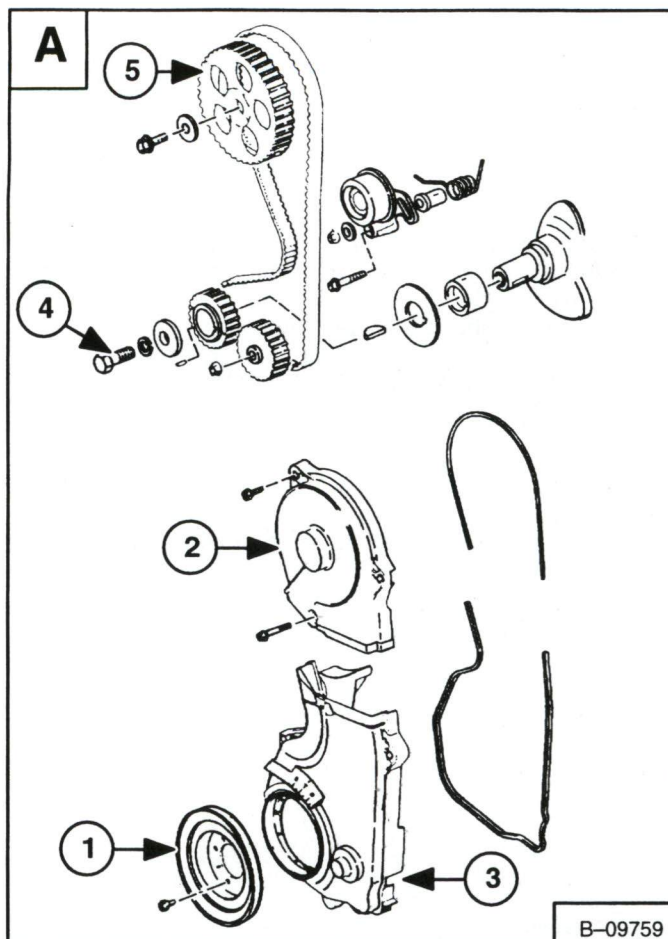
Removal

Remove the crankshaft pulley (Item 1) [A].

Remove the upper timing belt cover (Item 2) [A].

Remove the lower timing belt cover (Item 3) [A].

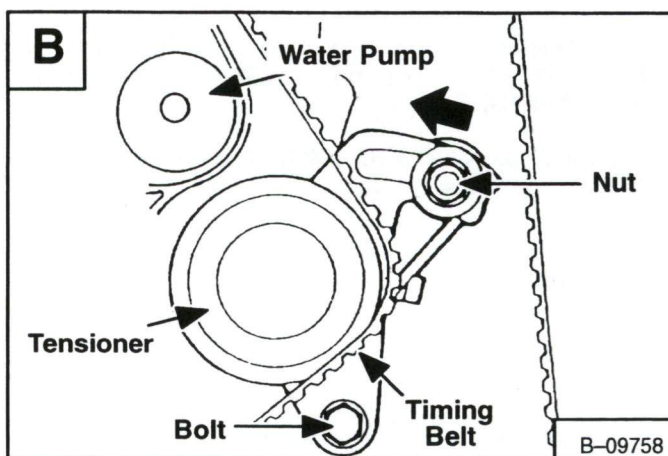
Remove the crankshaft sprocket bolt (Item 4) [A].



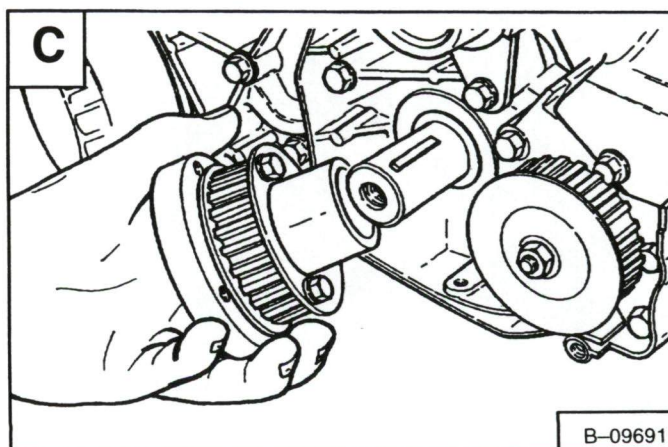
Loosen the belt tensioner mounting nut [B].

Move the belt tensioner to loosen the timing belt [B].

Remove the timing belt from the sprockets.



Remove the crankshaft sprocket [C].



TIMING BELT (Cont'd)

Inspection

Check the timing belt sprockets and tensioner for wear, cracks or damage.



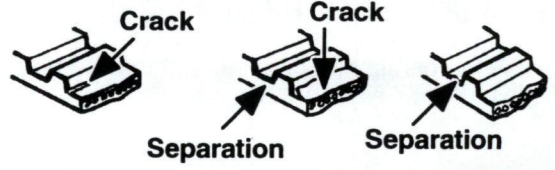





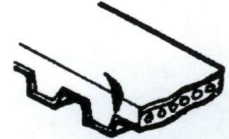
The surfaces of the oil pump sprocket and camshaft spacer which contact the oil seal must be checked for wear.

Inspect the tensioner for easy and smooth rotation. Check for end play and noise.

Check the belt for oil or dust deposits. The slight deposits must be cleaned with cloth or paper. DO NOT use solvent to clean the timing belt.

Check the timing belt in detail for the following conditions, replace as needed **[A]**.

1. Hardened back surface rubber.
2. Cracked back surface rubber.
3. Cracked or exposed canvas.
4. Badly worn teeth (initial stage).
5. Badly worn teeth (last stage).
6. Cracked tooth bottom.
7. Missing tooth.
8. Side of belt badly worn.
9. Side of belt cracked.

A	Flaw Conditions
1.	<p>Back surface glossy. Non-elastic and so hard that even if a fingernail is forced into it, no mark is produced.</p> 
2.	
3.	
4.	<p>Canvas on load side tooth flank worn. Fluffy canvas fibers, rubber gone and color changed to white, and unclear canvas texture.</p> 
5.	<p>Canvas on load side tooth flank worn down and rubber exposed (tooth width reduced).</p> 
6.	
7.	
<p>NOTE: Normal belt should have clear-cut sides as if cut by a sharp knife.</p>	
8.	
9.	

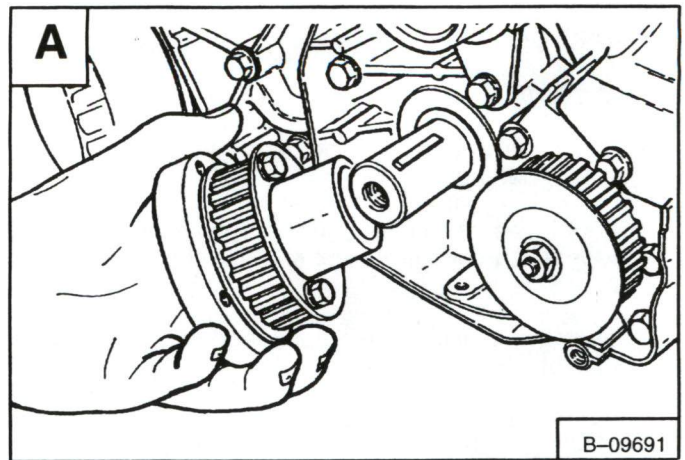
B-09751

TIMING BELT (Cont'd)

Assembly

Install the crankshaft sprocket [A].

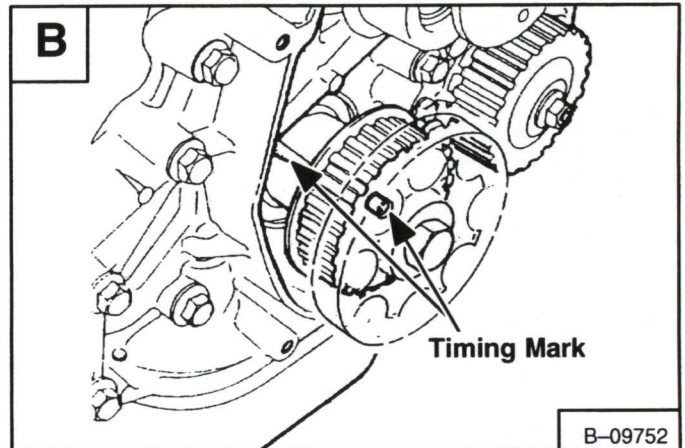
Tighten the bolt to 44–50 ft.-lbs. (60–68 Nm) torque.



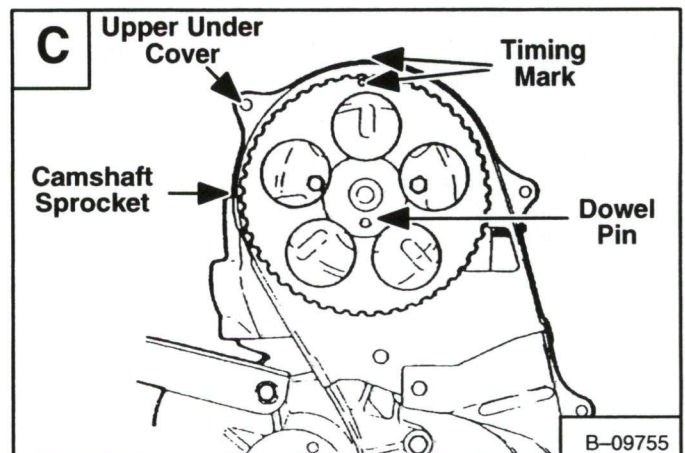
Align timing mark on the crankshaft sprocket with the timing mark on the front case [B].

Put a small amount of oil on the outside of the camshaft spacer and install the spacer on the camshaft.

Install the camshaft sprocket. Tighten the bolt to 44–57 ft.-lbs. (60–77 Nm) torque.



Align the camshaft timing mark with the mark on the upper cover [C].

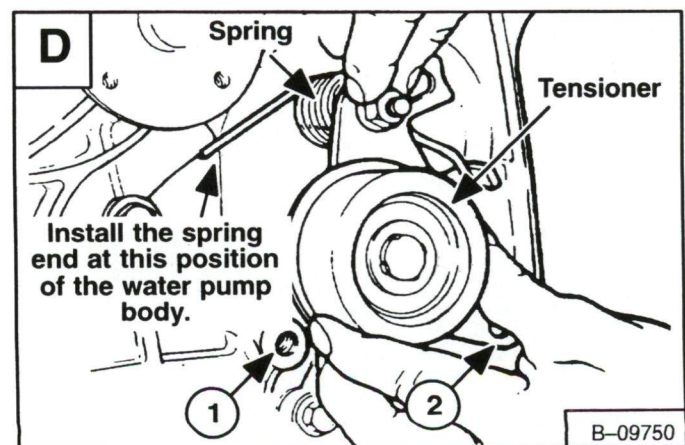


Install the spring and tensioner, and temporarily tighten the nut [D].

Push the flange, located under the tensioner, to make alignment of the holes (Items 1 & 2) [D]. Install the bolts into the holes.

Install the front end of the spring (bent at right angle) on the projection of the tensioner.

Install the other end (straight end) on the water pump body [D].



TIMING BELT (Cont'd)

Assembly (Cont'd)

Install the timing belt, use the following procedure:

Put the belt on the crankshaft sprocket.

Install on the oil pump sprocket.

Then on the camshaft sprocket.

Make sure that all the timing marks are in alignment.

Move the belt tensioner to apply pressure to the belt [A].

NOTE: Do not turn the crankshaft in a reverse direction. DO NOT push or twist the belt or try to test the tension. This will result in incorrect belt tension.

Push the tensioner, with your hand a small amount to make sure the belt comes in complete mesh with the sprockets. If this is neglected and the belt tension adjusted with the belt out of mesh with the sprocket (Item 1) [B], the belt tension will not be correct.

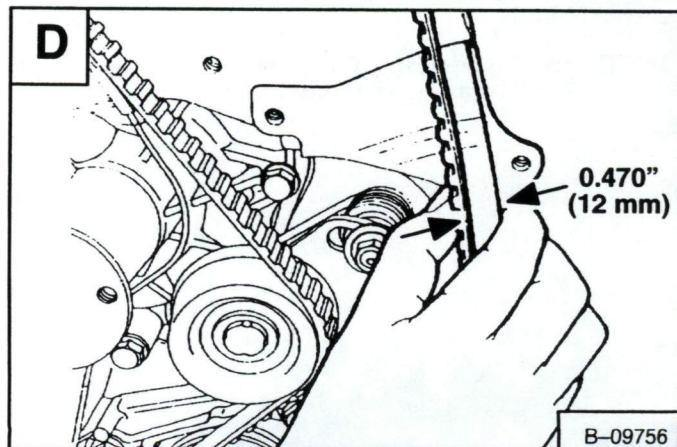
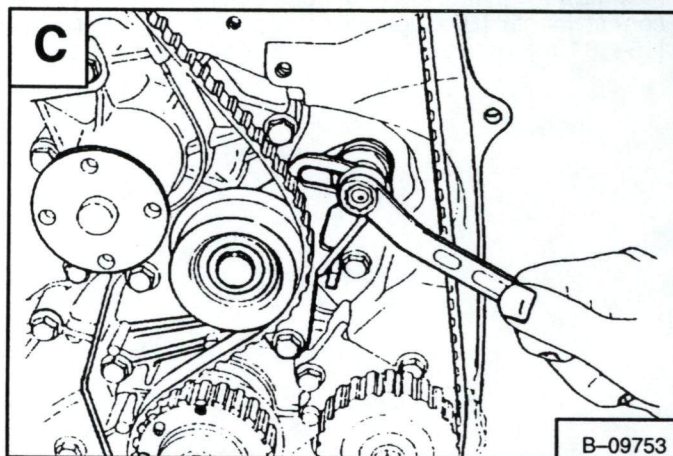
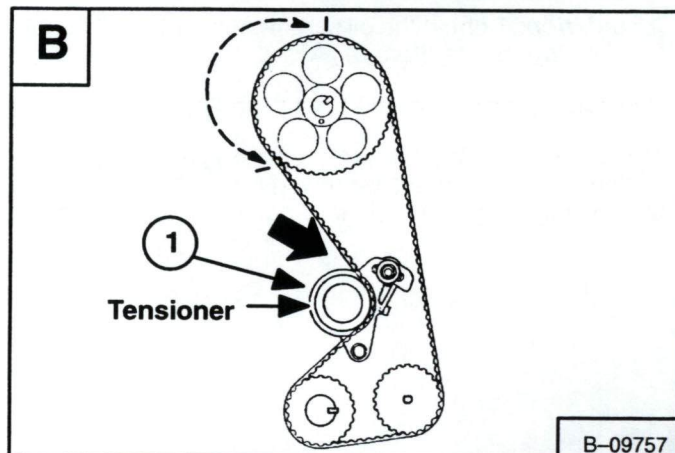
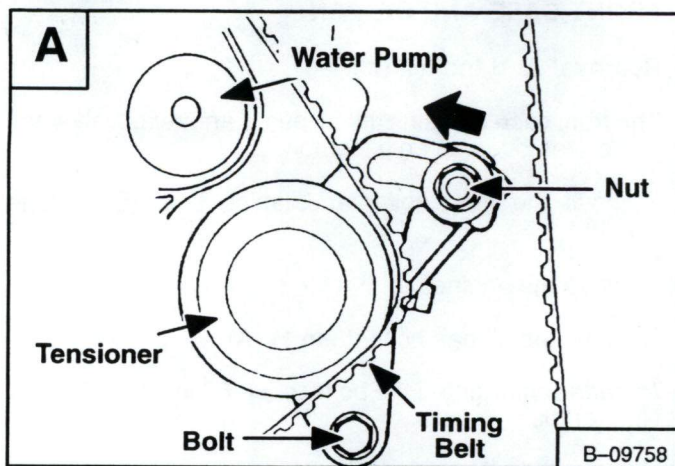
Turn the engine through one revolution in normal direction, to remove all slack at the timing belt.

Tighten the tensioner mounting nut first and then the bolt [C].

Tighten the nut and bolt to 16–21 ft.-lbs. (22–28 Nm) torque.

Check the tension side of the timing belt, the clearance between the belt and the seal line is 0.470 inch (12 mm) [D].

If specifications are not correct, readjust the belt.



FRONT CASE AND OIL PAN

Removal And Installation

The front case contains the oil pump and relief valve and can be removed as an assembly.

Remove the front cover and timing belt. (See Page 7D-48.)

Remove the engine oil.

Remove the oil pan bolts (Item 1) [A].

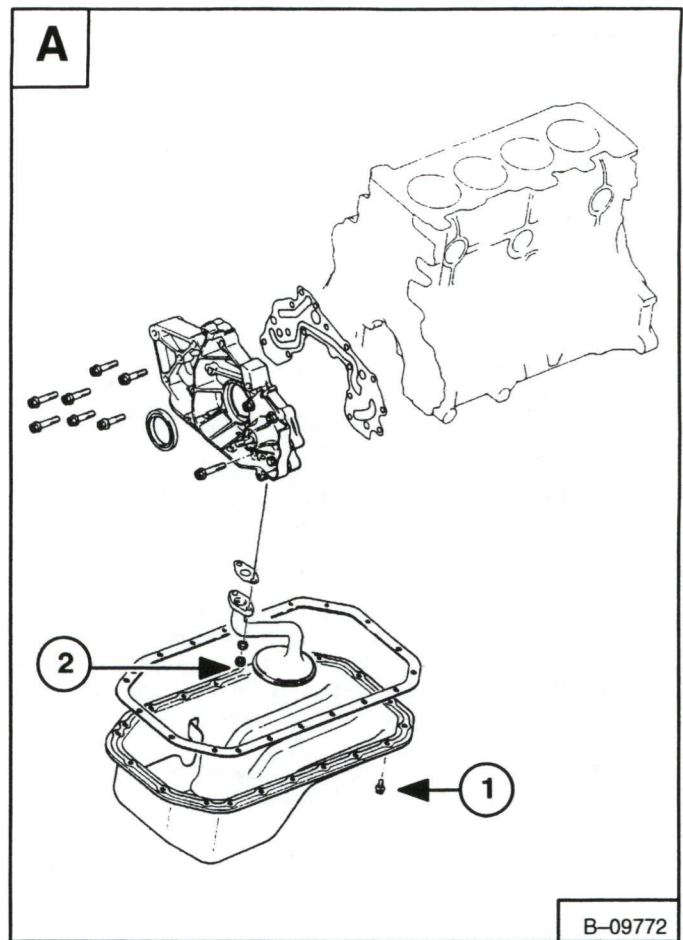
Installation: Tighten the bolts to 54-66 in.-lbs. (6,1-7,5 Nm) torque.

Remove the oil pan and oil screen.

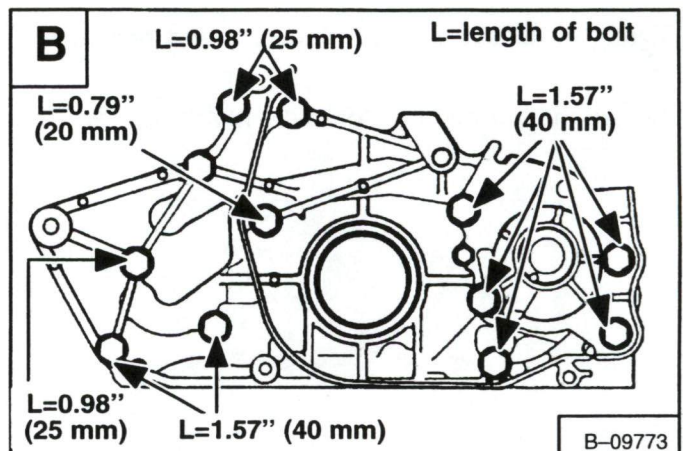
Installation: Tighten the oil screen nuts to 13-18 ft.-lbs. (18-24 Nm) torque (Item 2) [A].

Remove the bolts from the front case [A].

The front case is held closely to the engine block, it may be hard to loosen. Insert a screwdriver into the groove and pry. Avoid prying on the thinner portion of the flange.

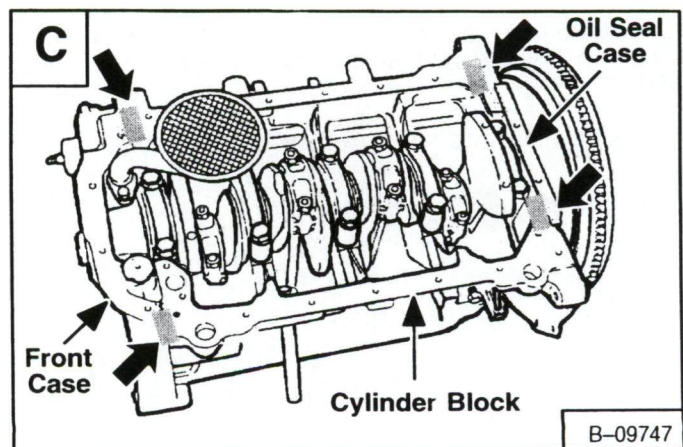


Installation: Install the front case bolts according to the correct length [B]. Tighten the bolts to 11-13 ft.-lbs. (15-18 Nm) torque.



When installing the oil pan, apply sealant to the four areas shown [C].

NOTE: For inspection of the oil pump. (See Page 7D-53 for the specifications.)



OIL PUMP

Removal

Remove the timing cover and timing belt. (See Page 7D-48.)

Remove the oil pump sprocket, use the following procedure:

Use an old timing belt and put it around the oil pump sprocket to hold it. DO NOT use a screwdriver.

Loosen the nut at the sprocket.

Remove the timing belt and sprocket.

Remove the pump bolts at the oil pump.

Slide the oil pump assembly away from the front case [A].

Remove the rotor from the oil pump cover.

Inspection

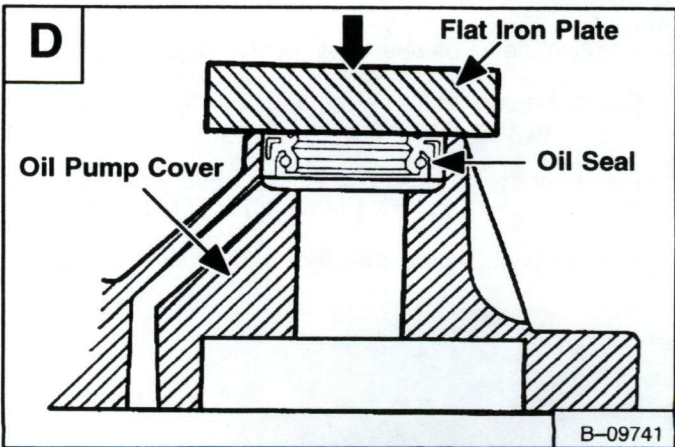
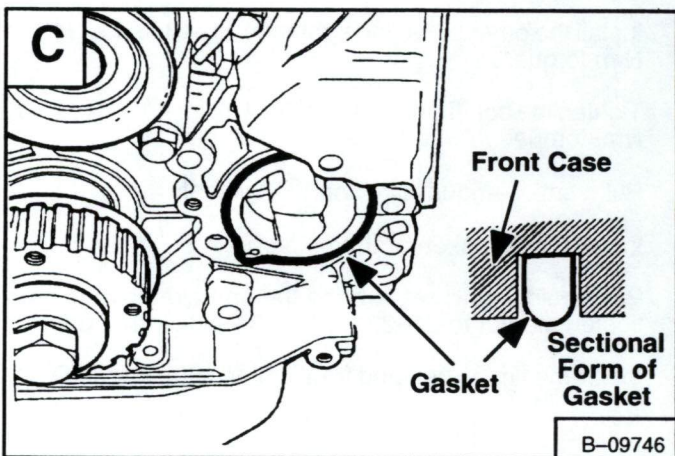
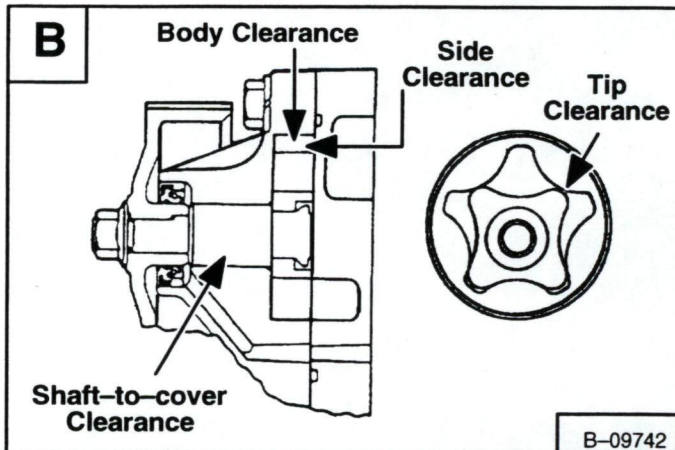
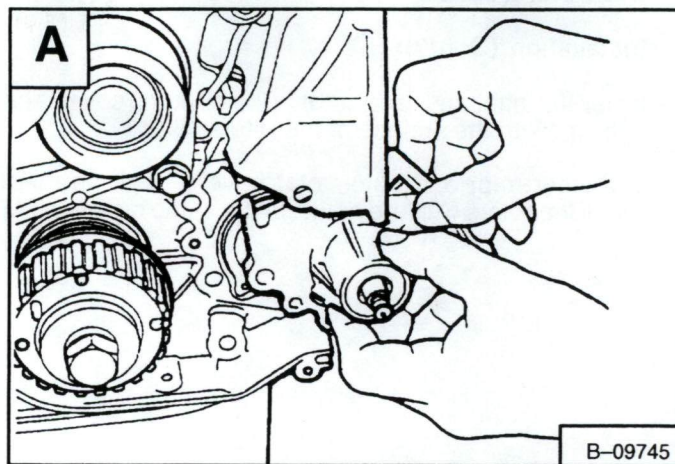
Use a feeler gauge to check the clearances as listed [B]:

Tip Clearance 0.0016–0.0047 inch (0,4–0,12 mm)
Body Clearance 0.0039–0.0063 inch (0,10–0,16 mm)
Side Clearance 0.0008–0.0020 inch (0,02–0,05 mm)
Shaft-to-Cover Clearance 0.0008–0.002 inch
(0,02–0,05 mm)

Installation

Install a new cover gasket in the front case [C]. Install the gasket with the round edge toward the oil pump cover.

Use a flat plate, install the oil seal using a press until it is flush with the front edge of the oil pump cover [D].

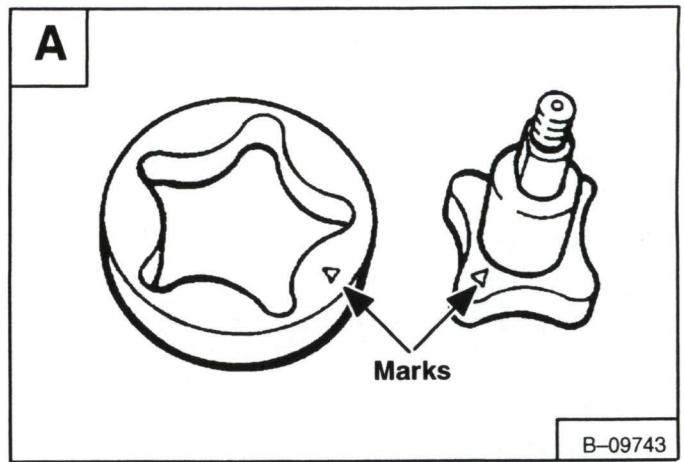


OIL PUMP (Cont'd)

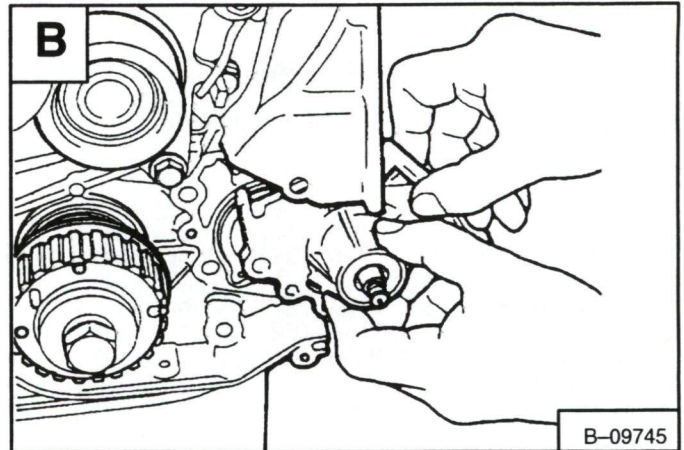
Installation (Cont'd)

Install the inner and outer rotor in the oil pump cover, after putting oil on the surface of the rotors.

The inner rotor and outer rotor have a mark on them, install the rotors with the marks in the same direction [A].



Slide the oil pump assembly into the front cover [B].



Install the 0.24 inch (6 mm) diameter bolt (item 1) [C].

Install the other bolts and tighten to 11–13 ft.-lbs. (15–18 Nm) torque.

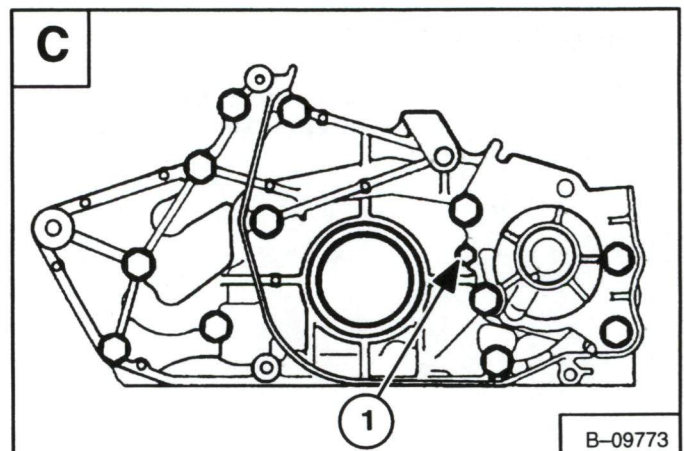
Tighten the bolt (Item 1) [C] to 90–102 in.-lbs. (10,2–11,5 Nm) torque.

Put a small amount of oil on the oil seal.

Install the sprocket for the oil pump.

Put an old timing belt around the sprocket to hold it and tighten the nut to 25–28 ft.-lbs. (34–38 Nm) torque.

Install the timing belt and front cover. (See Page 7D-48.)



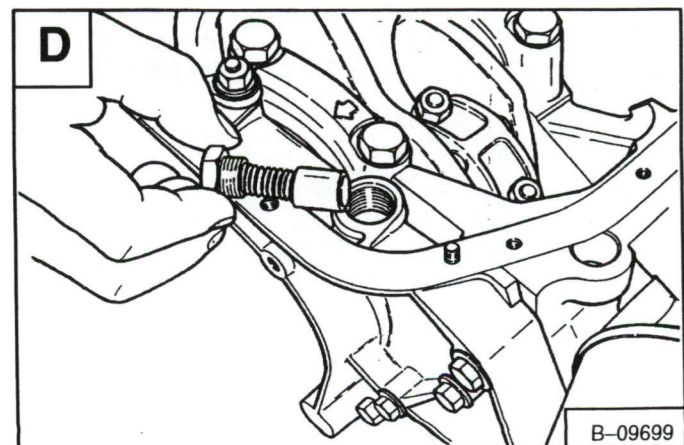
Relief Valve

Remove the oil pressure relief valve [D].

Check the poppet for damage. Check the spring for free length and pre-load as listed below:

Free Length 1.850 inches (47 mm)
Pre-load .. 16 lbs. @ 1.398 inches (71 N @ 35,5 mm)

If spring is not within specifications, replace the spring.



FRONT CASE SEAL

Removal And Installation

The tool listed will be needed to do the following procedure:

MEL1301 – Front Crankshaft Seal Installation Tool

Remove the crankshaft pulley, timing belt covers and timing belt. (See Page 7D-48.)

Remove the bolt at the crankshaft sprocket [A].

Installation: Tighten the bolt to 36–43 ft.-lbs. (49–58 Nm) torque.

Remove the crankshaft sprocket.

Drill a hole into the front seal [B].

Be careful not to damage the front case surface behind the seal with the drill.

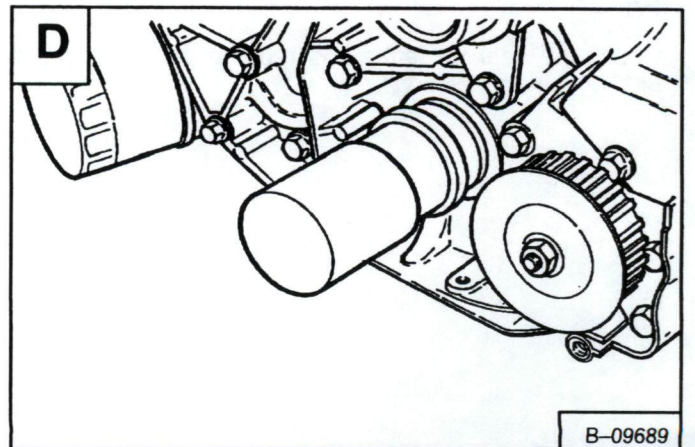
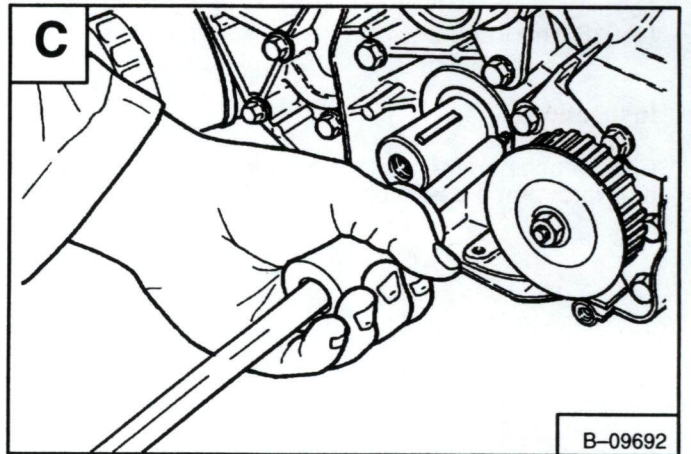
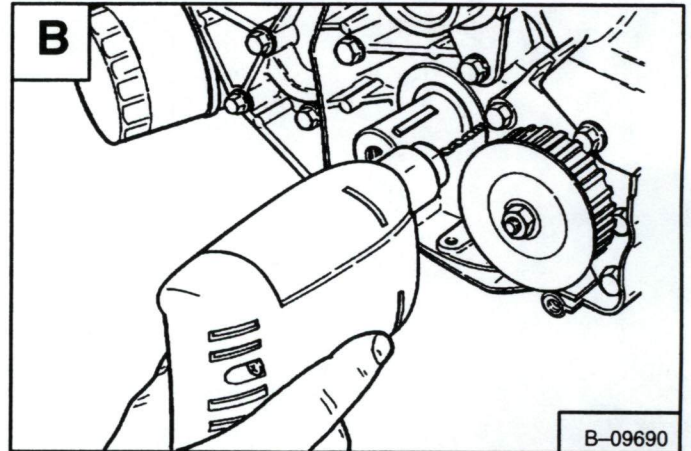
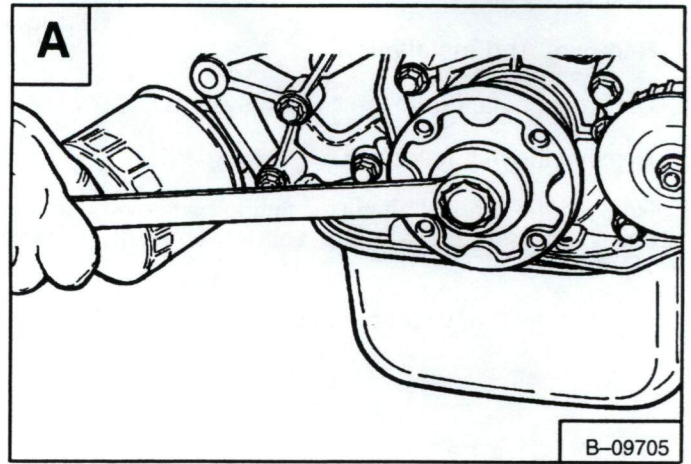
Use a slide hammer puller, remove the front seal [C].

Use the installation tool, install the front seal [D].

Install guide over camshaft and key way (MEL1301-1).

Install seal over the guide.

Using the driver, install the seal into the front housing (MEL1301-2).



WATER PUMP

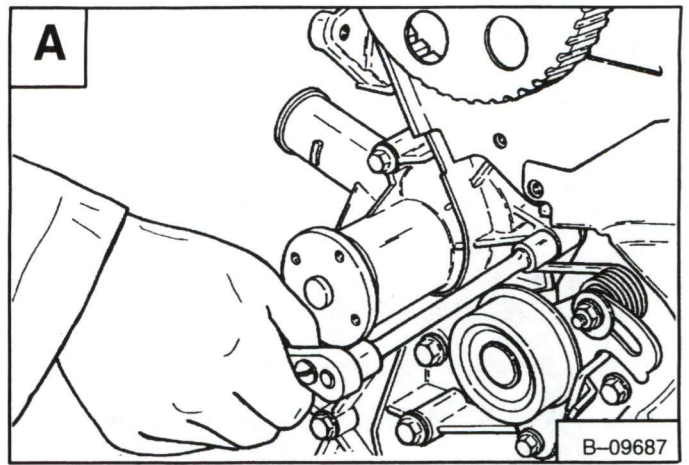
Removal And Installation

Drain the coolant from the cooling system.

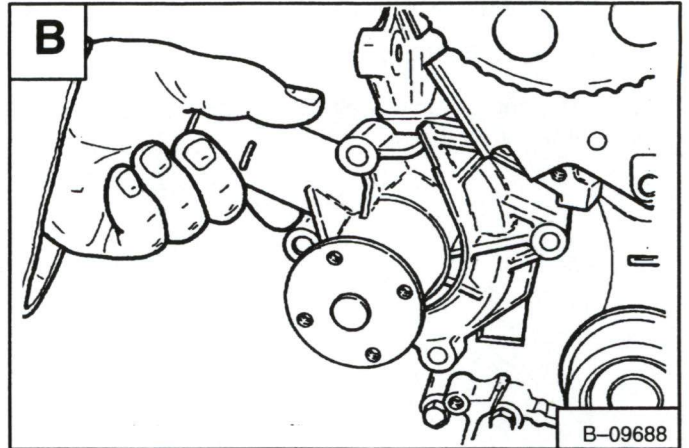
Remove the alternator belt.

Remove the crankshaft pulley, timing belt covers, timing belt, camshaft sprocket and belt tensioner. (See page 7D-48.)

Remove the four water pump bolts [A].



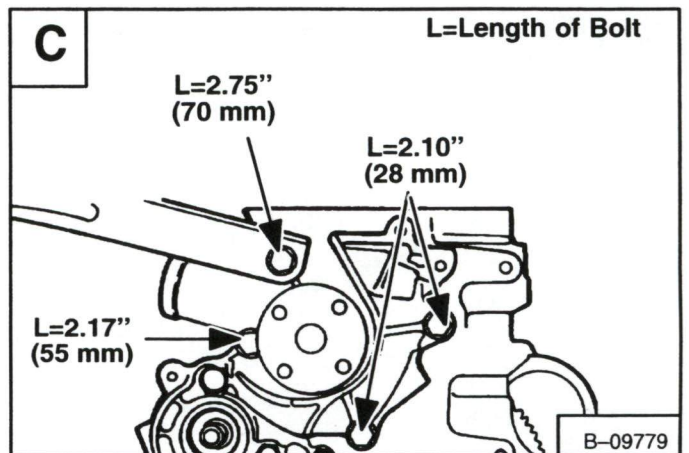
Slide the water pump to the side and remove it from the engine block [B].



Installation: Make sure the correct length bolt is in the correct location [C]. Tighten the bolts to 11-13 ft.-lbs. (15-18 Nm) torque.

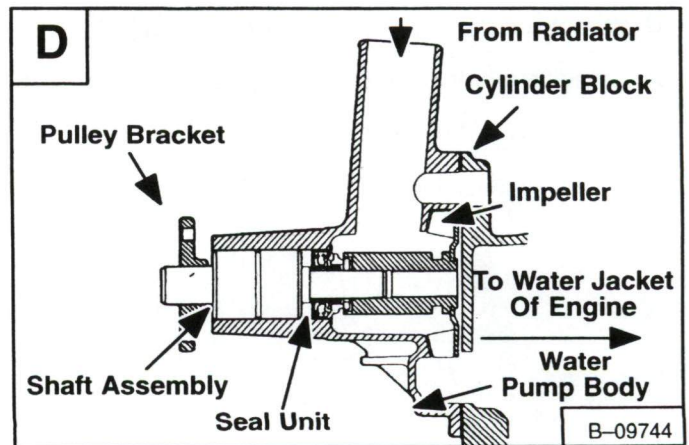
Inspection

Check each part for cracks, damage or wear and replace the water pump assembly if necessary.



Check the bearing for damage, noise and slow rotation [D].

Check the seal for leaks and replace the water pump assembly if necessary.



THERMOSTAT

Removal And Installation

The thermostat is of the wax type, valve cracking temperature is not affected by pressure in the water jacket. The jiggle valve removes air from the system during filling the cooling system and to reduce the warm-up time.

Drain the cooling system.

Remove the radiator hose at the thermostat housing.

Remove the bolts from the housing [A].

Remove the housing and the thermostat [B].

Inspection

Put the thermostat in a container filled with water. Heat the water. Measure the temperature at which the valve cracks and the valve lift is fully open.

Cracking Temperature	179° F. (82° C.)
		0.315 inch (8 mm)
Lift Temperature	203° F. (95° C.)

If the thermostat is not within specifications, replace the thermostat.

