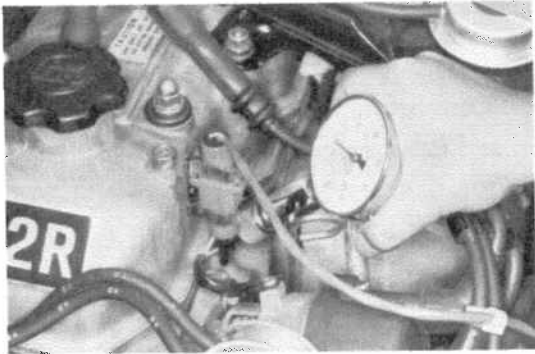


MAJOR ENGINE

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SPECIAL TOOLS AND TEST EQUIPMENT

Tool	SST No.	Use
Valve guide replacer	09201-60011	To replace valve guide
Valve spring compressor	Commercial	To replace valve
Crankshaft pulley puller	09213-31021 or Commercial	To remove crankshaft pulley
Timing gear puller	09213-36010 or Commercial	To remove pump drive and sprocket
Connecting rod aligner	Commercial	To check rod alignment
Connecting rod bushing replacer	09222-30010 or Commercial	To replace rod bushings
Pilot bearing puller	09303-35010	To remove pilot bearing
Pilot bearing replacer	09304-30012 or Commercial	To install pilot bearing
Crankshaft rear oil seal replacer	09608-35013 or Commercial	To install rear oil seal
Crankshaft front oil seal replacer	09223-50010 or Commercial	To install front oil seal



COMPRESSION CHECK

1. REMOVE FOUR SPARK PLUGS
2. DISCONNECT HIGH TENSION WIRE FROM IGNITION COIL
3. MEASURE CYLINDER COMPRESSION PRESSURE
 - (a) Insert a compression gauge into the spark plug hole.
 - (b) Fully open the throttle.
 - (c) While cranking the engine with the starter motor, measure the compression pressure.

CAUTION: This test must be done for as short a time as possible to avoid overheating of the catalytic converter.

NOTE: Always use a fully charged battery to obtain engine revolution of more than 250 rpm.

- (d) Repeat steps (a) through (c) for each cylinder.

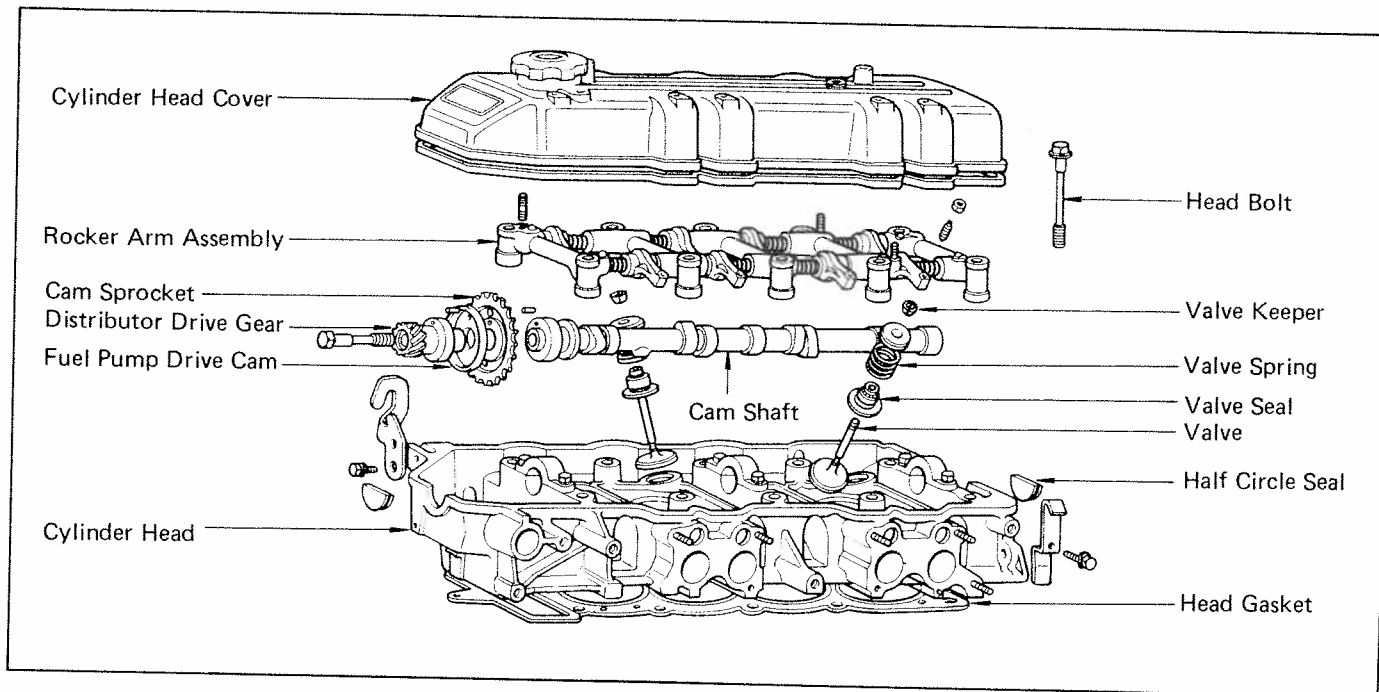
Compression pressure: 12 kg/cm² (171 psi)

Minimum pressure: 10 kg/cm² (142 psi)

Difference between each cylinder:

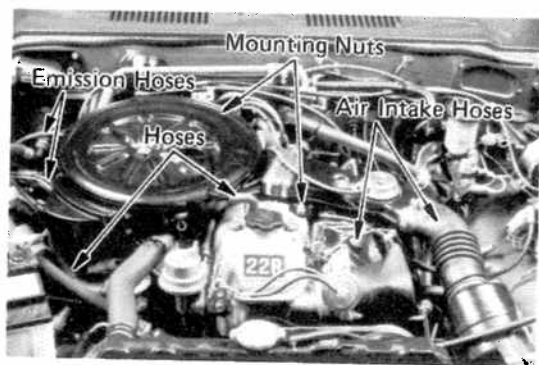
Less than 1.0 kg/cm² (14 psi)

CYLINDER HEAD



NOTE: If removing the cylinder head, perform these steps before beginning:

- Disconnect the cable from the negative terminal of the battery.
- Drain coolant from the radiator and engine block into a clean container.
- Drain engine oil as it may become contaminated with coolant.



REMOVAL OF CYLINDER HEAD COVER

1. REMOVE AIR CLEANER

- Disconnect the emission control hoses.
- Disconnect the air intake hose.
- Remove the two mounting nuts and butterfly nut.
- Lift up the air cleaner from the carburetor.
- Cover the carburetor with a clean cloth.

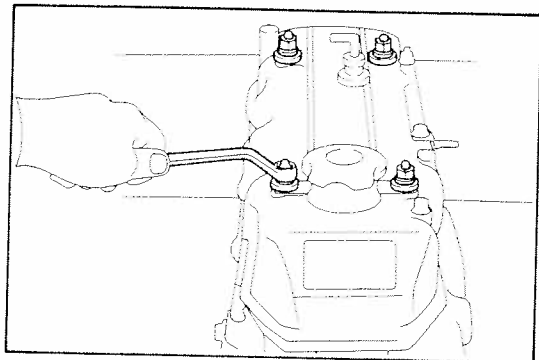
2. REMOVE FOLLOWING PARTS FROM CYLINDER HEAD COVER

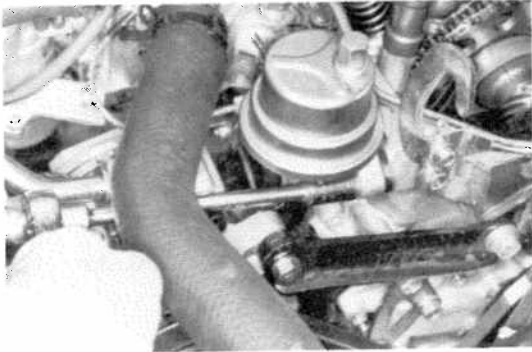
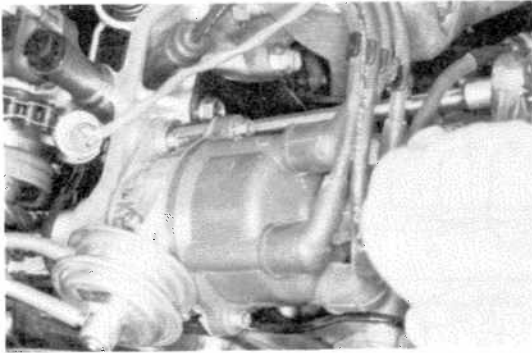
- PCV hose
- Two spark plug wire holders
- Distributor wire connector
- Throttle cable for A/T

3. REMOVE CYLINDER HEAD COVER

Remove four nuts and seals and lift off the cylinder head cover.

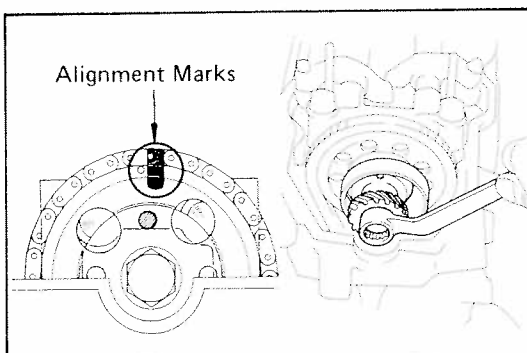
CAUTION: Cover the oil return hole in the head with a rag to prevent objects falling in.

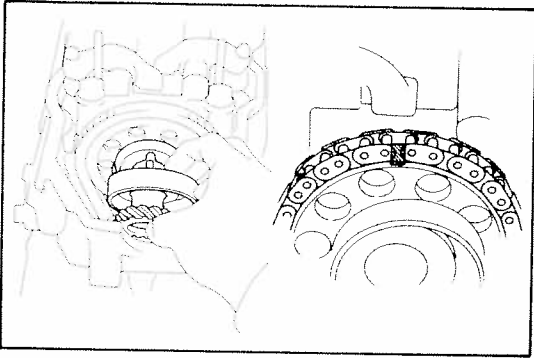




REMOVAL OF CYLINDER HEAD

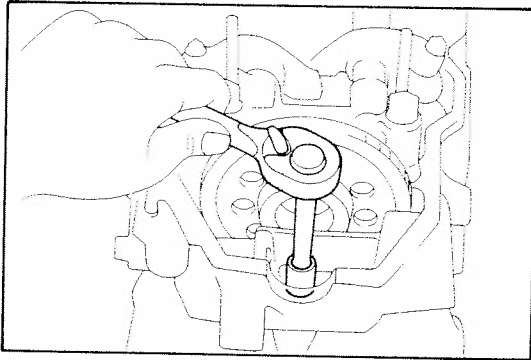
1. **DISCONNECT RADIATOR UPPER HOSE**
2. **REMOVE DISTRIBUTOR**
 - (a) Disconnect the spark plug wires by pulling the plug boot.
 - (b) Disconnect the primary ignition wire from the distributor cap.
 - (c) Disconnect the connector.
 - (d) Remove the distributor hold-down bolt.
 - (e) Remove the distributor from the cylinder head with the cap and wires attached.
3. **REMOVE FUEL PUMP**
(See steps 2 through 4, page 5-3)
4. **DISCONNECT FOLLOWING WIRES:**
 - (a) Bond cables from the front and rear of the cylinder head
 - (b) Carburetor wires
 - (c) Thermo switch wires
5. **DISCONNECT FOLLOWING HOSES:**
 - (a) Water by-pass hose from the intake manifold
 - (b) Heater inlet hose from the water valve.
 - (c) Brake booster hose from the intake manifold
 - (d) Two fuel hoses from the pipes under the intake manifold
 - (e) Hose from the air injection tube (Calif. RN and RN C&C)
 - (f) Label and disconnect emission control hoses from the carburetor and intake manifold that will allow removal of the head.
6. **DISCONNECT ACCELERATOR LINKAGE FROM CARBURETOR**
7. **DISCONNECT THROTTLE CABLE FROM CARBURETOR (A/T Vehicles)**
8. **REMOVE AIR SUCTION REAR PIPE (Fed. RN and Canada RN 4x2)**
9. **DISCONNECT EXHAUST PIPE FROM EXHAUST MANIFOLD**
10. **REMOVE CAM SPROCKET BOLT**
 - (a) Turn the crankshaft until No. 1 piston is set at T.D.C. compression position.
 - (b) Paint alignment marks on the sprocket and chain.
 - (c) Remove the half circle seal.
 - (d) Remove the cam sprocket bolt.





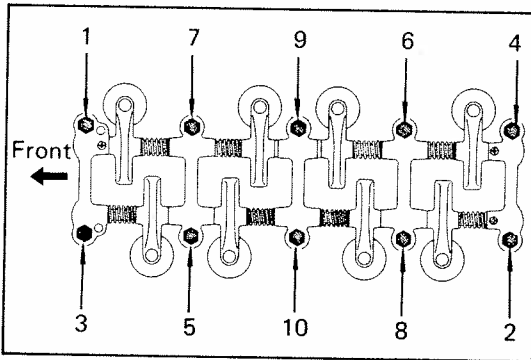
11. REMOVE DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM

- (a) Remove the distributor drive gear and fuel pump drive cam from the cam sprocket.
- (b) Remove the cam sprocket and chain from the cam and leave in the position shown.



12. REMOVE CHAIN COVER BOLT

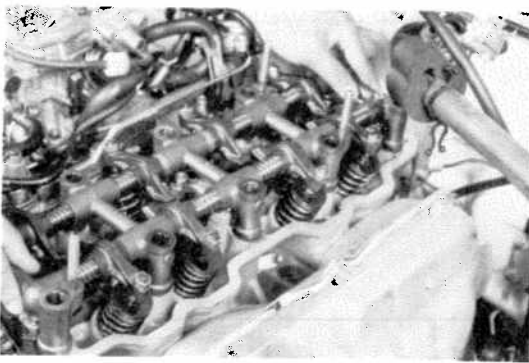
Remove one bolt in front of the head before the head bolts are removed.



13. REMOVE CYLINDER HEAD BOLTS

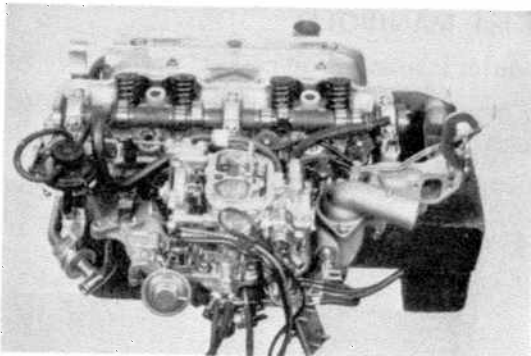
Remove ten head bolts in the numerical order shown.

CAUTION: Head warpage or cracking could result from removing in incorrect order.



14. REMOVE ROCKER ARM ASSEMBLY

It may be necessary to use a pry bar on the front and rear of the rocker arm assembly to separate it from the head.



15. REMOVE CYLINDER HEAD

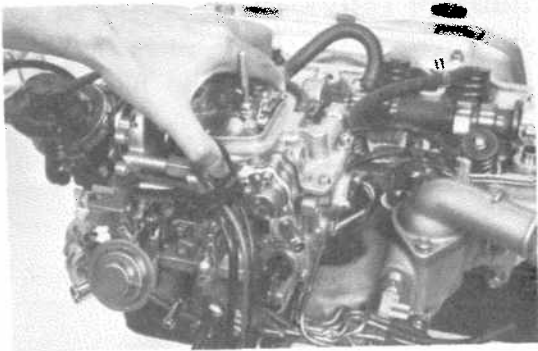
Lift the cylinder head from the dowels on the cylinder block and place the head on wood blocks on the bench.

CAUTION: Do not pry between cylinder head gasket and block deck.

DISASSEMBLY OF CYLINDER HEAD (See illustration on page 4-3)

1. REMOVE CARBURETOR

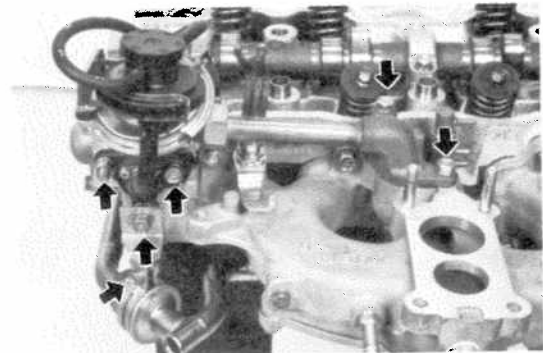
- (a) Disconnect the vacuum hoses from the carburetor.
- (b) Remove the carburetor from the intake manifold.



2. DISCONNECT VACUUM HOSES AND REMOVE VACUUM PIPE

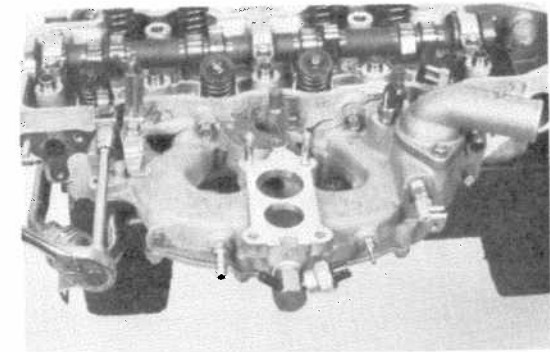
3. REMOVE EGR VALVE WITH VACUUM MODULATOR

- (a) Loosen the clamp on the AI check valve.
- (b) Remove the nut and two bolts.
- (c) Remove the two bolts on the intake manifold side of the EGR pipe.
- (d) Remove the EGR valve with vacuum modulator.



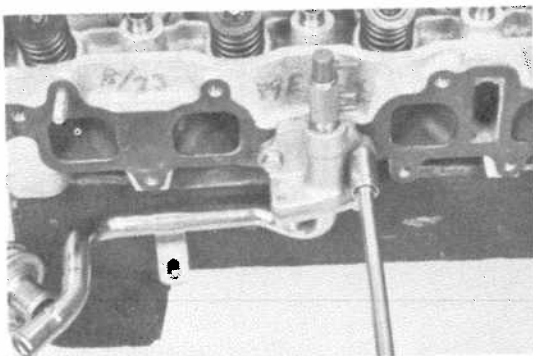
4. REMOVE INTAKE MANIFOLD

- (a) Remove six bolts and two nuts holding the manifold and remove the intake manifold.
- (b) Cover the intake manifold ports with clean cloths.



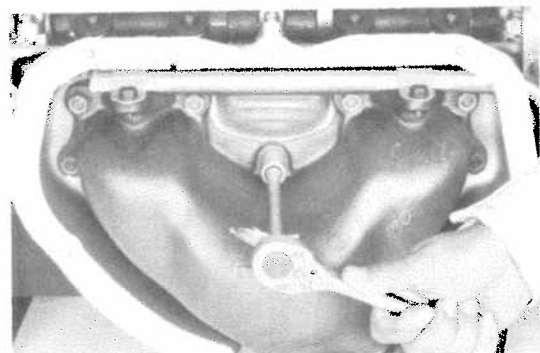
5. REMOVE THERMOSTATIC VALVE

Remove two bolts and remove the valve and manifold gasket.

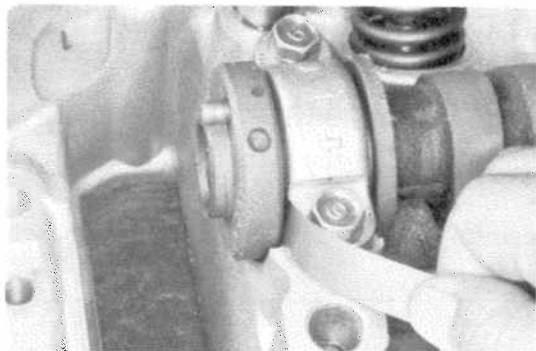


6. REMOVE EXHAUST MANIFOLD

- (a) Remove the outer insulator and gasket.
- (b) Remove the manifold with the air injection tube or air suction tube.
- (c) Remove the inner heat insulator.



7. REMOVE SPARK PLUGS



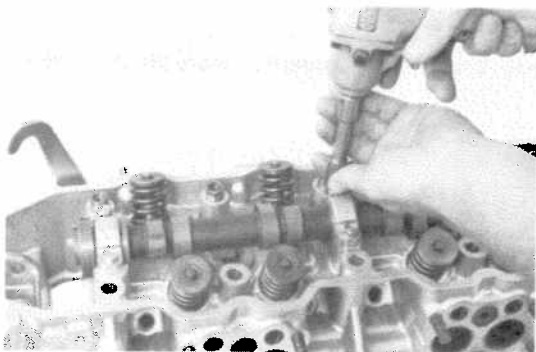
8. MEASURE CAMSHAFT THRUST CLEARANCE

Using a feeler gauge, measure the camshaft thrust clearance between the thrust bearing and cylinder head.

If clearance is greater than the maximum, replace the head.

Maximum clearance: 0.25 mm (0.0098 in.)

Standard clearance: 0.08 – 0.18 mm
(0.0031 – 0.0071 in.)



9. MEASURE JOURNAL OIL CLEARANCE

(a) Remove three cam bearing caps.

(b) Clean the bearing caps, camshaft and camshaft journals.

(c) Lay a strip of plastigage across each journal.

NOTE: Do not turn the camshaft while plastigage is in place.

(d) Install the correct numbered bearing cap on each journal with the arrows pointing to the front.

Torque each bolt.

Torque: 170 – 230 kg-cm (13 – 16 ft-lb)



(e) Remove the caps. Measure the plastigage at its widest point.

If the clearance is greater than the maximum, replace the head and/or camshaft.

Maximum clearance: 0.1 mm (0.004 in.)

Standard clearance: 0.01 – 0.05 mm
(0.0004 – 0.0020 in.)



10. LIFT OUT CAMSHAFT

11. REMOVE VALVES

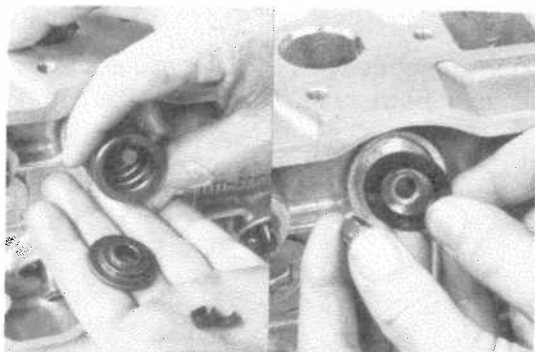
(a) Using a valve spring compressor, compress the valve retainer until two keepers can be removed.

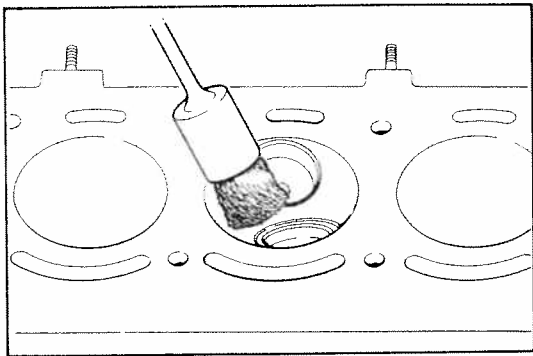
(b) Remove the valve keepers, retainers, springs and valves.

NOTE: Keep valves in order so the valves can be installed in the same order as removed.

(c) Remove the valve seals.

(d) Using a small screwdriver or magnet, remove the valve spring seats.



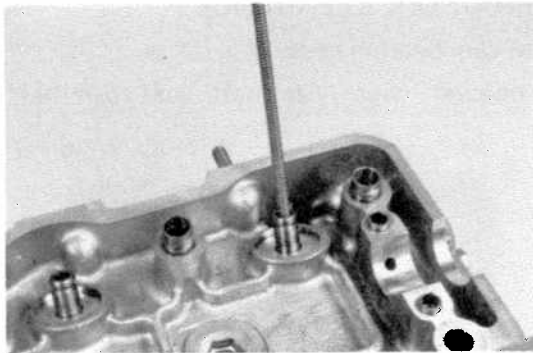


INSPECTION AND CLEANING OF CYLINDER HEAD COMPONENTS

1. CLEAN COMBUSTION CHAMBER

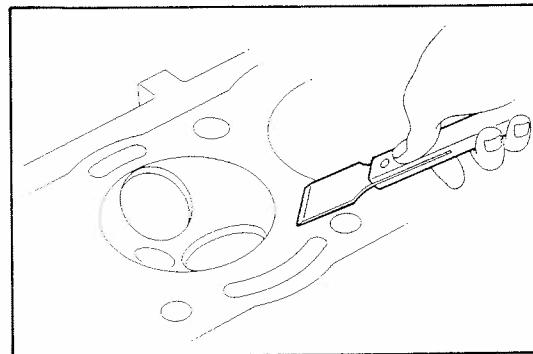
Using a wire brush, remove all the carbon from the combustion chambers.

CAUTION: Be careful not to scratch the head gasket surface.



2. CLEAN VALVE GUIDES

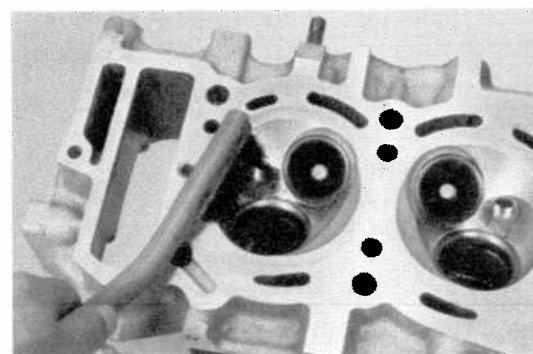
Using a valve guide brush and solvent, clean all the valve guides.



3. REMOVE GASKET MATERIAL

Using a gasket scraper, remove all gasket material from the manifold and head surfaces.

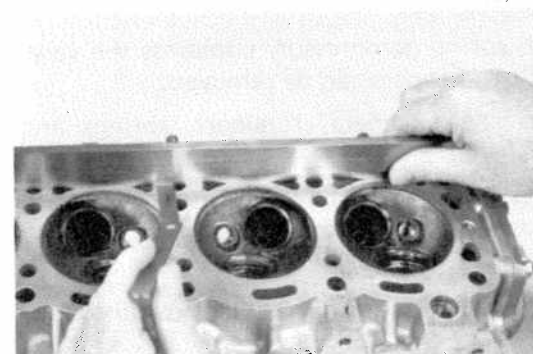
CAUTION: Do not scratch surfaces.



4. CLEAN CYLINDER HEAD

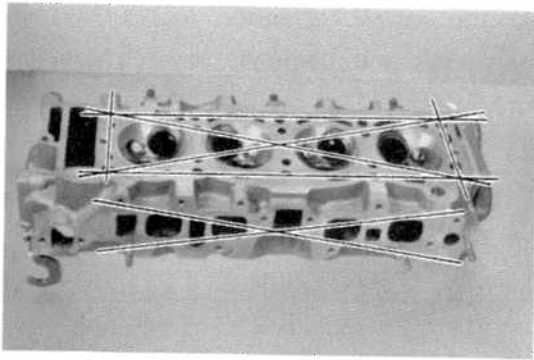
Using a soft brush and solvent, clean the head.

CAUTION: Do not clean the head in a hot tank as this would seriously damage it.



5. CHECK HEAD FOR FLATNESS

- (a) Using a precision straight edge and feeler gauge, check that the head and both manifold surfaces are not warped.

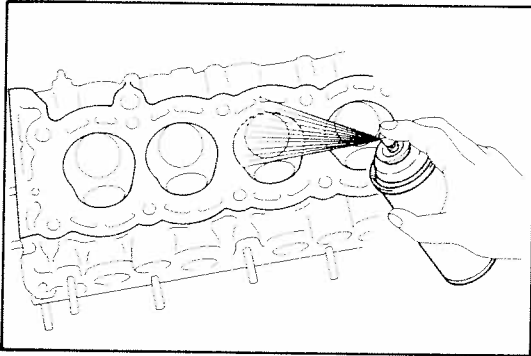


- (b) Measure warpage at the four sides and diagonals as illustrated.

If warpage is greater than specified value, correct by machining or replace the head.

Maximum head surface warpage: 0.15 mm
(0.0059 in.)

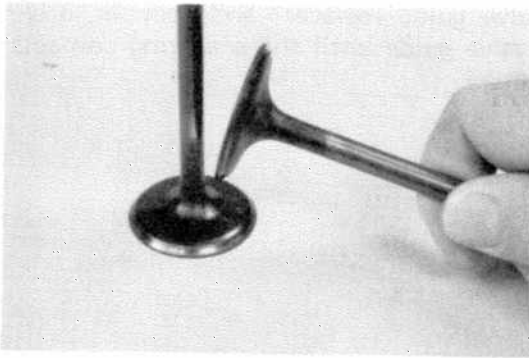
Maximum manifold surface warpage: 0.2 mm (0.008 in.)



6. CHECK CYLINDER HEAD FOR CRACKS

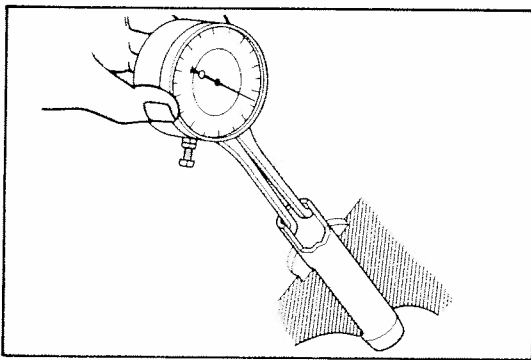
Using a dye penetrant, check the combustion chamber, intake and exhaust ports, head surface and the top of the head for cracks.

If a crack is found, replace the head.



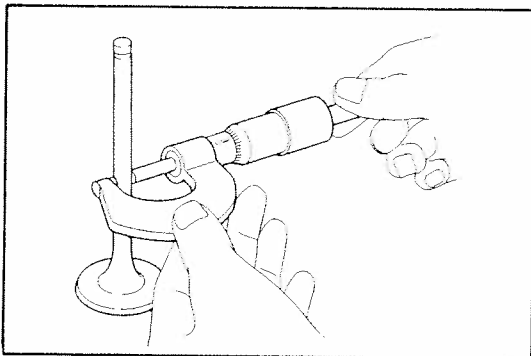
7. CLEAN VALVES

Use an old valve to chip any carbon from the valve head.



8. CHECK VALVE STEM GUIDE WEAR

- (a) Using a dial indicator or telescoping gauge, measure the inside diameter of the valve guide.



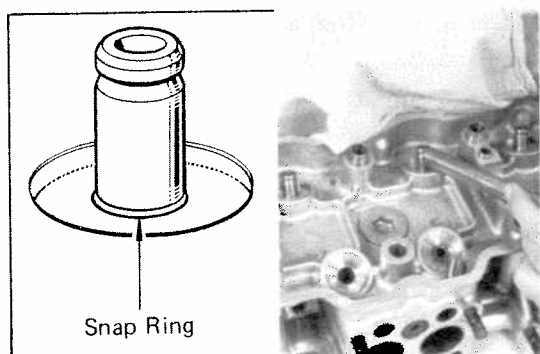
- (b) Using a micrometer, measure the diameter of the valve stem.

- (c) Subtract the valve stem measurement from the valve guide measurement.

If the clearance is greater than the following values, replace the valve and guide:

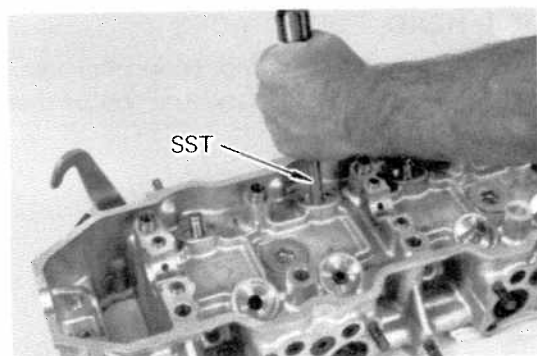
Maximum intake clearance: 0.08 mm (0.0031 in.)

Maximum exhaust clearance: 0.10 mm (0.0039 in.)



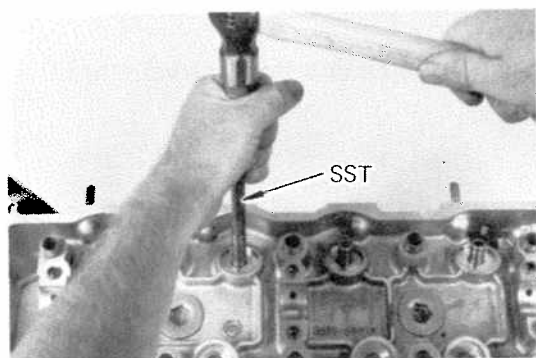
If necessary, replace the worn valve guides.

- (a) Using a brass punch and hammer, break the valve guide.



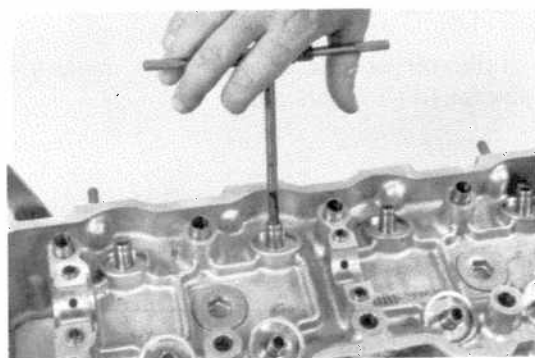
- (b) Using a valve guide remover* and hammer, drive out the valve guide.

*SST 09201-60011



- (c) Using the valve guide replacer* and hammer, drive in the new valve guide until the snap ring contacts the cylinder head.

*SST 09201-60011



- (d) Using a sharp 8 mm reamer, ream the valve guide to obtain specified clearance between the guide and new valve.

Intake clearance: 0.02 – 0.06 mm
(0.0008 – 0.0024 in.)

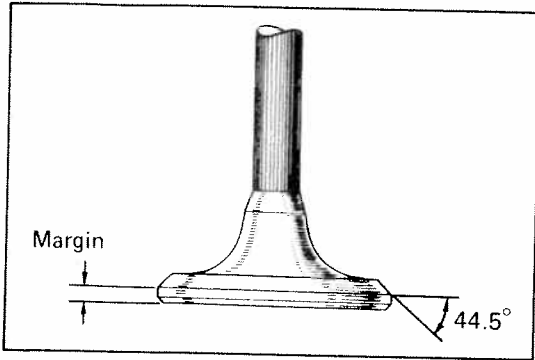
Exhaust clearance: 0.03 – 0.07 mm
(0.0012 – 0.0028 in.)

9. CHECK AND GRIND VALVES

- (a) Grind valves only enough to remove pits and carbon.

Make sure the valves are ground at the correct valve face angle.

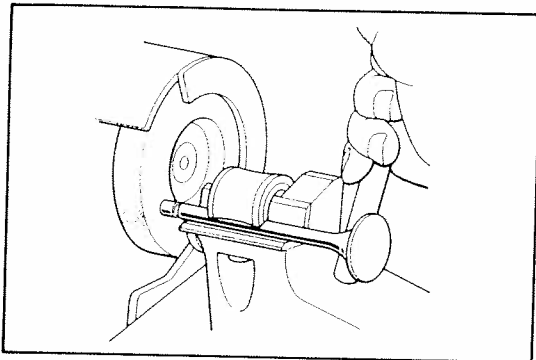
Valve face angle: 44.5°



(b) Check the valve head margin.

If the valve head margin is less than specified, replace the valve.

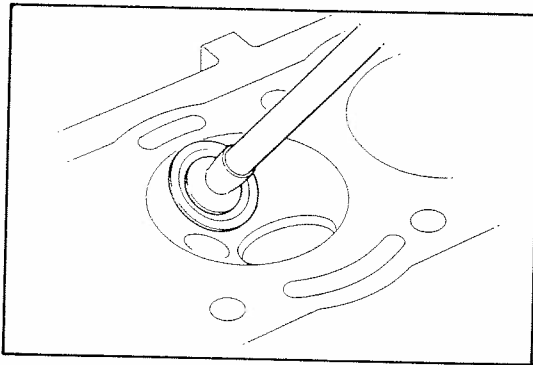
Minimum margin: 0.6 mm (0.024 in.)



(c) Check the surface of the valve stem tip for wear.

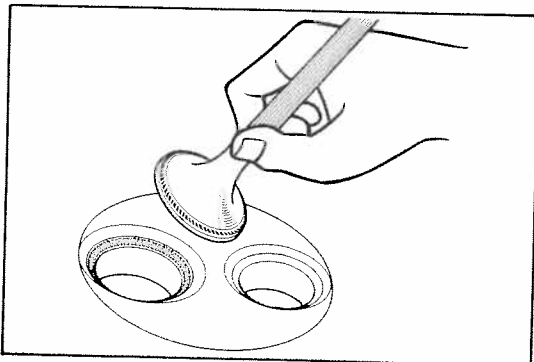
If the valve stem tip is worn, resurface the tip with a grinder.

CAUTION: Do not grind more than 0.5 mm (0.020 in.).



10. CHECK AND CLEAN VALVE SEATS

(a) Using a 45° carbide cutter, resurface the valve seats. Remove only enough metal to clean the seats.



(b) Check the valve seating position.

Apply a thin coat of prussian blue (or white lead) to the valve face. Install the valve. While applying light pressure to the valve, rotate the valve against the seat. Check the valve face and seat for the following:

- If blue appears 360° around the face, the valve is concentric. If not, replace the valve.
- If blue appears 360° around the valve seat, the guide and seat are concentric. If not, resurface the seat.
- Check that the seat contact is on the middle of the valve face with the following width:

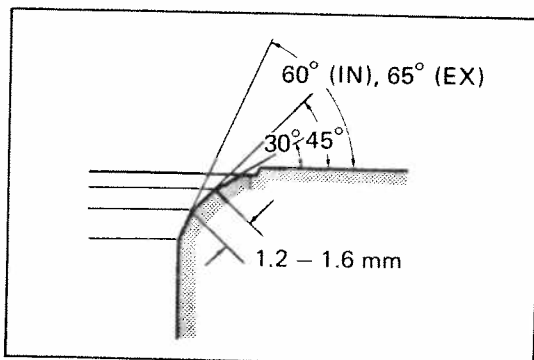
1.2 – 1.6 mm (0.047 – 0.063 in.)

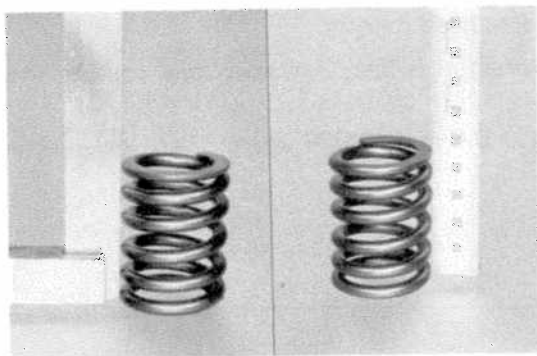
If not, correct the valve seat as follows:

If seating is too high on the valve face, use 30° and 45° cutters to correct the seat.

If seating is too low on the valve face, use 60° (IN) or 65° (EX) and 45° cutters to correct the seat.

(c) Hand-lap the valve and valve seat together with abrasive compound.





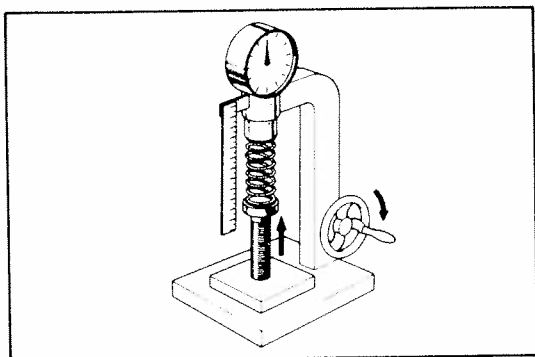
11. CHECK VALVE SPRING

- (a) Using a steel square, check the squareness of the valve springs. If a spring is out of square more than the maximum allowable, replace the spring.

Maximum allowable: 1.6 mm (0.063 in.)

- (b) Measure the free height of all springs. Replace any spring that is not correct.

Free height: 45.8 mm (1.803 in.)

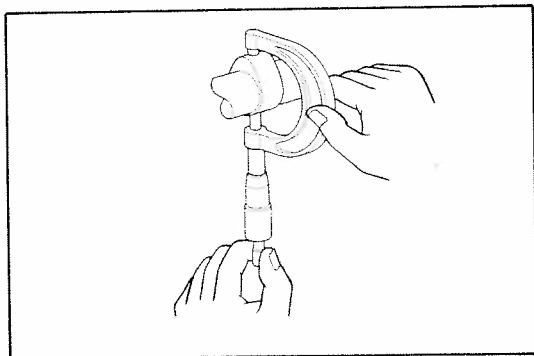


- (c) Using a spring tester, check the tension of each spring at the specified installed height.

If the installed tension is less than the minimum, replace the spring.

Installed height: 40.5 mm (1.594 in.)

Minimum installed tension: 22.5 kg (49.6 lb)



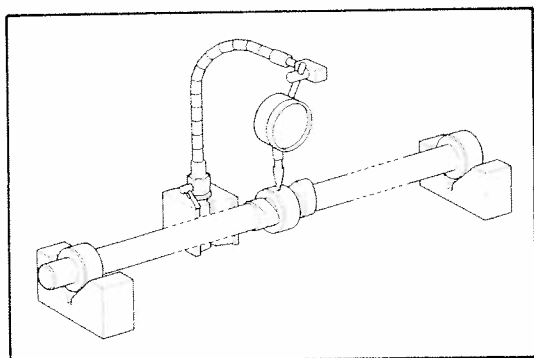
12. CHECK CAMSHAFT

- (a) Using a micrometer, measure the cam lobes.

If the lobe height is less than the minimum allowable, the camshaft is worn and must be replaced.

Minimum intake lobe height: 42.63 – 42.72 mm
(1.6783 – 1.6819 in.)

Minimum exhaust lobe height: 42.69 – 42.78 mm
(1.6807 – 1.6842 in.)



- (b) Place the camshaft on V-blocks and measure the runout at the center journal.

If the runout is greater than the maximum allowable, replace the camshaft.

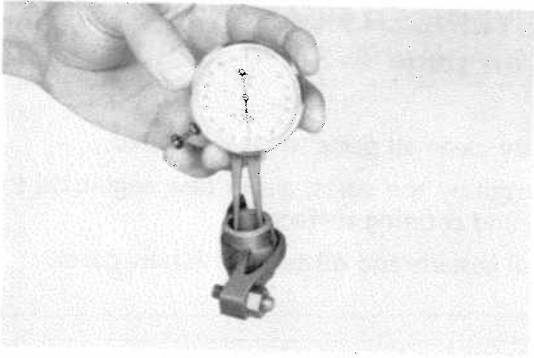
Maximum runout: 0.2 mm (0.008 in.)

13. INSPECT ROCKER ARMS

Check the clearance between the rocker arms and shaft by moving the rocker arms as shown. Little or no movement should be felt.

If movement is felt, disassemble the rocker arm assembly and measure the oil clearance as follows:

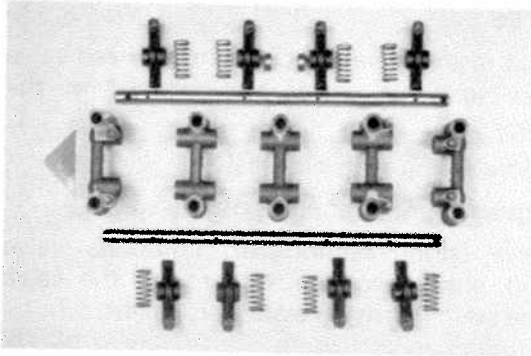




- (a) Using a dial indicator, measure the inside diameter of the rocker arm. Using a micrometer, measure the outside diameter of the shaft. Subtract the shaft diameter from the rocker arm diameter.

If the oil clearance is not within specification, replace the rocker arm and/or shaft.

Maximum oil clearance: 0.08 mm (0.0031 in.)



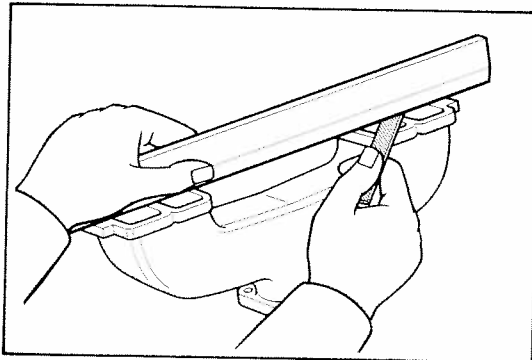
- (b) Assemble the rocker arm assembly as shown, and install three screws. The arrow indicates the front of the engine.

NOTE: All rocker arms are the same. All rocker stands are different and must be assembled in the correct order.



14. CLEAN TOP OF PISTONS AND TOP OF BLOCK

- (a) Turn the crankshaft and bring each piston to top dead center. Scrape the carbon from the piston top.
- (b) Remove all gasket material from the top of the block. Blow carbon and oil from the bolt holes.



15. INSPECT INTAKE AND EXHAUST MANIFOLDS

- (a) Inspect manifolds for corrosion, cracks, clogged coolant passages and leaking coolant fittings. Replace as necessary.
- (b) Using a precision straight edge and feeler gauge, check the surfaces contacting the cylinder head for warpage. If warpage is greater than maximum, replace manifold.

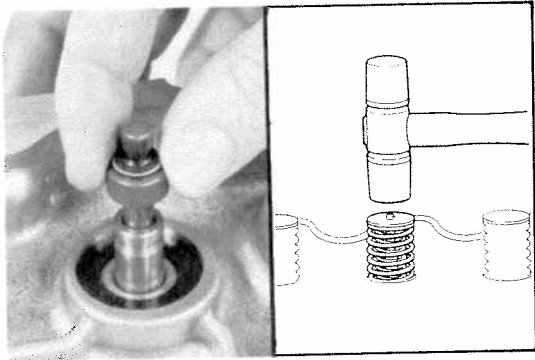
Maximum intake warpage: 0.2 mm (0.008 in.)

Maximum exhaust warpage: 0.7 mm (0.028 in.)

ASSEMBLY OF CYLINDER HEAD (See illustration on page 4-3)

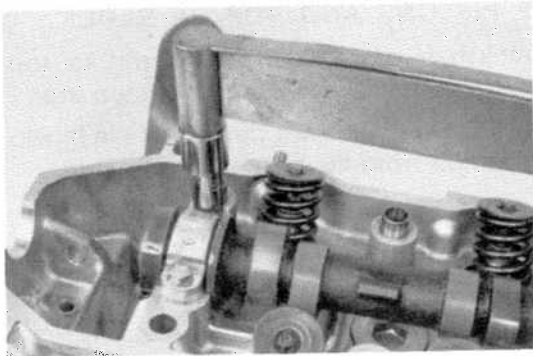
NOTE:

- (a) Thoroughly clean all parts to be assembled.
- (b) Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- (c) Replace all gaskets and oil seals with new parts.



1. INSTALL VALVES

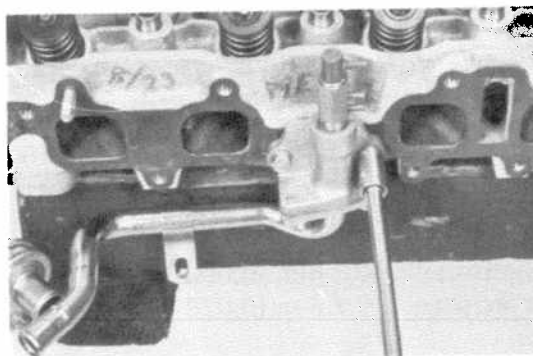
- (a) Lubricate and insert valves in the cylinder head valve guides. Make sure the valves are installed in the correct order.
- (b) Install the valve spring seats and seals.
- (c) Install springs and spring retainers on the valves.
- (d) Using a valve spring compressor, compress valve retainers and place two keepers around the valve stem. Tap the stem lightly to assure proper fit.



2. INSTALL CAMSHAFT

- (a) Coat all bearing journals with engine oil.
- (b) Place the camshaft in the cylinder head and install the bearing caps in numbered order from the front with arrows pointing toward the front.
- (c) Install and torque the cap bolts.

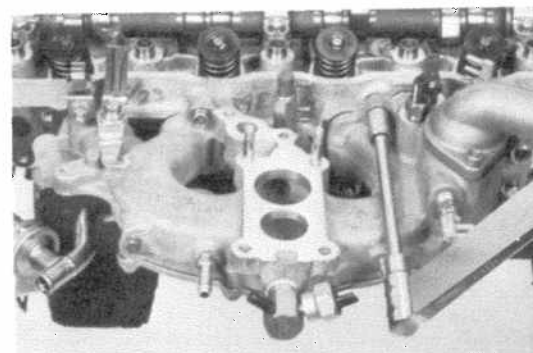
Torque: 170 – 230 kg-cm (13 – 16 ft-lb)



3. INSTALL THERMOSTATIC VALVE

- (a) Position a new intake manifold gasket on the cylinder head.
- (b) Install the thermostatic valve with two bolts. Torque the bolts.

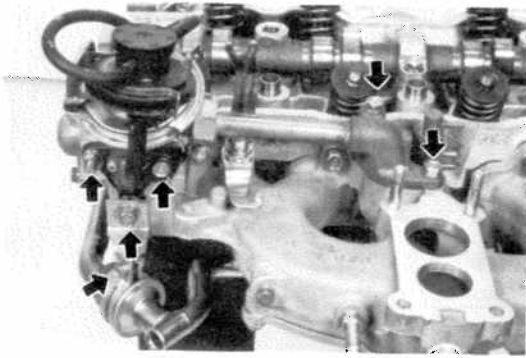
Torque: 170 – 230 kg-cm (13 – 16 ft-lb)



4. INSTALL INTAKE MANIFOLD

Install the intake manifold with six bolts and two nuts. Torque the bolts and nuts.

Torque: 180 – 260 kg-cm (14 – 18 ft-lb)

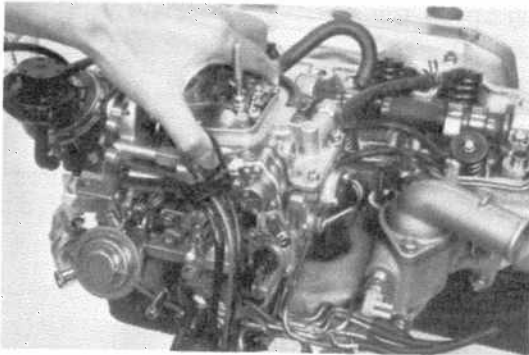


5. INSTALL EGR VALVE WITH VACUUM MODULATOR

- (a) Position a new gasket on the cylinder head.
- (b) Place the EGR valve in the installed position and tighten two bolts on the intake manifold side of EGR valve shaft.
- (c) Apply a sealer to the upper right bolt.
- (d) Torque the nut and two bolts.

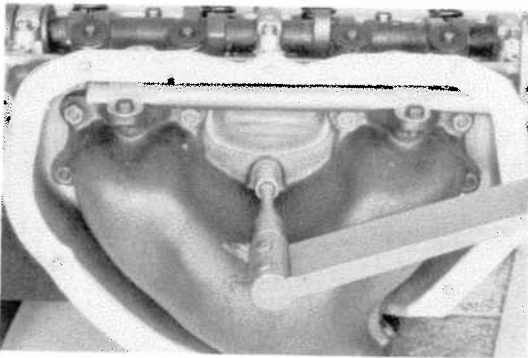
Torque: 100 — 160 kg-cm (8 — 11 ft-lb)

- (e) Install the vacuum hose to the EGR vacuum modulator.



6. INSTALL CARBURETOR

- (a) Install the carburetor to the intake manifold.
- (b) Connect the vacuum hoses to the carburetor.



7. INSTALL EXHAUST MANIFOLD

- (a) Install the inner heat insulator and exhaust manifold with the air injection tube or air suction tube. Torque the seven nuts.

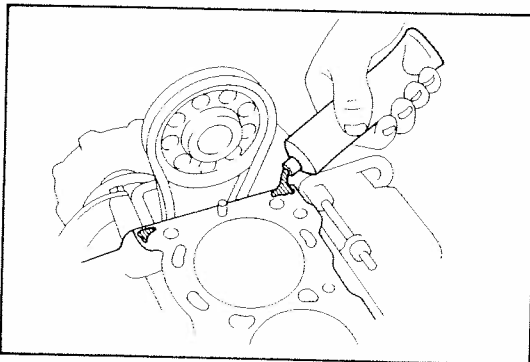
Torque: 400 — 500 kg-cm (29 — 36 ft-lb)

- (b) Install gaskets on the inner heat insulator and install the outer heat insulator with six nuts.
- (c) Install the EGR valve bolt holding the air injection tube support.

INSTALLATION OF CYLINDER HEAD

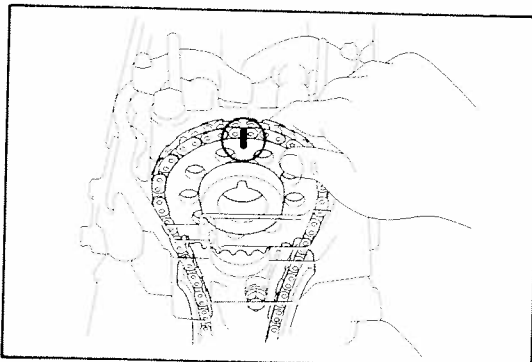
1. APPLY SEALER TO CYLINDER BLOCK

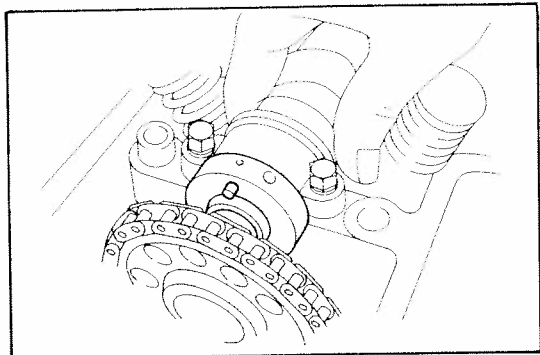
- (a) Apply liquid sealer to two locations shown.
- (b) Place a new head gasket over dowels on the cylinder block.



2. INSTALL CYLINDER HEAD

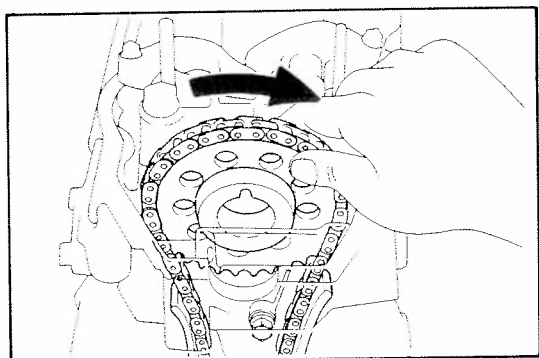
- (a) If the sprocket was removed, align the alignment marks painted on the sprocket and chain during removal.
- (b) Position the cylinder head over dowels on the block.



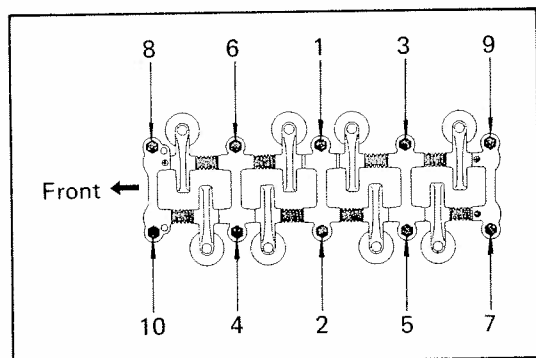


3. SET CAM TIMING

- (a) Turn the camshaft to position the dowel at the top.



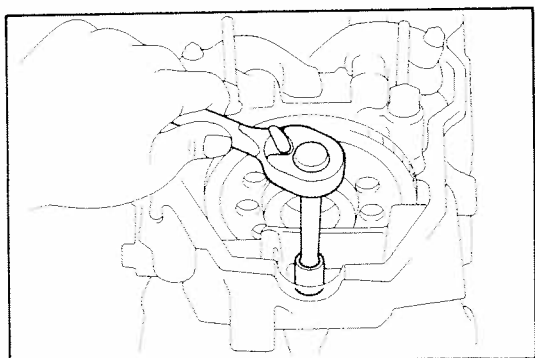
- (b) While holding up on the sprocket and chain, turn the crankshaft until the cam sprocket groove is at the top, as shown.



4. INSTALL ROCKER ARM ASSEMBLY

- (a) Place the rocker arm assembly over the dowels on the cylinder head.
- (b) Install and tighten the head bolts gradually in three passes in the sequence shown. Torque the bolts on the final pass.

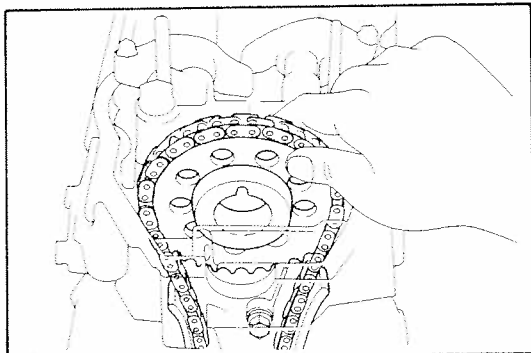
Torque: 720 – 880 kg-cm (53 – 63 ft-lb)



5. INSTALL CHAIN COVER BOLT

Torque the bolt.

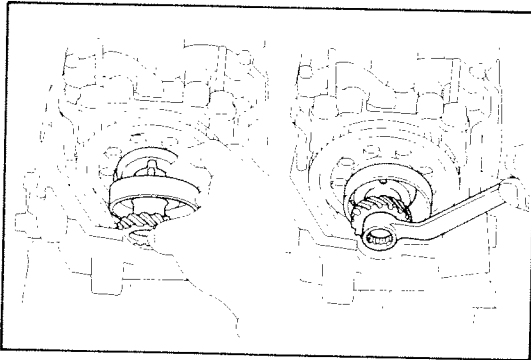
Torque: 100 – 160 kg-cm (8 – 11 ft-lb)



6. INSTALL SPROCKET ON CAMSHAFT

Place chain sprocket over the camshaft dowel.

NOTE: If the chain does not seem long enough, turn the crankshaft back and forth while pulling up on the chain and sprocket.



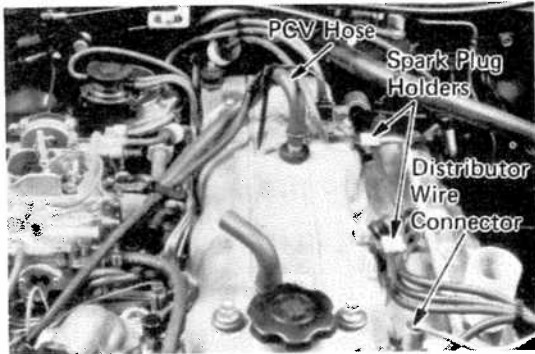
7. **INSTALL DISTRIBUTOR DRIVE GEAR AND FUEL PUMP DRIVE CAM**
Place the distributor drive gear and fuel pump drive cam over the chain sprocket.
Torque the bolt.
Torque: 700 — 900 kg-cm (51 — 65 ft-lb)
8. **ADJUST VALVES** (See page 2-7)
9. **INSTALL FUEL PUMP** (See steps 1 through 4, page 5-3)
10. **SET TIMING MARK AND INSTALL DISTRIBUTOR** (See page 3-16)
11. **INSTALL SPARK PLUGS AND WIRES**
Adjust the plug gap to 0.8 mm (0.031 in.) and torque the plugs.
Torque: 150 — 210 kg-cm (11 — 15 ft-lb)
12. **INSTALL AIR SUCTION REAR PIPE** (Fed. RN and Canada RN 4x2)
13. **INSTALL EXHAUST PIPE ON EXHAUST MANIFOLD**
Torque three nuts.
Torque: 350 — 450 kg-cm (26 — 32 ft-lb)
14. **CONNECT ACCELERATOR LINKAGE TO CARBURETOR**
15. **CONNECT THROTTLE CABLE TO CARBURETOR (A/T Vehicles)**
16. **CONNECT FOLLOWING HOSES:**
 - (a) Emission control hoses to the carburetor and intake manifold as labeled
 - (b) Hose to the air injection tube (Calif. RN and RN C&C)
 - (c) Two fuel hoses to the pipes under the intake manifold
 - (d) Brake booster hose to the intake manifold
 - (e) Heater inlet hose to the water valve
 - (f) Water by-pass hose to the intake manifold
17. **CONNECT FOLLOWING WIRES:**
 - (a) Thermo switch wires
 - (b) Carburetor wires
 - (c) Bond cables to the front and rear of the cylinder head
18. **CONNECT RADIATOR UPPER HOSE**
19. **INSTALL COVER SEALS**
Apply liquid sealer to front and rear half circle seals, and install those to the cylinder head.
20. **ADD ENGINE OIL**
Pour four quarts of grade SE or better oil over distributor gear and sprocket assembly. Refer to the owner's manual to select the correct weight of oil.

INSTALLATION OF CYLINDER HEAD COVER

1. INSTALL CYLINDER HEAD COVER

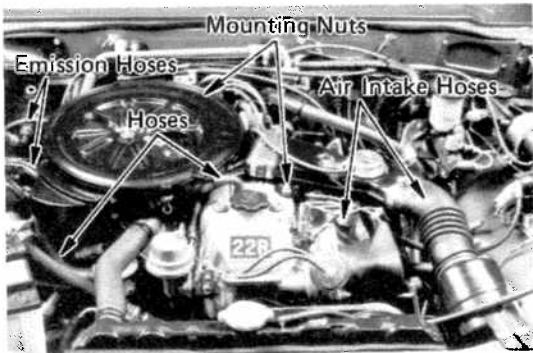
- Inspect rubber seals. Replace, if necessary.
- Place cylinder head cover on the cylinder head and install four seals and nuts. Torque the nuts.

Torque: 50 — 110 kg-cm (44 — 95 in.-lb)



2. INSTALL FOLLOWING PARTS ON CYLINDER HEAD COVER

- Throttle cable for A/T
- Distributor wire connector
- Two spark plug wire holders
- PCV hose



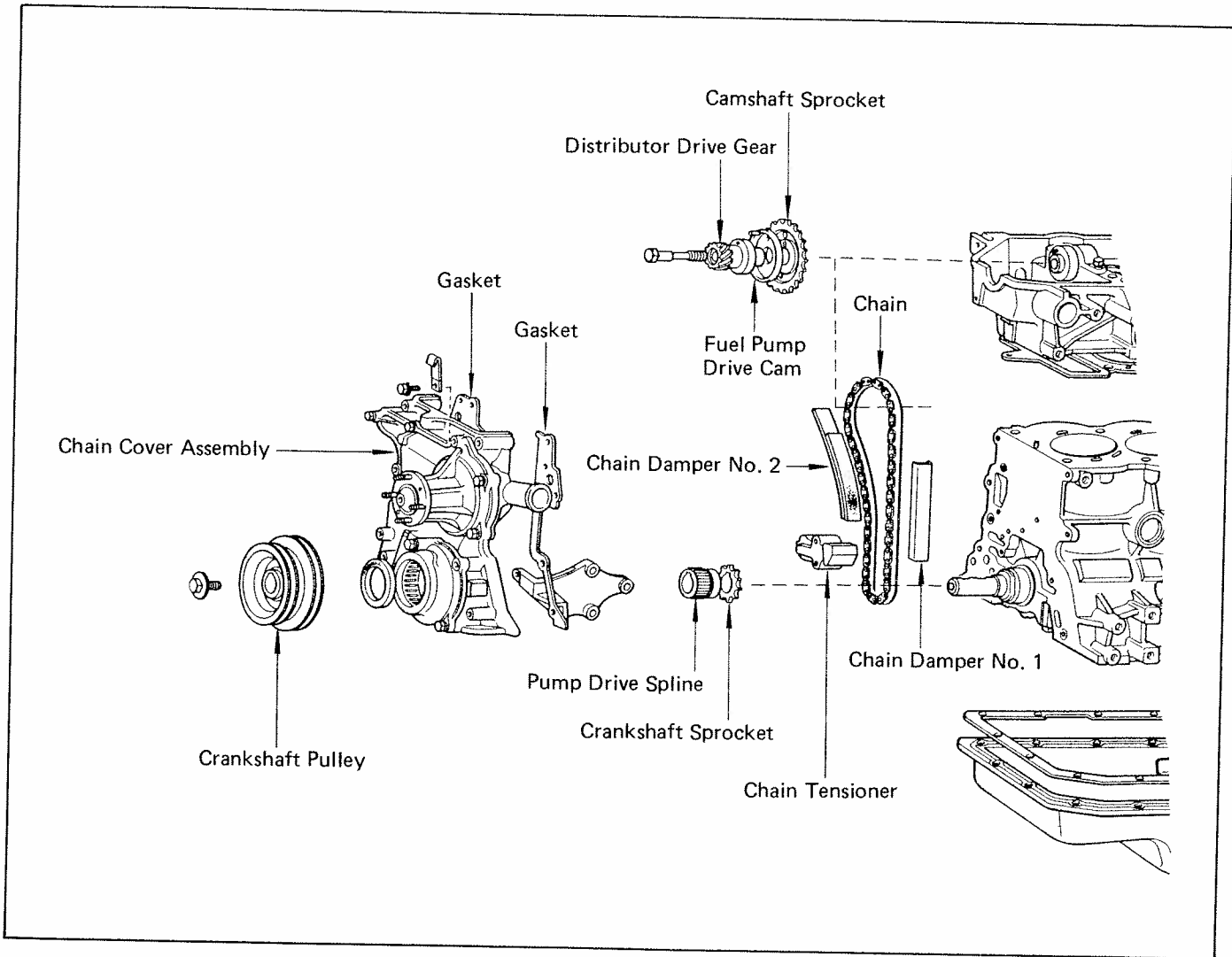
3. INSTALL AIR CLEANER

- Place the air cleaner in position and install the two mounting nuts and butterfly nut.
- Connect the air intake hose.
- Connect the emission control hoses.

NOTE: If the cylinder head was removed, perform the following steps:

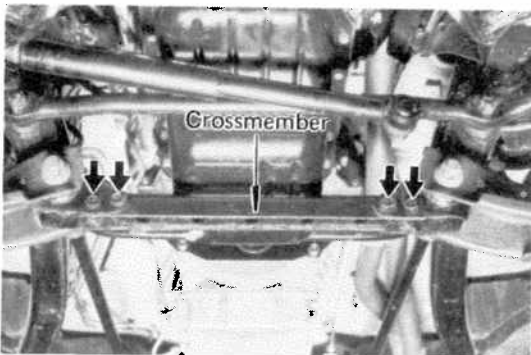
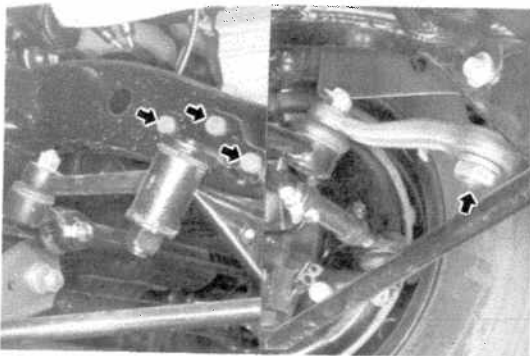
- Fill the radiator with approved coolant mixed to specifications.
- Connect the cable to the negative terminal of the battery.
- Start the engine and allow it to reach operating temperature.
- Reset the timing.
- Readjust the valves.
- Road test the vehicle and check for smooth idle and acceleration and no exhaust smoke.

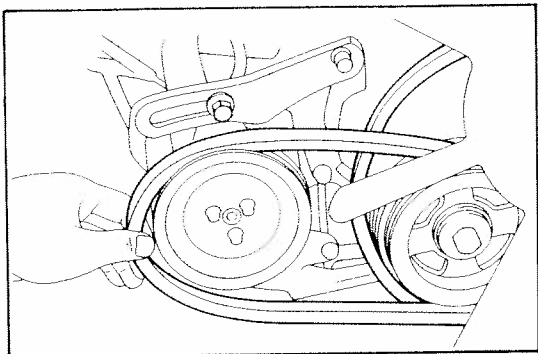
TIMING CHAIN



REMOVAL OF TIMING CHAIN

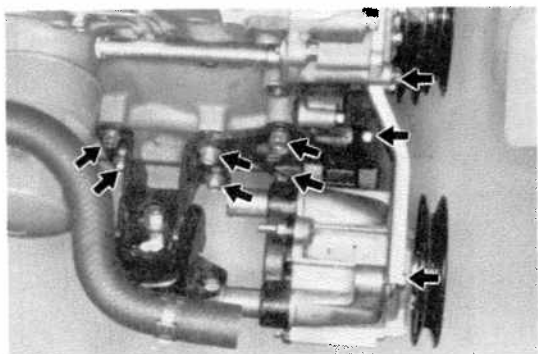
1. REMOVE CYLINDER HEAD (See page 4-4)
2. REMOVE RADIATOR (See page 6-6)
3. REMOVE OIL PAN
 - (a) Remove the engine undercover.
 - (b) Remove three bolts holding the steering idler arm bracket. (RN 4x2)
 - (c) Remove the pitman arm from the sector shaft. (RN 4x2) (See page 16-73)
 - (d) Remove four mounting bolts and crossmember. (RN 4x2)
 - (e) Remove seventeen bolts and two nuts, and remove the oil pan and gasket.





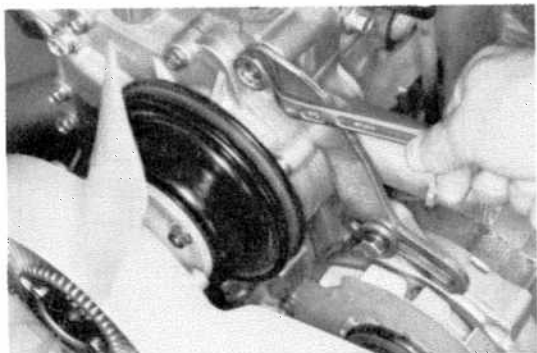
4. REMOVE DRIVE BELTS

- (a) Loosen the belt adjusting bolts and pivot bolts of the air pump and alternator.
- (b) Remove the two belts.



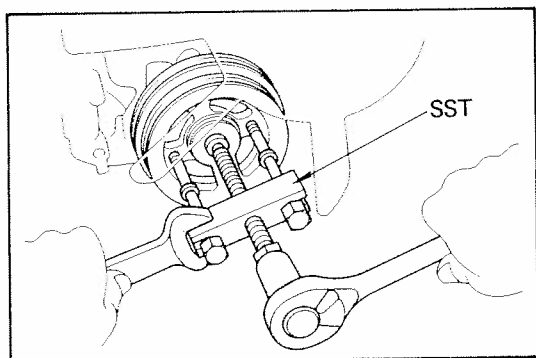
5. REMOVE AIR PUMP

- (a) Disconnect the air lines from the air pump.
- (b) Remove the adjuster bracket by removing two bolts.
- (c) Remove the front two bolts from the motor mount. Loosen the back two bolts.
- (d) Remove three bolts holding the lower air pump bracket.
- (e) Remove the bracket and air pump.



6. REMOVE ALTERNATOR ADJUSTER

Remove the bolt holding the alternator adjuster bracket to the chain cover. Move the bracket toward the alternator.

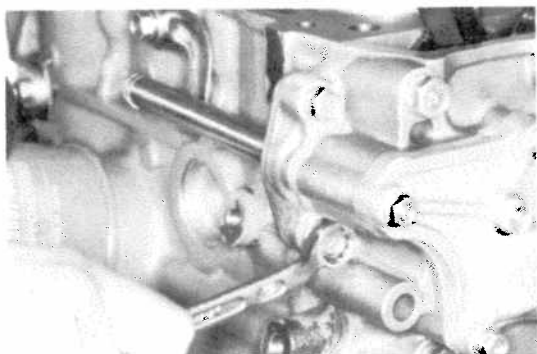


7. REMOVE CRANKSHAFT PULLEY

- (a) Remove the pulley center bolt.
- (b) Using a puller*, remove the pulley.

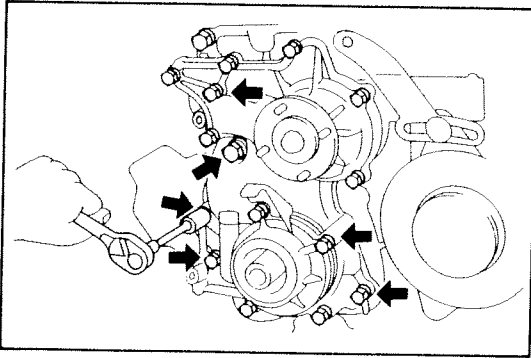
*SST 09213-31021 or Commercial puller

NOTE: If the front seal is to be replaced, see page 4-46.

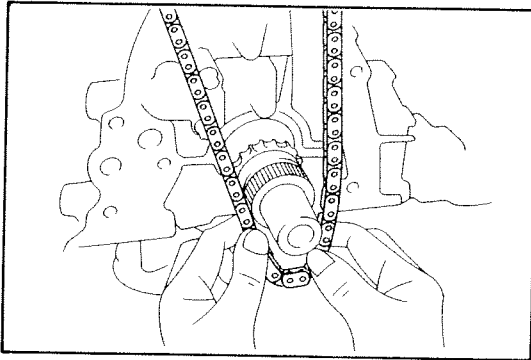


8. REMOVE WATER BY-PASS TUBE BOLTS

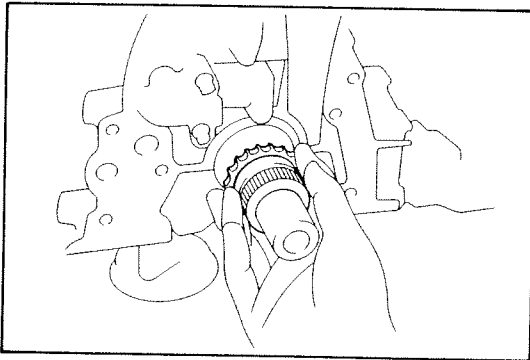
Remove two bolts.

**9. REMOVE CHAIN COVER ASSEMBLY**

- (a) Remove six timing chain cover bolts, shown by the arrows.
- (b) Using a plastic-faced hammer, loosen the chain cover and remove it.

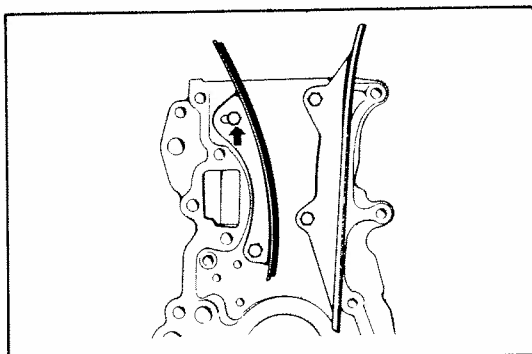
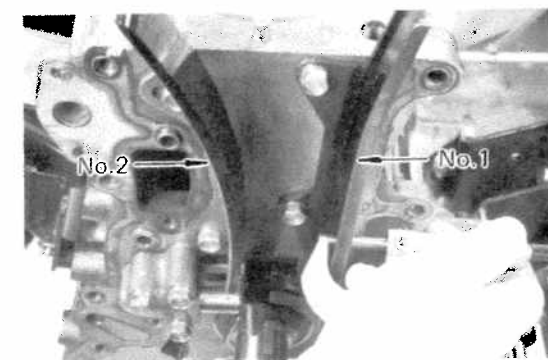
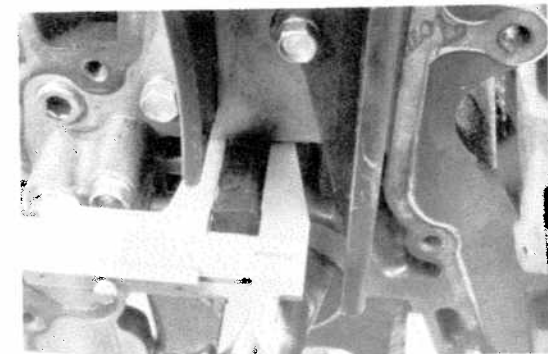
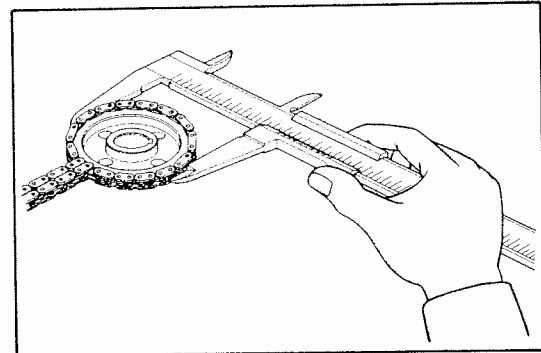
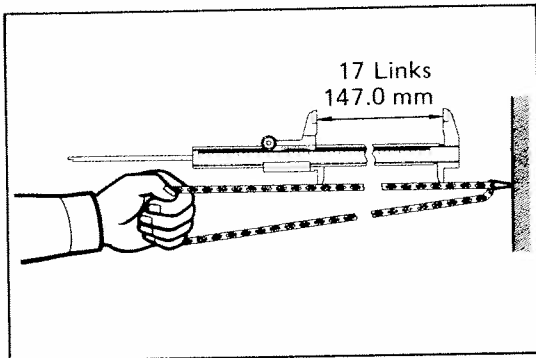
**10. REMOVE CHAIN AND CAMSHAFT SPROCKET**

- (a) Remove the chain from the damper.
- (b) Remove the cam sprocket and chain together.

**11. REMOVE PUMP DRIVE AND CRANKSHAFT SPROCKET**

If the pump drive and sprocket cannot be removed by hand, use a puller* to remove them together.

*SST 09213-36010 or Commercial puller



INSPECTION OF COMPONENTS

1. MEASURE CHAIN AND SPROCKET WEAR

- Measure the length of 17 links with the chain stretched tight with the force of one hand.
- Make the same measurements at more than three other places selected at random.

If over the limit at any one place, replace the chain.

Chain elongation limit at 17 links: 147.0 mm (5.787 in.)

- Wrap the chain around the sprocket.
- Using a vernier caliper, measure the outer sides of the chain rollers as shown. Measure both sprockets.

If the measurement is less than the minimum, replace the chain and two sprockets.

Crankshaft sprocket minimum: 59.4 mm (2.339 in.)

Camshaft sprocket minimum: 113.8 mm (4.480 in.)

2. CHECK CHAIN TENSIONER

- Inspect chain tensioner for wear.
- Using a vernier caliper, measure the tensioner as shown.

If the tensioner is worn or less than the minimum, replace the chain tensioner.

Tensioner minimum: 11 mm (0.43 in.)

3. CHECK CHAIN DAMPERS

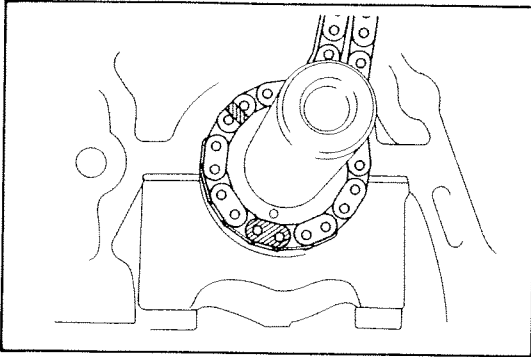
- Check chain dampers for wear.
- Using a micrometer, measure each damper.

No.1 damper minimum: 5 mm (0.20 in.)

No.2 damper minimum: 4.5 mm (0.177 in.)

If either damper is worn or is less than the minimum, replace the damper as follows:

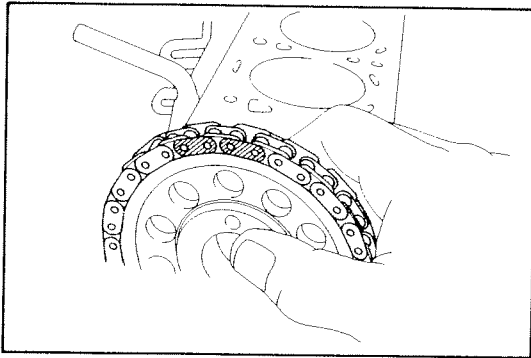
- Bolt down the new damper bolts as shown.



INSTALLATION OF TIMING CHAIN (See illustration on page 4-19)

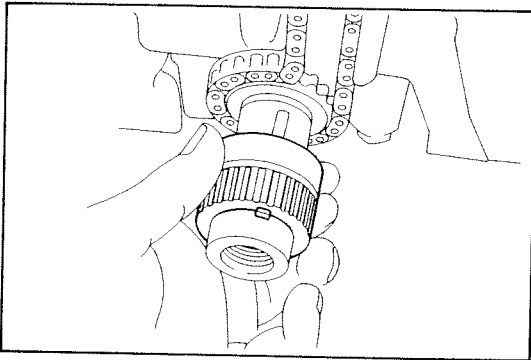
1. INSTALL CRANKSHAFT SPROCKET AND CHAIN

- Turn the crankshaft until the shaft key is on the top.
- Slide the sprocket over the key on the crankshaft.
- Place the timing chain on the sprocket with the single bright link aligned with the timing mark on the sprocket.



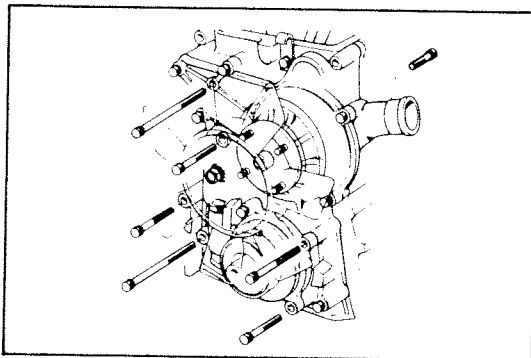
2. PLACE CHAIN ON CAMSHAFT SPROCKET

- Place the timing chain on the sprocket so that the timing mark is between two bright chain links.
- Make sure the chain is positioned between the two dampers.
- Turn the camshaft sprocket counterclockwise to take the slack out of the chain.



3. INSTALL OIL PUMP DRIVE

Slide oil pump drive spline over the crankshaft key.



4. INSTALL TIMING CHAIN COVER ASSEMBLY

- Remove the old cover gaskets. Clean the gasket surface. Install new gaskets over the dowels.
- Slide the cover assembly over the dowels and pump spline.
- Insert the bolts as shown and torque.

Torque: 8 mm bolt 100 – 160 kg-cm (8 – 11 ft-lb)
10 mm bolt 350 – 500 kg-cm (26 – 36 ft-lb)

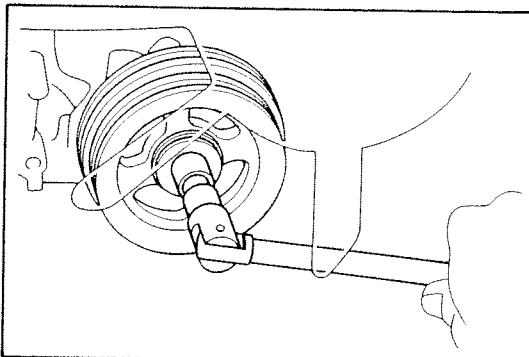
5. INSTALL CRANKSHAFT PULLEY

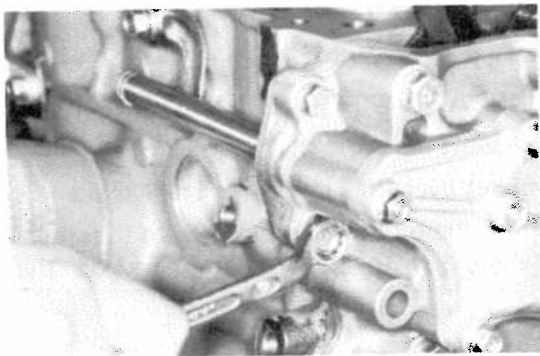
- Install the pulley over the crankshaft key.

CAUTION: Do not turn the crankshaft.

- Torque the pulley center bolt.

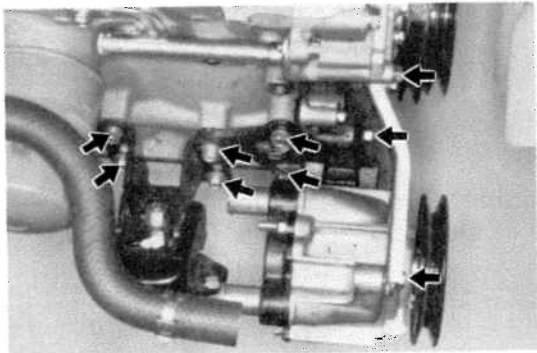
Torque: 1,400 – 1,800 kg-cm (102– 130 ft-lb)





6. INSTALL WATER BY-PASS TUBE

Place the new gasket and install the water by-pass tube.



7. INSTALL AIR PUMP

- Install the air pump and bracket with three bolts.
- Install the front two motor mount bolts. Tighten the back two bolts.
- Install the adjuster bracket with two bolts.
- Connect the air lines to the air pump.

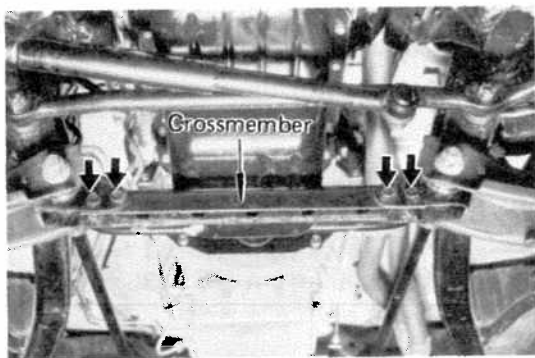
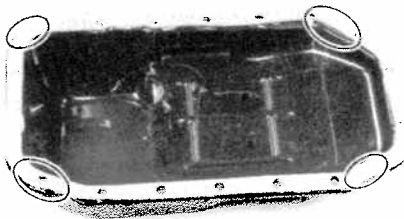
8. INSTALL BOLT HOLDING ALTERNATOR ADJUSTER BRACKET TO CHAIN COVER

9. INSTALL DRIVE BELTS (See page 4-43)

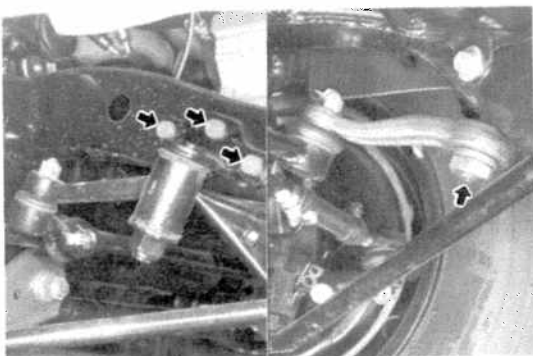
10. INSTALL OIL PAN

- Apply sealer to the new pan gasket as shown.
- Install the oil pan over the studs on the block with seventeen bolts and two nuts. Torque the nuts and bolts.

Torque: 40 – 80 kg-cm (35 – 69 in.-lb)



- Install the crossmember with four bolts. (RN 4x2)



- Install the pitman arm to the sector shaft. (RN 4x2)
- Install three bolts holding the idler arm bracket. (RN 4x2)
- Install the engine under cover.

11. INSTALL RADIATOR (See page 6-6)

12. INSTALL CYLINDER HEAD (See page 4-15)

CYLINDER BLOCK

REMOVAL OF ENGINE

1. REMOVE HOOD
2. REMOVE BATTERY
3. REMOVE AIR CLEANER (See page 4-3)
4. DRAIN COOLING SYSTEM

Drain coolant from the radiator and engine block.

5. REMOVE RADIATOR, SHROUD AND RADIATOR HOSES (See page 6-6)

When removing the radiator, disconnect the heater outlet hose and oil cooler hoses for A/T from the radiator.

6. IF VEHICLE HAS AIR CONDITIONING, REMOVE DRIVE BELT AND REMOVE COMPRESSOR MOUNTING BOLTS

Lay compressor aside without disconnecting the hoses.

7. REMOVE FAN, PULLEY AND DRIVE BELT

8. DISCONNECT FOLLOWING HOSES:

- (a) Heater inlet hose from water valve
- (b) Brake booster hose from intake manifold
- (c) Two fuel hoses from the pipes under the intake manifold
- (d) Disconnect two emission control hoses from charcoal canister and outer vent control valve.

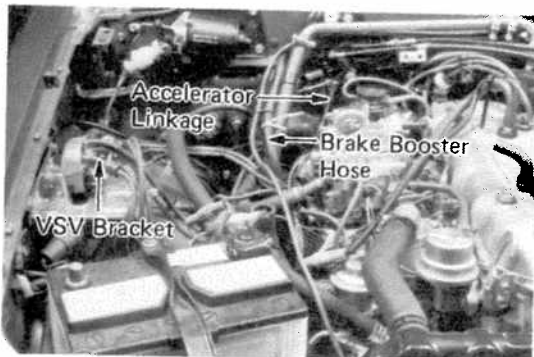
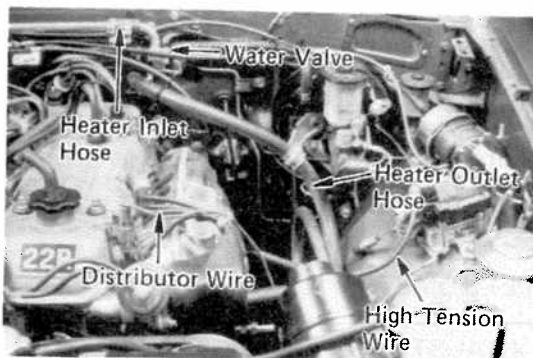
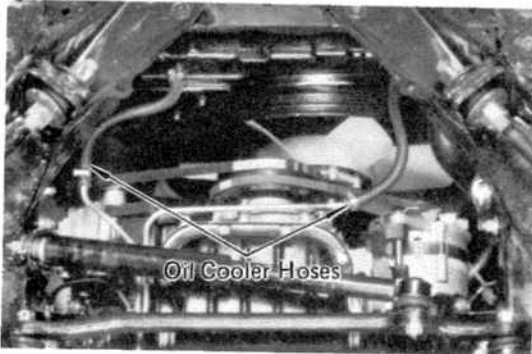
9. DISCONNECT FOLLOWING WIRES:

- (a) Alternator wires
- (b) Bond cables from the front and rear of the cylinder head
- (c) High tension wire from the ignition coil
- (d) Distributor wire
- (e) Carburetor wires
- (f) Water temperature sending unit wire
- (g) Thermo switch wire

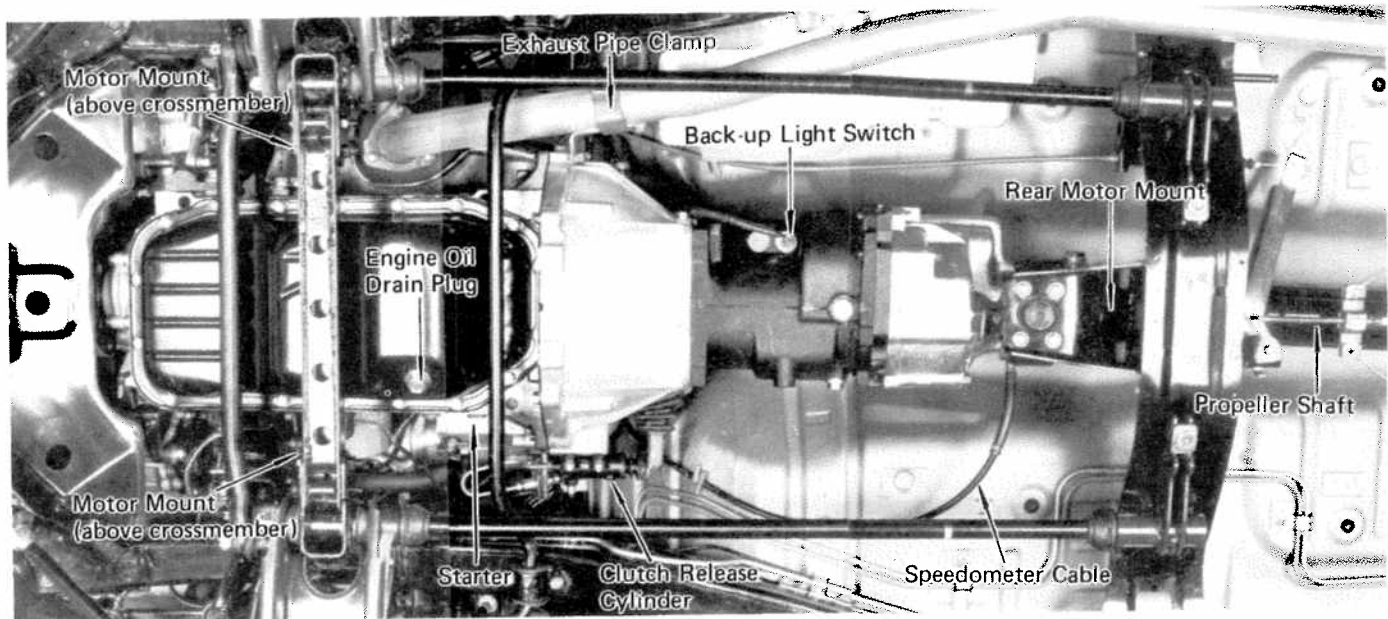
10. REMOVE VSV BRACKET AND VACUUM HOSE BRACKET

- (a) Disconnect the wires from the vacuum switch and VSVs.
- (b) Remove the VSV bracket and vacuum hose bracket, and lay them on the engine.

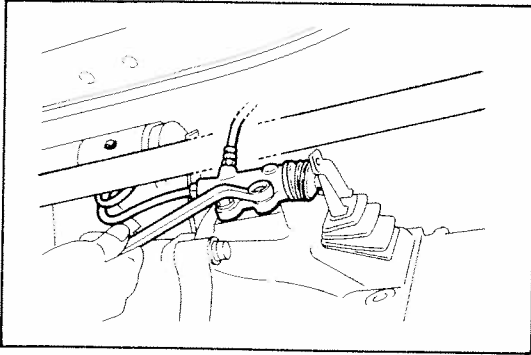
11. DISCONNECT ACCELERATOR LINKAGE FROM CARBURETOR



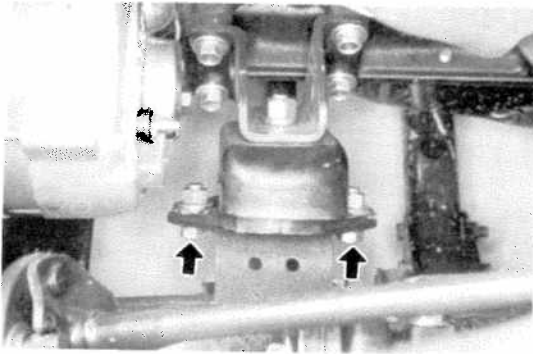
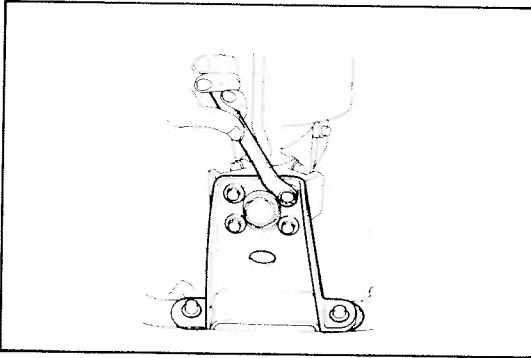
12. DISCONNECT THROTTLE CABLE FROM CARBURETOR AND VALVE COVER FOR A/T
13. REMOVE TRANSMISSION SHIFT LEVER FROM INSIDE OF VEHICLE FOR M/T (See page 9-12)
14. RAISE VEHICLE (See page 1-7)
CAUTION: Be sure the vehicle is securely supported.



15. DRAIN ENGINE OIL
16. DISCONNECT FOLLOWING WIRES:
 - (a) Oil pressure switch wire
 - (b) Oil pressure sending unit wire
 - (c) Back-up light switch wire
 - (d) Bond cable from the right engine mounting bracket
 - (e) Starter wires
 - (f) Neutral start switch, back-up light switch and OD solenoid wires for A/T
17. REMOVE PROPELLER SHAFT (See page 12-3)
18. DISCONNECT SPEEDOMETER CABLE
19. DISCONNECT EXHAUST PIPE CLAMP FROM TRANSMISSION HOUSING
20. DISCONNECT EXHAUST PIPE MOUNT NUTS FROM EXHAUST MANIFOLD
21. DISCONNECT SHIFT LINKAGE TO SHIFT LEVER FOR A/T

**22. REMOVE CLUTCH RELEASE CYLINDER FOR M/T**

- (a) Remove the clutch release cylinder and hose bracket mounting bolts.
- (b) Lay the release cylinder alongside the frame.

**23. REMOVE ENGINE MOUNTING BOLTS ON EACH SIDE OF ENGINE****24. PLACE JACK UNDER TRANSMISSION**

Be sure to put a wooden block between the jack and the transmission pan to prevent damage.

25. REMOVE ENGINE REAR MOUNTING BRACKET FROM MEMBER**26. REMOVE ENGINE WITH TRANSMISSION FROM VEHICLE**

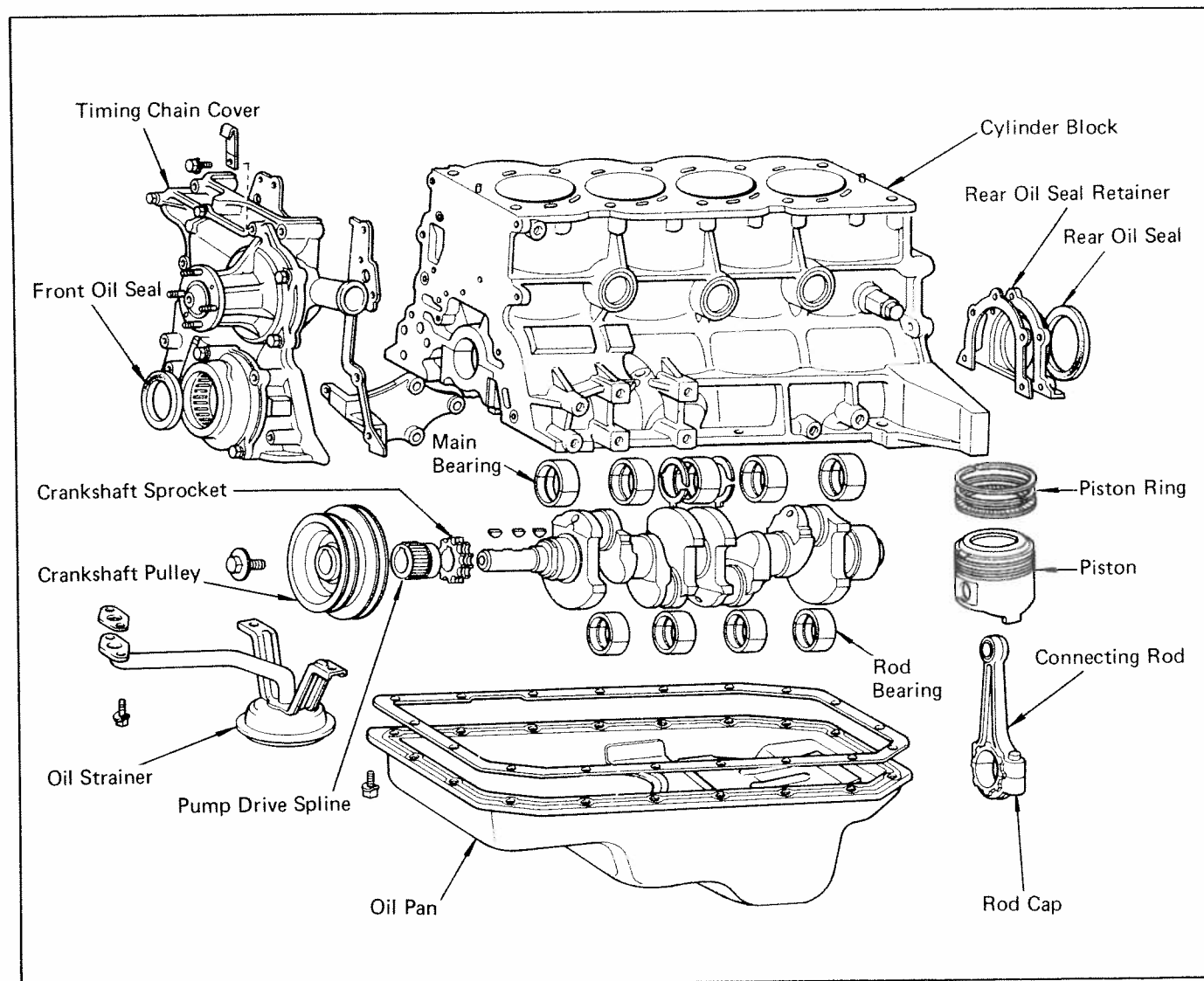
CAUTION: If vehicle has air conditioning, be careful not to damage the condenser.

- (a) Attach the engine hoist chain to the lift brackets of the engine.
- (b) Lift the engine out of the vehicle slowly and carefully.

NOTE: Make sure the engine is clear of all wiring and hoses.

27. DISCONNECT TRANSMISSION FROM ENGINE

- (a) Remove the starter.
- (b) Remove stiffener plate bolts from the transmission.
- (c) Remove the transmission housing mount bolts.
- (d) Disconnect the transmission from the engine.



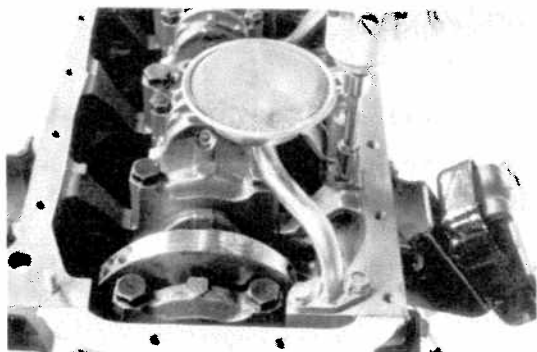
REMOVAL OF PISTON AND CONNECTING ROD ASSEMBLY

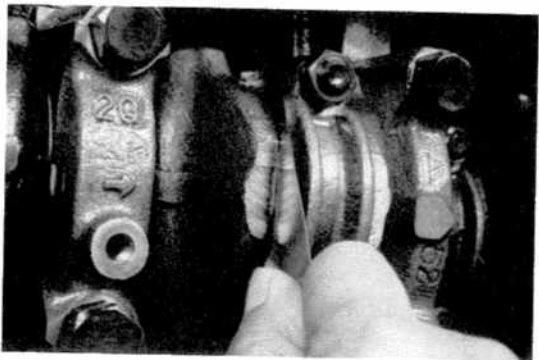
NOTE: If inspecting pistons and connecting rods or replacing bearings only, the timing chain and engine do not have to be removed.

1. REMOVE ENGINE (See page 4-25)
2. REMOVE CYLINDER HEAD (See page 4-4)
3. REMOVE TIMING CHAIN (See page 4-19)
4. REMOVE OIL STRAINER

NOTE: If the timing chain cover was not removed, remove the oil pan. (See page 4-19)

Remove four bolts holding the oil strainer.



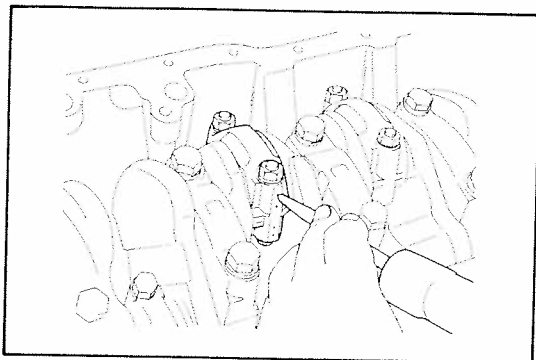


5. MEASURE CONNECTING ROD THRUST CLEARANCE

Using a feeler gauge, measure the rod thrust clearance.

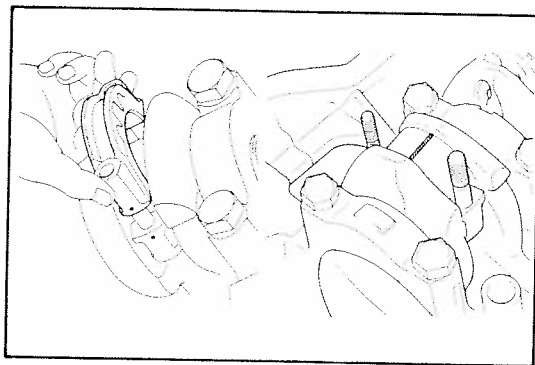
If clearance is greater than the maximum, replace the connecting rod.

Rod thrust maximum clearance: 0.3 mm (0.012 in.)



6. REMOVE ROD CAPS AND MEASURE OIL CLEARANCE

- (a) Using a punch or numbering stamp, mark connecting rods and caps to ensure correct reassembly.



- (b) Remove the rod caps.

Remove the rod cap nuts. Using a plastic-faced hammer, tap the rod bolts lightly and lift off the rod cap. Keep the bearing insert with the cap.

- (c) Clean the bearings and crankshaft pin.

- (d) Measure the rod journal oil clearance.

- Lay a strip of Plastigage across the crankshaft pin.
- Install the rod cap. Torque the rod cap nuts.

Torque: 570 – 690 kg-cm (42 – 49 ft-lb)

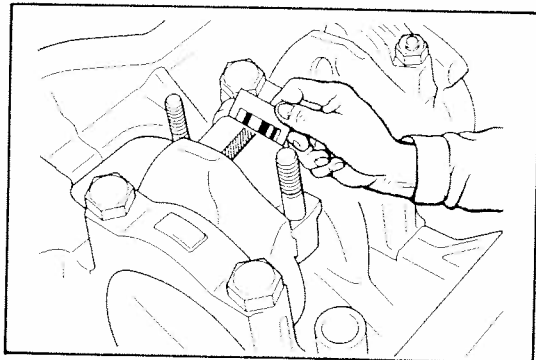
- Remove the rod cap.

- Measure the plastigage at its widest point.

If the clearance is greater than the maximum, replace the bearings.

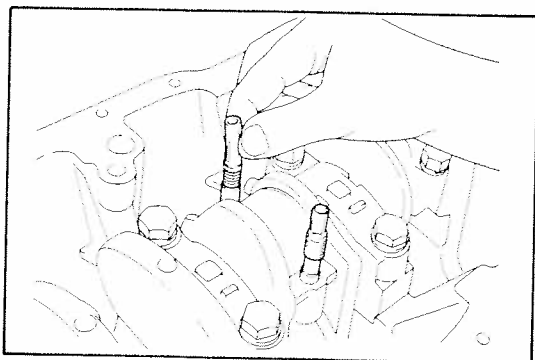
Maximum clearance: 0.1 mm (0.004 in.)

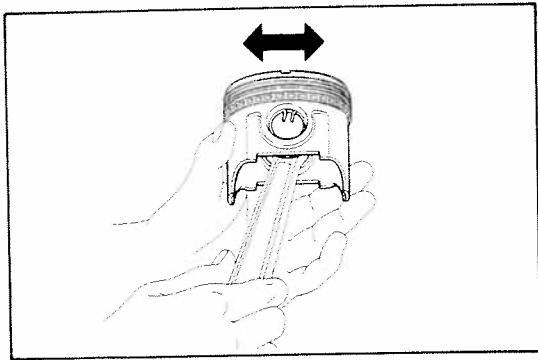
**Standard clearance: 0.02 – 0.05 mm
(0.0008 – 0.0020 in.)**



7. PUSH OUT PISTON AND CONNECTING ROD ASSEMBLY

- (a) Cover the rod bolts with a short piece of hose to protect the crankshaft from damage.
- (b) Push piston and connecting rod assembly out through the top of the cylinder block.

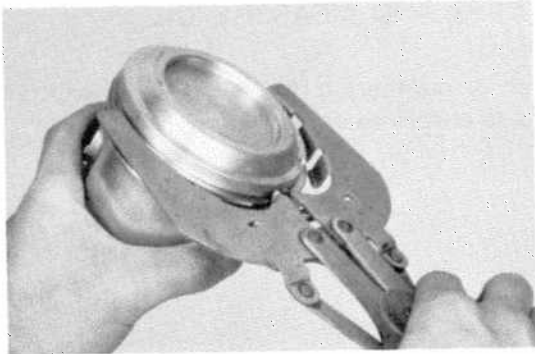




DISASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

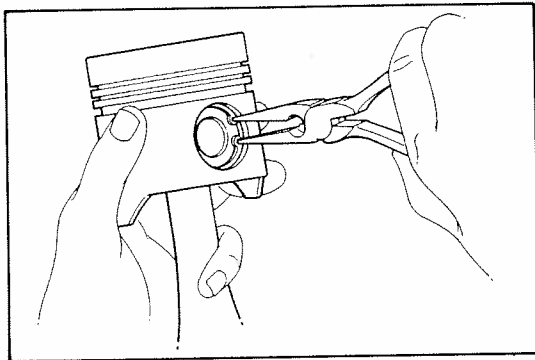
1. CHECK FIT BETWEEN PISTON AND PIN

Try to move the piston back and forth on the piston pin. If any movement is felt, replace the piston and pin.



2. REMOVE PISTON RINGS

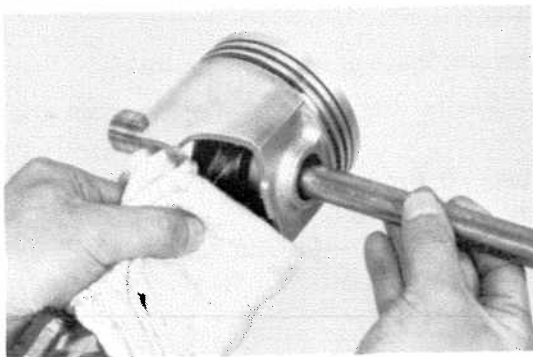
Using a piston ring expander, remove the piston rings. Keep the rings for each cylinder separated.



3. DISCONNECT CONNECTING ROD FROM PISTON

(a) Using needle-nose pliers, remove the snap rings from the piston pin.

(b) Heat the piston in hot water to about 80°C (176°F).



(c) Using a plastic-faced hammer and driver, tap the pin lightly to remove the pin from the piston.

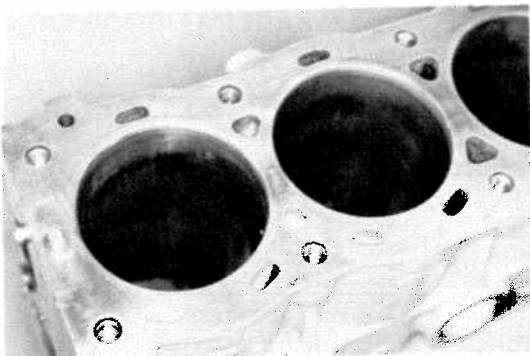
NOTE:

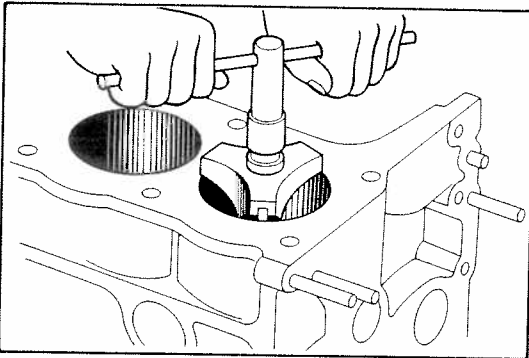
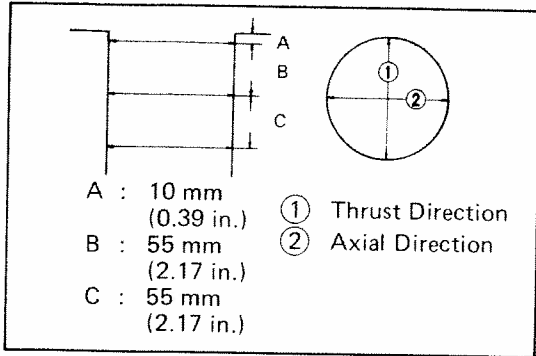
- The piston and pin are a matched set.
- Keep the piston, piston pin and rings and connecting rod together for each cylinder.

INSPECTION OF CYLINDER BLOCK

1. INSPECT CYLINDERS

Visually inspect cylinders for vertical scratches. If deep scratches are present, rebore all four cylinders. (See page 4-37)





2. MEASURE CYLINDER BORE

Using a cylinder micrometer, measure the cylinder bore at positions A, B and C in the thrust and axial directions. If any of the following measurements are not within specification, rebore all four cylinders. (See page 4-37)

- (a) Cylinder diameter greater than maximum.
- (b) Difference between A, B and C measurements greater than taper limit.
- (c) Difference between thrust and axial measurements greater than out-of-round limit

Maximum diameter: 92.23 mm (3.6311 in.)

Taper and out-of-round limit: 0.02 mm (0.0008 in.)

3. REMOVE CYLINDER RIDGE

Using a ridge remover, remove the piston ring ridge from the top of the cylinders.

INSPECTION OF PISTON AND CONNECTING ROD ASSEMBLY

1. INSPECT ROD BEARING

Inspect the rod bearings for flaking or scoring. If the bearings are damaged, replace the bearing.

2. INSPECT AND CLEAN PISTONS AND RINGS

- (a) Using a micrometer, measure the piston diameter as shown.

Standard diameter: 91.938 – 91.968 mm
 (3.6196 – 3.6208 in.)

Check that the difference between the cylinder diameter and the piston diameter is within specification.

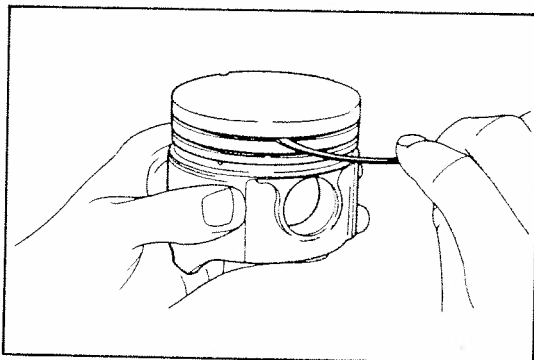
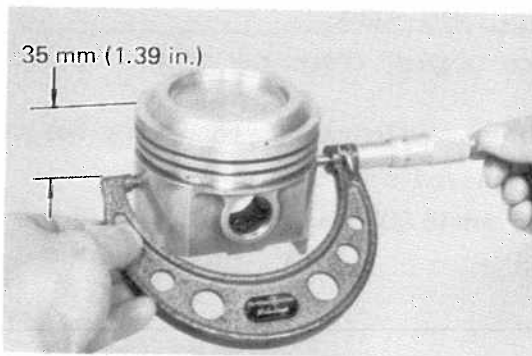
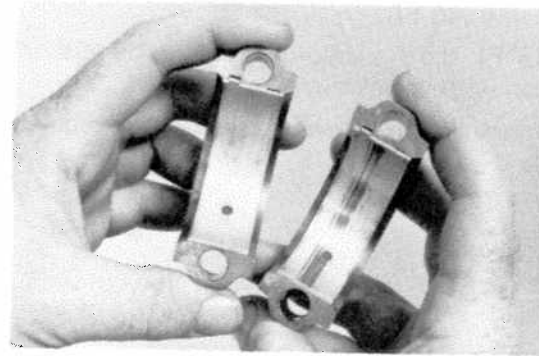
If not within specification, replace the piston and/or rebore the cylinder.

Piston clearance: 0.052 – 0.072 mm (0.0020 – 0.0028 in.)

- (b) Clean the pistons as follows:

- Scrape carbon from the piston top.
- Using a groove cleaning tool or broken ring, clean the ring grooves.
- Using solvent and brush, clean the piston thoroughly.

CAUTION: Do not use a wire brush.

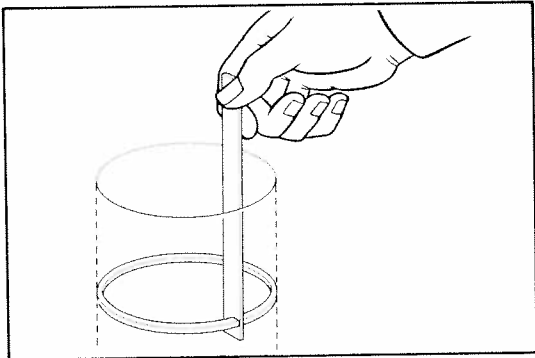




- (c) Using a feeler gauge, measure the clearance between the new piston ring and the ring land.

If the clearance is greater than the maximum, replace the piston.

Maximum clearance between compression ring No.1 or 2 and ring land: 0.2 mm (0.008 in.)



- (d) Measure the ring end gap.

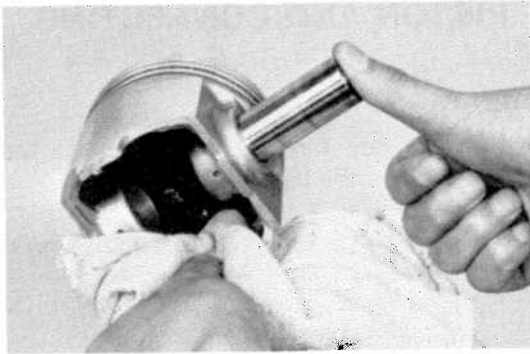
- Insert the compression ring into the cylinder.
- Using a piston, push the ring to the bottom of the ring travel.
- Using a feeler gauge, measure the end gap.

If not within specification, replace the ring. Do not file the ring end.

Ring end gap:

No.1 0.24 – 0.36 mm (0.0094 – 0.0142 in.)

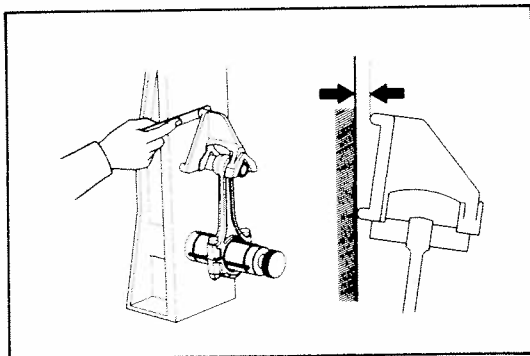
No.2 0.18 – 0.39 mm (0.0071 – 0.0154 in.)



- (e) Check the piston pin fit.

At 80°C (176°F), the pin should be able to be pushed into the piston with your thumb.

If the pin can be installed at a lower temperature, replace the piston and pin.



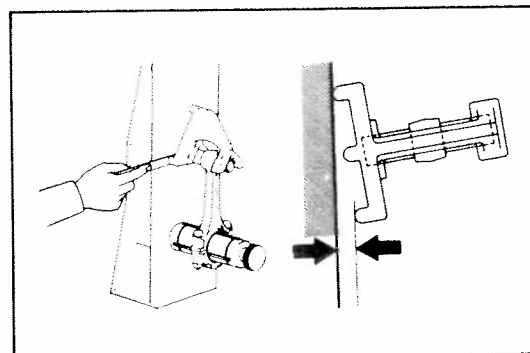
3. INSPECT CONNECTING RODS

- (a) Using a rod aligner, check the connecting rod alignment.

If the rod is bent or twisted, replace the connecting rod.

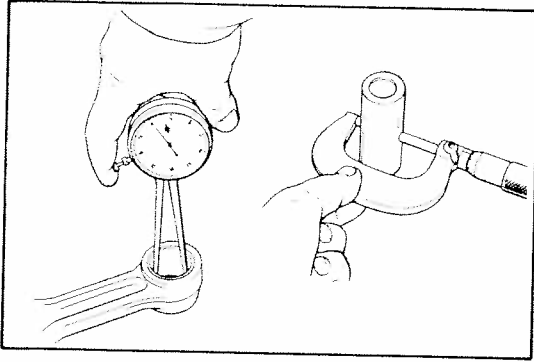
- Check that the rod is not bent.

Bend limit: 0.05 mm (0.0020 in.) per 100 mm (3.94 in.)



- Check that the rod is not twisted.

Twist limit: 0.15 mm (0.0059 in.) per 100 mm (3.94 in.)



- (b) Measure the oil clearance between the rod bushing and piston pin.

- Using an inside dial indicator, measure the inside diameter of the rod bushing.
- Using a micrometer, measure the diameter of the piston pin.
- Check that the difference between the measurements is less than the oil clearance limit.

If the clearance is greater than the limit, replace the rod bushing.

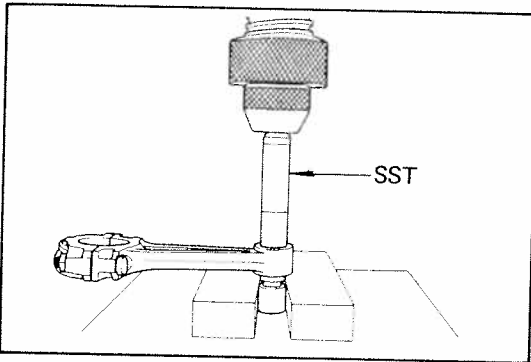
Oil clearance limit: 0.015 mm (0.0006 in.)

REPLACEMENT OF ROD BUSHING

1. REPLACE ROD BUSHING

Using a driver*, remove the rod bushing from the connecting rod. Install the new bushing.

*SST 09222-30010 or Commercial driver

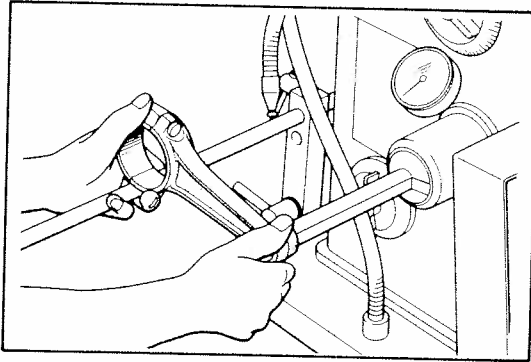


2. HONE NEW BUSHING AND CHECK PIN FIT IN CONNECTING ROD

- (a) Hone the new bushing and check that the oil clearance is within standard specifications.

Oil clearance standard: 0.005 – 0.011 mm
(0.0002 – 0.0004 in.)

- (b) Check the pin fit at the normal room temperature. Coat the pin with engine oil and push the pin into the rod with thumb pressure.



INSPECTION OF CRANKSHAFT (Crankshaft Installed)

1. MEASURE CRANKSHAFT THRUST

Using a feeler gauge, measure the clearance at the center bearing.

If the clearance is greater than the maximum, replace the thrust washer.

Maximum clearance: 0.3 mm (0.012 in.)

Select a thrust washer to obtain the standard clearance.

Standard clearance: 0.02 – 0.22 mm
(0.0008 – 0.0087 in.)

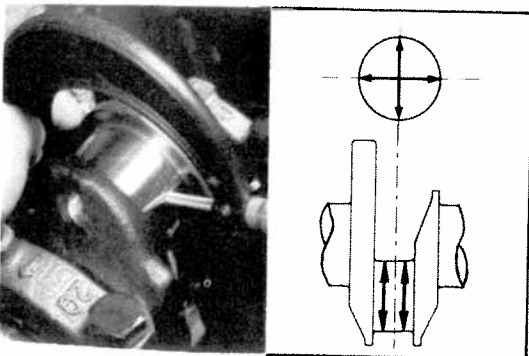
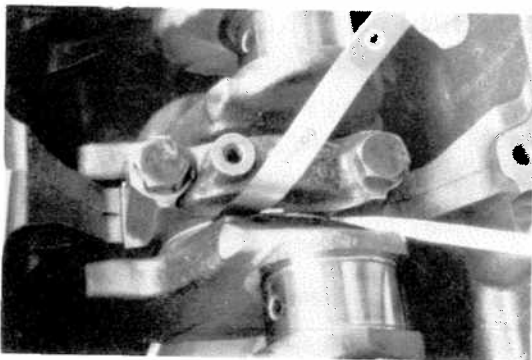
2. MEASURE CRANK PIN JOURNALS

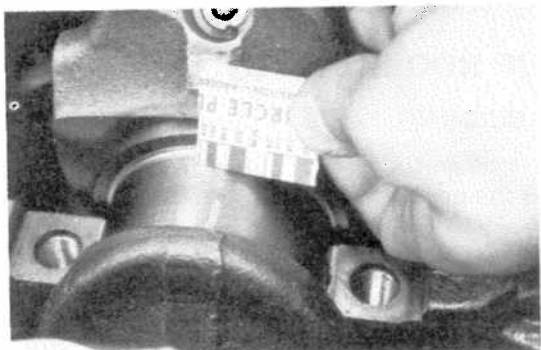
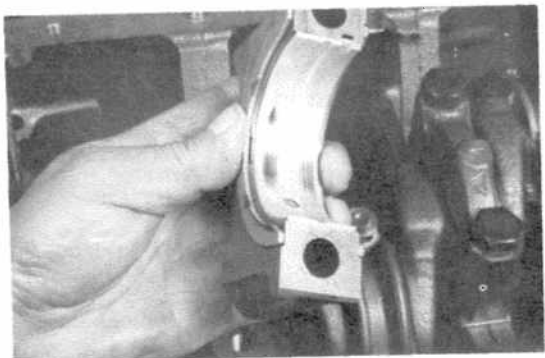
Using a micrometer, check the crank pin journal diameter. Measure the journals for out-of-round and taper as shown.

If journals are worn, regrind or replace the crankshaft.

Crank pin journal diameter: 52.99 – 53.00 mm
(2.0862 – 2.0866 in.)

Taper and out-of-round limit: 0.01 mm (0.0004 in.)





3. REMOVE MAIN BEARING CAPS AND MEASURE OIL CLEARANCE

- (a) Remove the main bearing caps by removing two bolts.
- (b) Clean the bearings and crank pin journals.
- (c) Inspect each bearing for pitting and radial scratches. If bearings are damaged, replace the bearing.
- (d) Measure the main bearing oil clearance.
 - Lay a strip of plastigage across the main journals.
 - Install the main bearing caps. Torque the cap bolts.

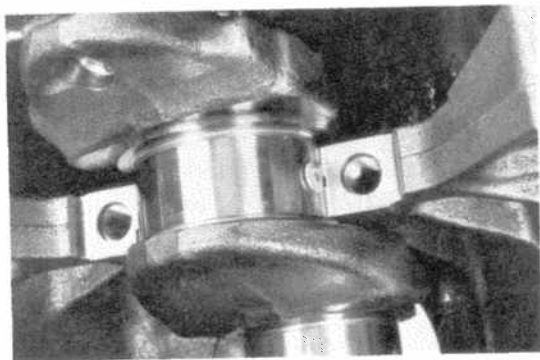
Torque: 950 – 1,150 kg-cm (69 – 83 ft-lb)

- Remove the main bearing caps.
- Measure the plastigage at its widest point.

If the clearance is greater than maximum, replace the main bearings.

Maximum clearance: 0.08 mm (0.0031 in.)

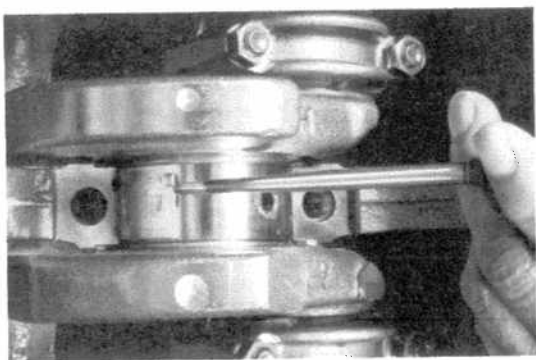
**Standard clearance: 0.016 – 0.050 mm
(0.0006 – 0.0020 in.)**



REPLACEMENT OF MAIN BEARINGS (Crankshaft Installed)

1. ROLL OUT UPPER HALF OF MAIN BEARING

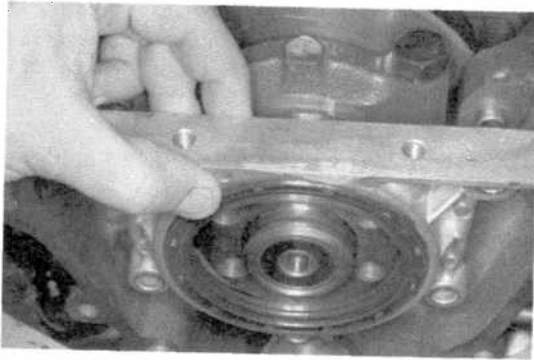
- (a) Insert a roll-out tool into the crankshaft journal oil hole.
- (b) Turn the crankshaft slowly to roll out the upper bearing shell.



2. ROLL IN NEW BEARING

- (a) Lubricate the bearing face only with engine oil.
- (b) Align the tab on the bearing shell with the groove in the cylinder block.
- (c) Push the upper bearing shell into position. If necessary, a punch may be used to push the shell into position.
- (d) Check the main bearing oil clearance again.

If the clearance is still not within specification, the crankshaft must be removed and machined and undersized bearings installed.



REMOVAL OF FLYWHEEL, REAR OIL SEAL AND CRANKSHAFT

1. REMOVE FLYWHEEL

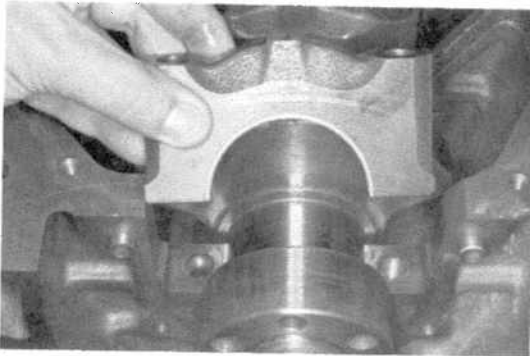
Remove six bolts and the flywheel.

2. REMOVE REAR OIL SEAL RETAINER

Remove five bolts, rear oil seal retainer and gasket.

3. REMOVE CRANKSHAFT

- If the main bearing caps have not been removed, remove the caps.
- Lift out the crankshaft.
- Remove the upper main bearings from the cylinder block.



INSPECTION AND REPAIR OF CRANKSHAFT

1. MEASURE CRANKSHAFT

- Place the crankshaft on V-blocks.
- Using a runout gauge, measure the runout at the center journal.

If the runout is greater than the maximum, replace the crankshaft.

Runout maximum: 0.1 mm (0.004 in.)

- Using a micrometer, check the diameter of the main and crank pin journal.

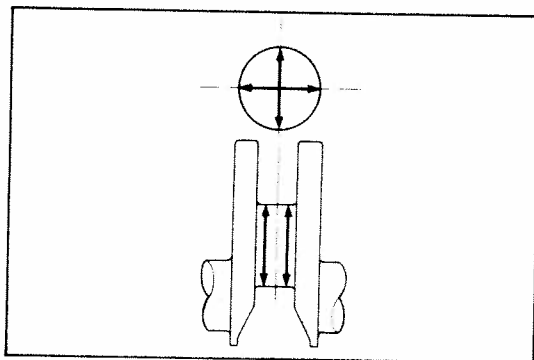
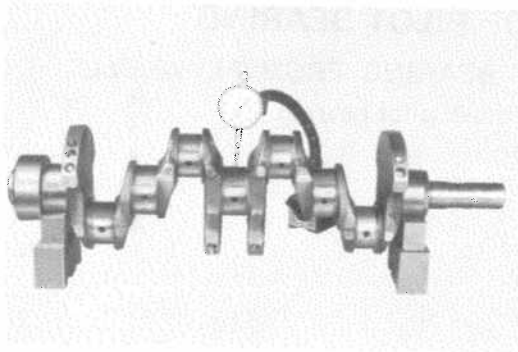
Measure the journals for out-of-round and taper as shown.

If journals are worn, regrind or replace the crankshaft.

**Main journal diameter: 59.98 – 60.00 mm
(2.3614 – 2.3622 in.)**

**Crank pin diameter: 52.99 – 53.00 mm
(2.0862 – 2.0866 in.)**

Taper and out-of-round limit: 0.01 mm (0.0004 in.)



Bearing size	Crank pin finished diameter — mm (in.)
U/S 0.25	52.70 – 52.71 (2.0748 – 2.0752)

Bearing size	Main finished diameter — mm (in.)
U/S 0.25	59.70 – 59.71 (2.3504 – 2.3508)

2. GRIND CRANK PIN AND/OR MAIN JOURNALS IF NECESSARY

Grind the crank pin and/or main journals to the undersized finished diameter. Install a new rod and/or main undersize bearings.

INSPECTION OF FLYWHEEL

1. INSPECT FLYWHEEL

(a) Inspect the ring gear.

If the ring gear is damaged, cracked or worn, replace the flywheel.

(b) Inspect the surface contacting the clutch.

If damaged or excessively worn, replace the flywheel.

(c) Using a runout gauge, measure the surface contacting the clutch.

If runout is greater than the maximum, replace the flywheel.

Runout maximum: 0.2 mm (0.008 in.)

2. CHECK PILOT BEARING

Turn the bearing by hand while applying force in the rotating direction.

If the bearing sticks or has hard resistance, replace the pilot bearing.

REPLACEMENT OF PILOT BEARING

1. REMOVE PILOT BEARING FROM FLYWHEEL

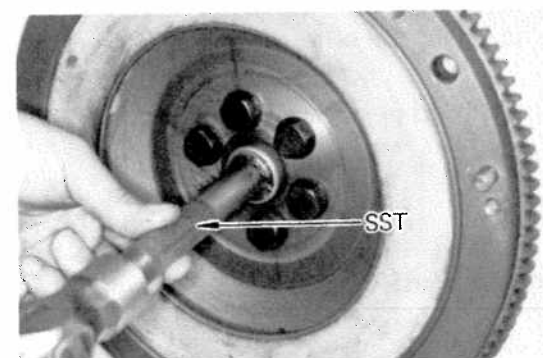
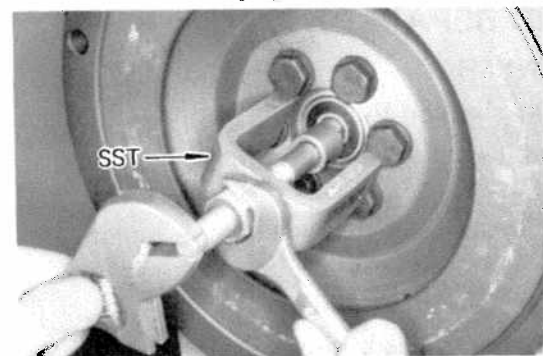
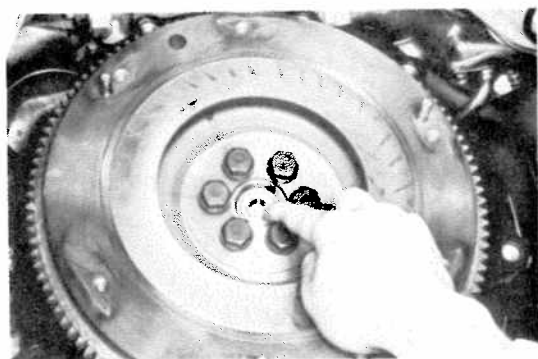
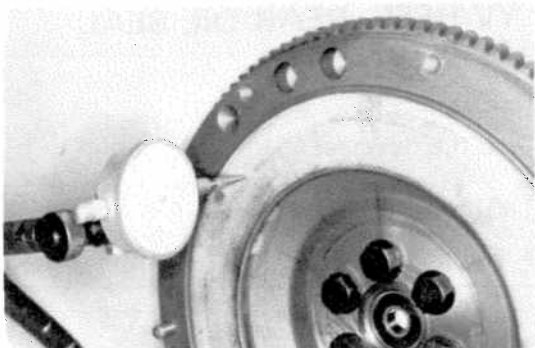
Using a puller*, remove pilot bearing.

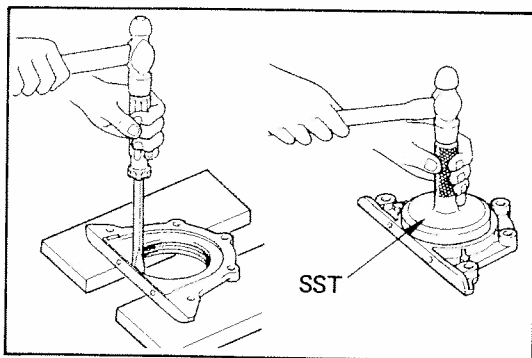
*SST 09303-35010

2. INSTALL PILOT BEARING IN FLYWHEEL

Using a driver*, install the pilot bearing.

*SST 09304-30012 or Commercial driver





INSPECTION AND REPLACEMENT OF REAR OIL SEAL

INSPECT REAR OIL SEAL

If the lip of the oil seal is worn, damaged or cracked, replace the seal as follows:

- Using a screwdriver, remove the oil seal.
- Using an oil seal driver*, install a new oil seal.

*SST 09608-35013 or Commercial driver

- Coat the seal lightly with multipurpose grease.

Size	Outside diameter mm (in.)
O/S 0.50	92.438 – 92.468 (3.6393 – 3.6405)
O/S 1.00	92.938 – 92.968 (3.6590 – 3.6602)

BORING OF CYLINDERS

1. SELECT OVERSIZED PISTON

O/S pistons with pins are available in the sizes listed. Replace pistons in matched sets. Take the largest bore measured and select the oversized piston for that bore. Bore all cylinders for the oversized piston selected.

2. CALCULATE DIMENSION TO BORE CYLINDERS

- Using a micrometer, measure the piston diameter as shown.
- Calculate the size each cylinder is to be rebored as follows:

$$\text{Size to be rebored} = P + C - H$$

P = piston diameter

C = piston clearance

$$0.052 - 0.072 \text{ mm } (0.0020 - 0.0028 \text{ in.})$$

H = allowance for honing

$$\text{Less than } 0.02 \text{ mm } (0.0008 \text{ in.})$$

3. BORE AND HONE CYLINDERS TO CALCULATED DIMENSIONS

Honing amount: 0.02 mm (0.0008 in.) maximum

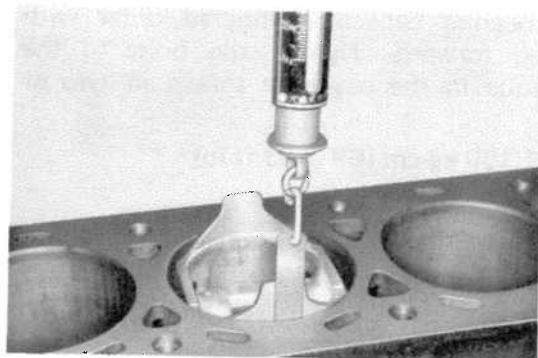
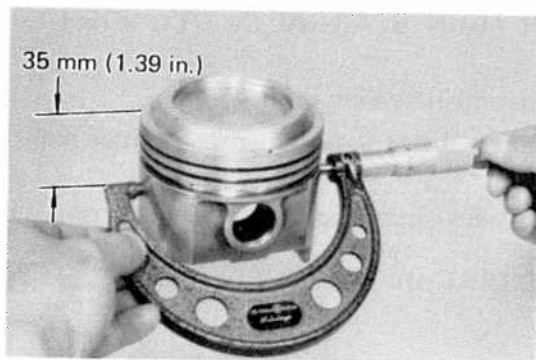
CAUTION: Excess honing will destroy the finished roundness.

4. CHECK PISTON FIT IN CYLINDER

Insert a piston and 0.03 – 0.05 mm (0.0012 – 0.0020 in.) feeler gauge held by a tension gauge into the cylinder.

If the scale reading is correct, the clearance is correct.

Scale reading: 1.0 – 2.5 kg (2.2 – 5.5 lb)



CLEANING OF CYLINDER BLOCK

DEGLAZE AND CLEAN CYLINDERS

- (a) If the crankshaft is installed, cover the crankshaft journals.
- (b) Using a glaze breaker, remove the glaze from the cylinder bore.
- (c) Clean the bore with soap and water. Dry thoroughly.

GENERAL ASSEMBLE NOTE:

Thoroughly clean all parts to be assembled. Before installing parts, apply new engine oil to all sliding and rotating surfaces.

INSTALLATION OF CRANKSHAFT, MAIN BEARINGS, REAR OIL SEAL AND FLYWHEEL

1. INSTALL UPPER MAIN BEARING IN CYLINDER BLOCK

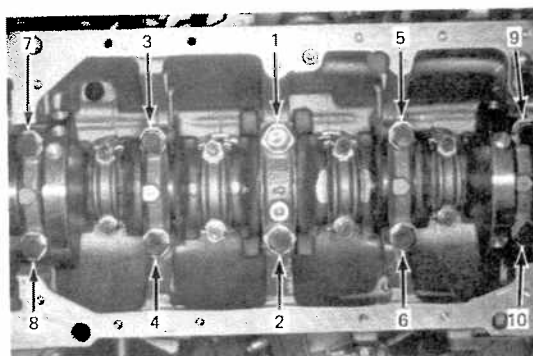
- (a) Place the upper main bearing in the block.
- (b) Install the upper thrust washers on the center main bearing with the oil grooves facing out.
- (c) Lubricate the faces of the bearings with engine oil.

2. PLACE CRANKSHAFT IN CYLINDER BLOCK

3. INSTALL MAIN BEARING CAPS

NOTE: Each bearing cap is numbered.

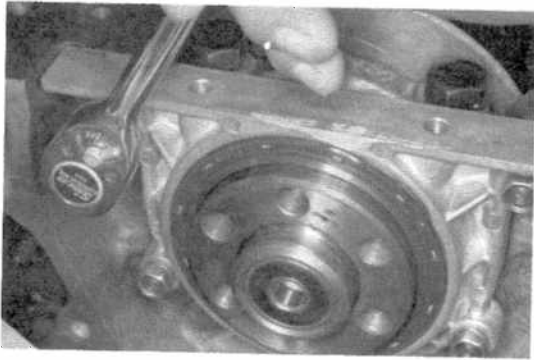
- (a) Install thrust washers on bearing cap No. 3 with the oil grooves facing out.



- (b) Install the bearing caps in numbered order with arrows facing forward. Tighten the bolts to the specified torque in the sequence shown in two or three passes.

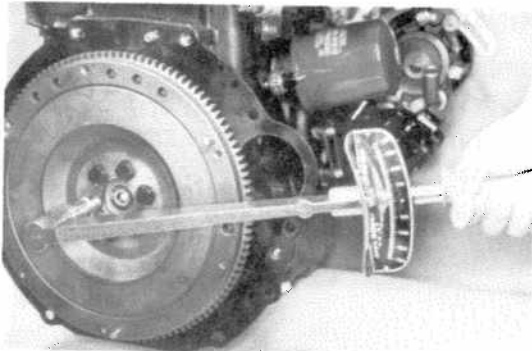
Torque: 950 — 1,150 kg-cm (69 — 83 ft-lb)

- (c) Check that the crankshaft turns.
- (d) Measure the crankshaft thrust. (See page 4-33)



4. INSTALL REAR OIL SEAL RETAINER

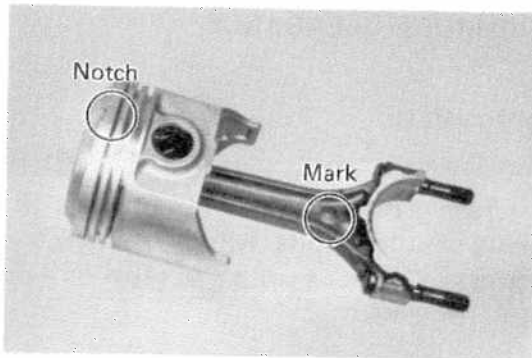
- (a) Place the gasket on the cylinder block.
- (b) Install the rear oil seal retainer over the crankshaft with five bolts.



5. INSTALL FLYWHEEL

Install the flywheel on the crankshaft with six bolts.
Torque the bolts.

Torque: 1,000 – 1,200 kg-cm (73 – 86 ft-lb)



ASSEMBLY OF PISTON AND CONNECTING ROD ASSEMBLY

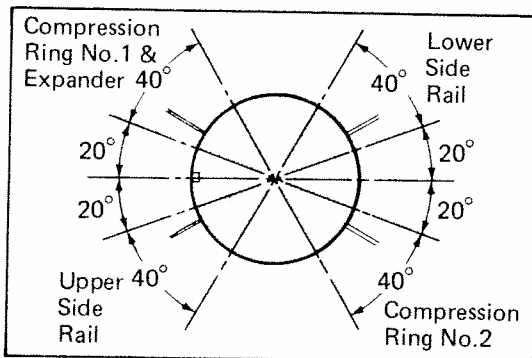
1. ASSEMBLE PISTON AND CONNECTING ROD

- (a) Install the new snap ring on one side of the piston pin hole.
- (b) Heat the piston in hot water to about 80°C (176°F).
- (c) Align the notch on the piston with the mark on the rod and push the piston pin in with your thumb.
- (d) Install the new snap ring on the other side of the pin.

2. PLACE RINGS ON PISTON

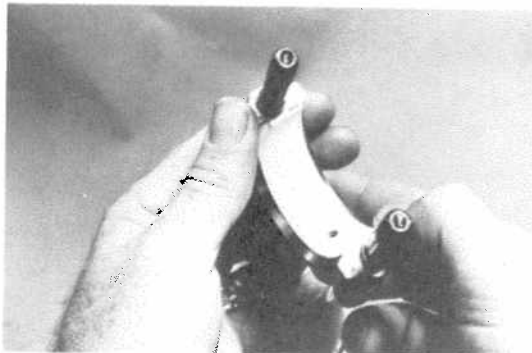
- (a) Using a ring expander, install the top two compression rings with the code marks facing up.
- (b) Position the piston rings so that the ring end gaps are in the shaded area as shown.

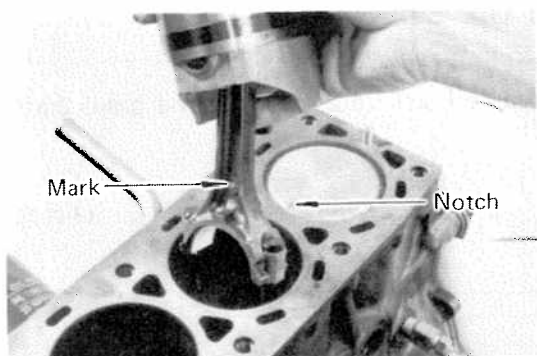
CAUTION: Do not align the end gaps.



3. INSTALL BEARING INSERTS

- (a) Install the bearing inserts in the connecting rods and rod caps.
- (b) Lubricate the face of the bearings with engine oil.





INSTALLATION OF PISTON AND CONNECTING ROD ASSEMBLY

1. INSTALL PISTON AND CONNECTING ROD ASSEMBLY

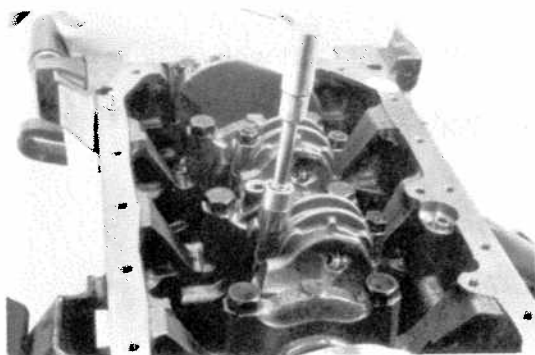
- Lubricate the cylinder bore and rod journals with clean engine oil.
- Using a ring compressor, push the correctly numbered piston and rod assembly into each cylinder. Make sure the notch and mark are facing forward.

2. INSTALL ROD BEARING CAPS

- Match the numbered cap with the numbered rod.
- Align the marks punched on the rod and cap and tighten the cap nuts to specified torque alternately in two or three passes.

Torque: 570 – 690 kg-cm (42 – 49 ft-lb)

NOTE: After tightening the caps, check that the crankshaft rotates smoothly.

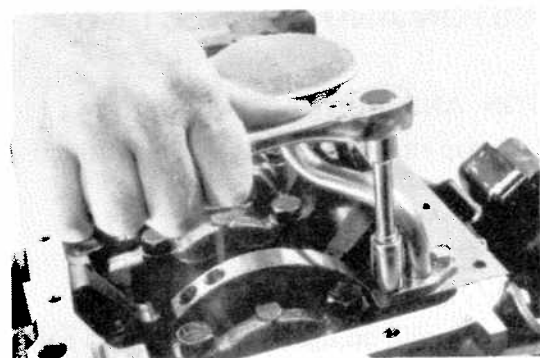


3. MEASURE ROD THRUST CLEARANCE (See page 4-29)

4. INSTALL OIL STRAINER

- Clean the oil strainer.
- Place the oil screen gasket in place and install the oil strainer assembly with four bolts. Torque the bolts.

Torque: 100 – 160 kg-cm (8 – 11 ft-lb)

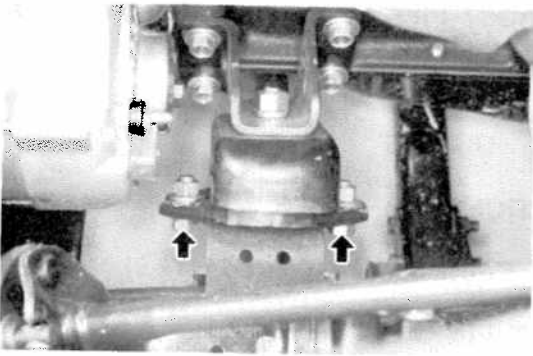


5. INSTALL OIL PAN (See page 4-24)

6. INSTALL TIMING CHAIN IF REMOVED (See page 4-24)

7. INSTALL CYLINDER HEAD (See page 4-15)

8. INSTALL ENGINE IF REMOVED (See page 4-41)



INSTALLATION OF ENGINE

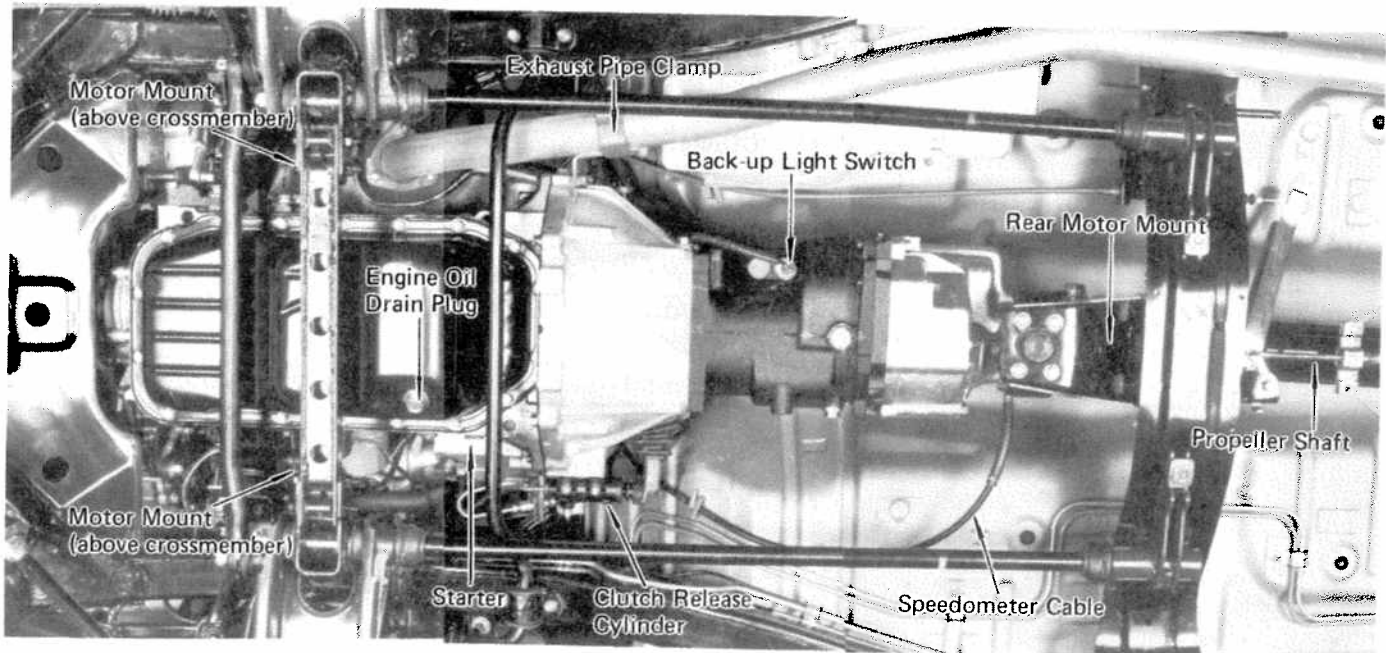
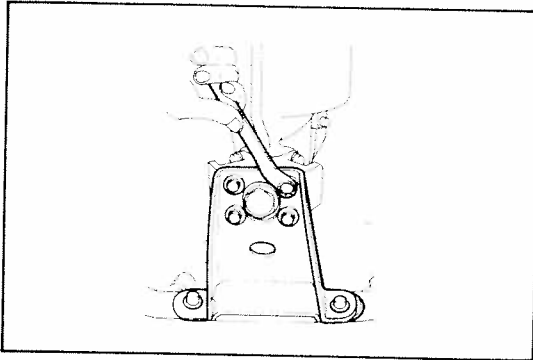
1. CONNECT TRANSMISSION TO ENGINE

- (a) Install the transmission housing mount bolts.
- (b) Install the starter with the mount nut.
- (c) Install stiffener plate bolts.

2. INSTALL ENGINE WITH TRANSMISSION IN VEHICLE

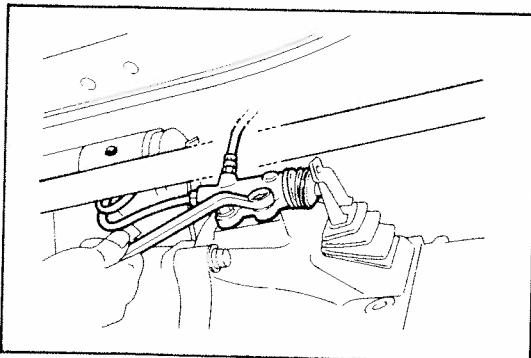
CAUTION: If vehicle has air conditioning, be careful not to damage the condenser.

- (a) Attach the engine hoist chain to lift brackets on the engine.
- (b) Lower the engine into the engine compartment.
- (c) Align the engine with the motor mount supports and the rear motor support.
- (d) Install the motor mount bolts on each side of the engine.
- (e) Install the rear motor mount bolts on the rear motor mount support.
- (f) Remove the hoist chain.

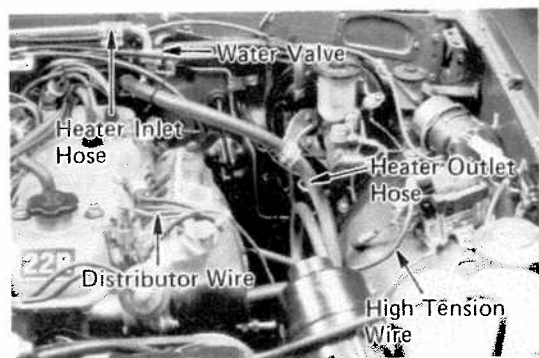
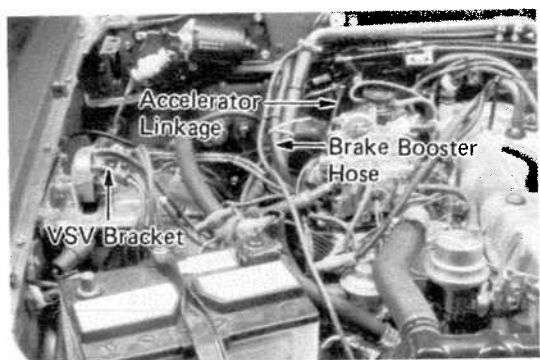


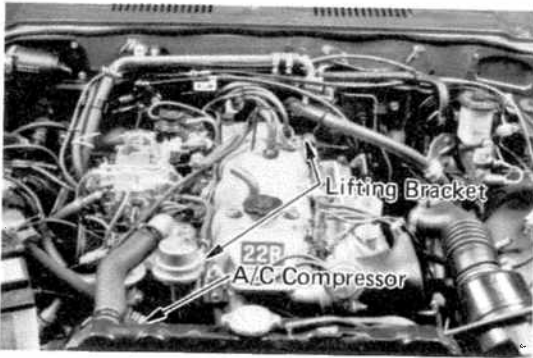
3. INSTALL CLUTCH RELEASE CYLINDER FOR M/T

Install the clutch release cylinder and hose bracket.

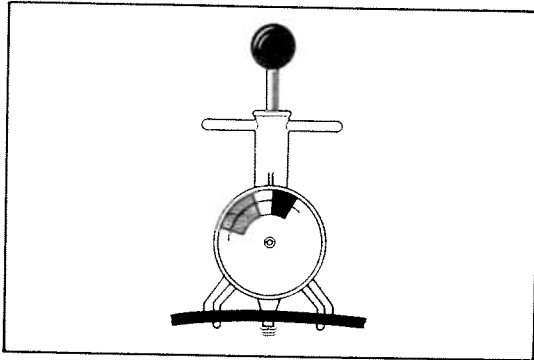


4. CONNECT EXHAUST PIPE MOUNT NUTS TO EXHAUST MANIFOLD
5. CONNECT EXHAUST PIPE CLAMP TO TRANSMISSION HOUSING
6. CONNECT SPEEDOMETER CABLE
7. INSTALL PROPELLER SHAFT (See page 12-8)
8. CONNECT SHIFT LINKAGE TO SHIFT LEVER FOR A/T
9. CONNECT FOLLOWING WIRES:
 - (a) Starter wires
 - (b) Bond cable to the right engine mounting bracket
 - (c) Back-up light switch wire
 - (d) Oil pressure sending unit wire
 - (e) Oil pressure switch wire
 - (f) Neutral start switch, back-up light switch and OD solenoid wires for A/T
10. INSTALL TRANSMISSION SHIFT LEVER TO INSIDE OF VEHICLE FOR M/T
(See page 9-55)
11. CONNECT ACCELERATOR LINKAGE TO CARBURETOR
12. CONNECT THROTTLE CABLE TO CARBURETOR AND VALVE COVER FOR A/T
INSTALL VSV BRACKET AND VACUUM HOSE BRACKET
 - (a) Install the VSV bracket and vacuum hose bracket.
 - (b) Connect the wires to the vacuum switch and VSVs.
13. CONNECT FOLLOWING WIRES:
 - (a) Thermo switch wire
 - (b) Water temperature sending unit wire
 - (c) Carburetor wires
 - (d) Distributor wire
 - (e) High tension wire to the ignition coil
 - (f) Bond cable to the front and rear of the cylinder head
 - (g) Alternator wires



**14. CONNECT FOLLOWING HOSES:**

- (a) Heater inlet hose to water valve
- (b) Brake booster hose to intake manifold
- (c) Two fuel hoses to the pipes under the intake manifold
- (d) Connect two emission control hoses to charcoal canister and outer vent control valve

**15. INSTALL FAN, PULLEY AND DRIVE BELT**

Adjust the belt.

Drive belt tension:

New belt 125 ± 25 lb

Used belt 80 ± 20 lb

(W/ Borroughs belt tension gauge No. BT-33-73F)

16. IF VEHICLE HAS AIR CONDITIONING, INSTALL COMPRESSOR AND DRIVE BELT

Adjust the belt as shown above.

**17. INSTALL RADIATOR, SHROUD AND RADIATOR HOSES (See page 6-6)**

When installing the radiator, connect the heater outlet hose and oil cooler hoses for A/T to the radiator.

18. INSTALL AIR CLEANER**19. INSTALL BATTERY****20. INSTALL AND ADJUST HOOD (See page 18-2)****21. ADD COOLANT TO RADIATOR**

Close engine and radiator drain cocks. Fill radiator with approved coolant mixed to specifications.

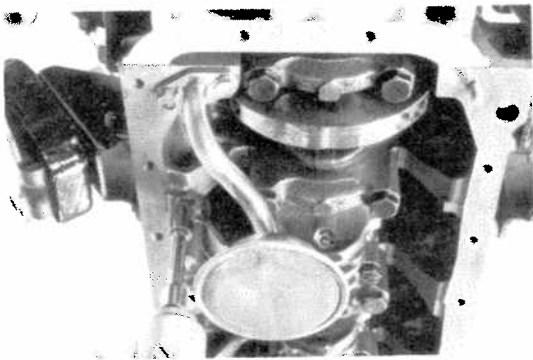
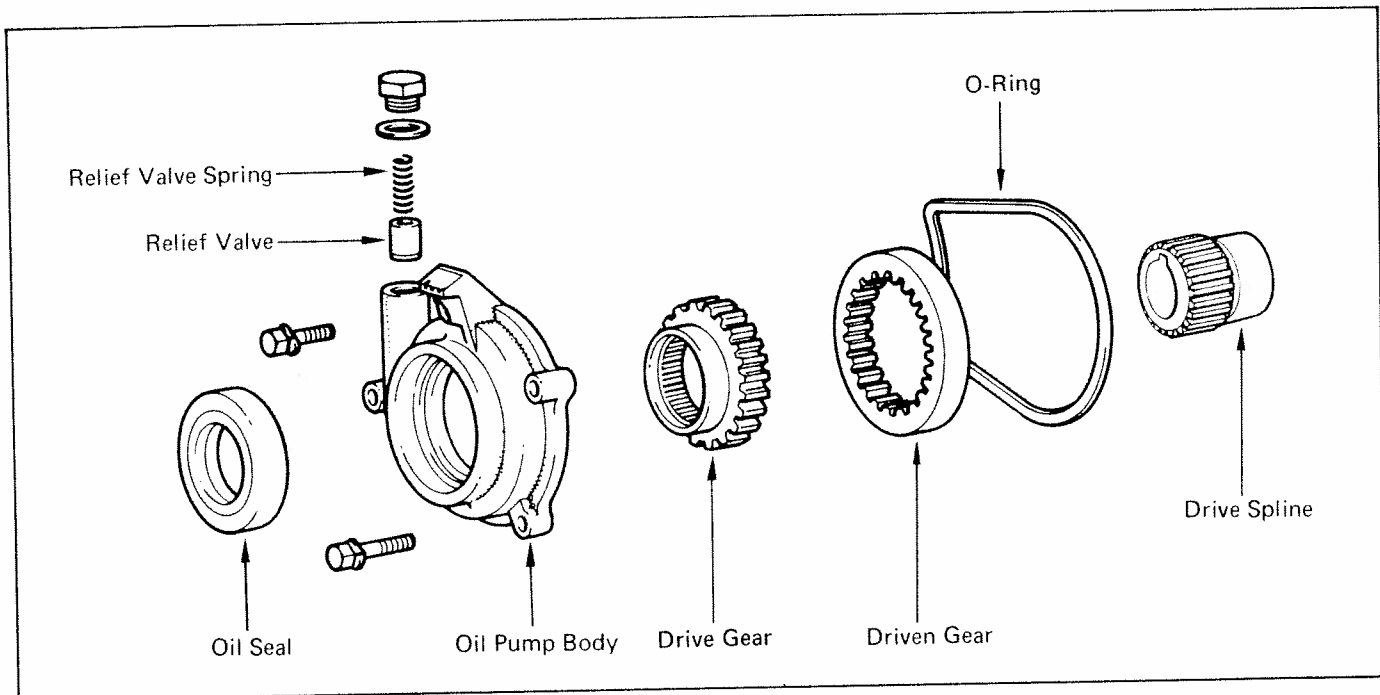
22. ENGINE OIL

Add four quarts of API grade SF, fuel-efficient and multi grade oil. Refer to the owner's manual to select the correct weight of oil.

23. START ENGINE

- (a) Check for leaks.
- (b) Perform engine adjustments as necessary.
- (c) Perform road test of the vehicle.
- (d) Recheck the coolant level.

OIL PUMP



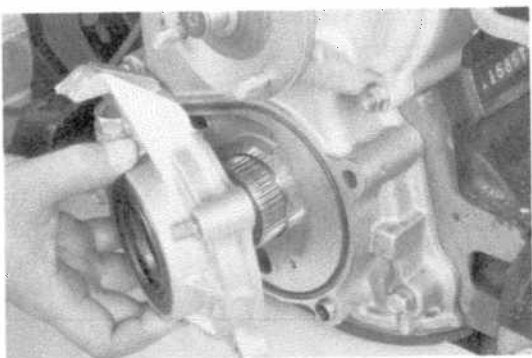
REMOVAL AND DISASSEMBLY OIL PUMP

NOTE: When repairing the oil pump, the oil pan and screen should be removed and cleaned.

1. REMOVE OIL PAN (See step 3, page 4-19)

2. REMOVE OIL SCREEN

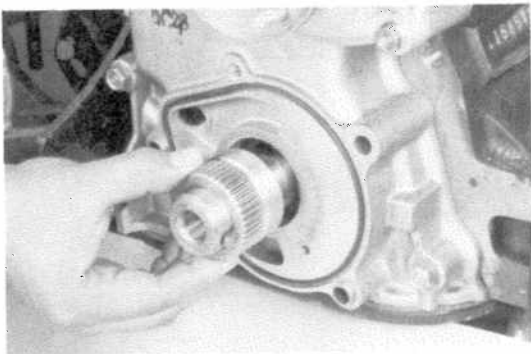
Remove four bolts holding the oil pick-up screen.



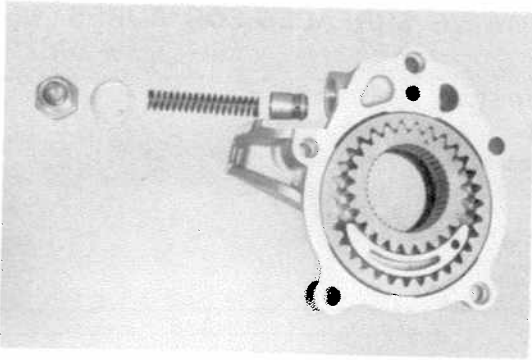
3. REMOVE DRIVE BELTS AND CRANKSHAFT PULLEY (See step 4 and 7, page 4-20)

4. REMOVE OIL PUMP ASSEMBLY

Remove five bolts and the oil pump assembly.

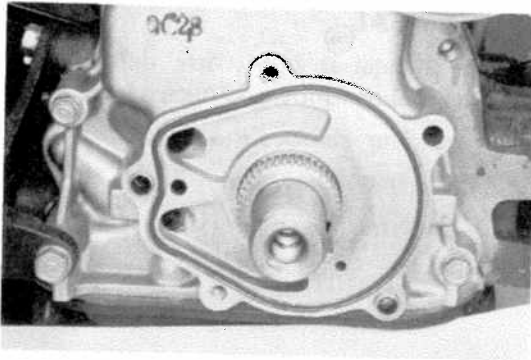


5. REMOVE OIL PUMP DRIVE SPLINE AND O-RING



6. DISASSEMBLE OIL PUMP ASSEMBLY

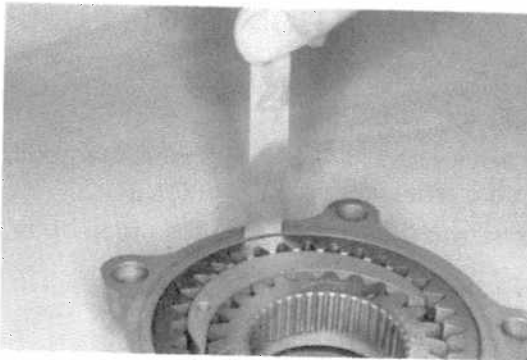
- (a) Unscrew the relief valve plug, and remove spring and the relief valve piston.
- (b) Remove the drive, and driven gears.



INSPECTION OF OIL PUMP

1. INSPECT FOLLOWING COMPONENTS FOR WEAR OR DAMAGE:

- (a) Drive spline
- (b) Drive gear, driven gear
- (c) Pump body
- (d) Timing chain cover



2. MEASURE BODY CLEARANCE

Using a feeler gauge, measure the clearance between the driven gear and body.

If the clearance is greater than the maximum, replace the gear and/or body.

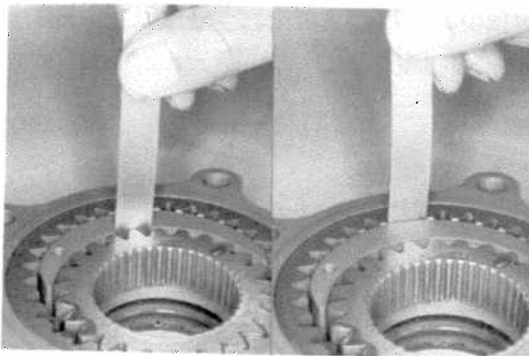
Maximum clearance: 0.2 mm (0.008 in.)

3. MEASURE TIP CLEARANCE

Using a feeler gauge, measure the clearance between both gear tips and crescent.

If the clearance is greater than the maximum, replace the gears and/or body.

Maximum clearance: 0.3 mm (0.012 in.)



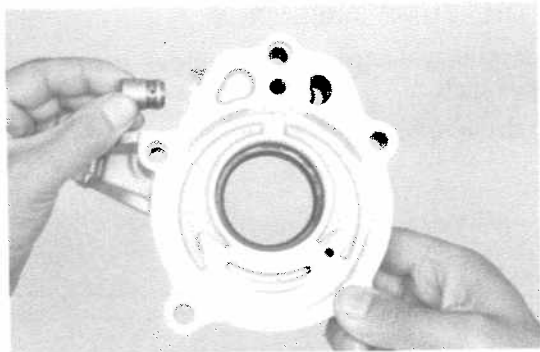
4. MEASURE SIDE CLEARANCE

Using a feeler gauge and flat block, measure the side clearance as shown.

If the clearance is greater than the maximum, replace the gears and/or body.

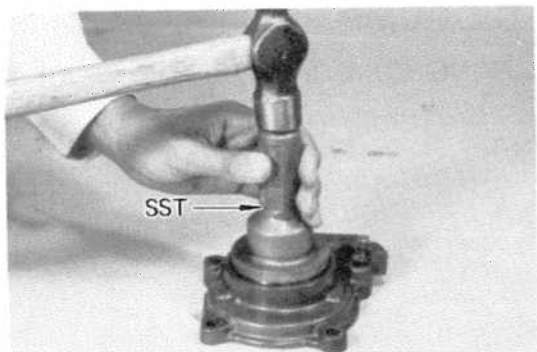
Maximum clearance: 0.15 mm (0.0059 in.)





5. INSPECT FOLLOWING SURFACES FOR BURRS AND SCORING

- (a) Relief valve piston
- (b) Oil passages
- (c) Sliding surfaces



6. INSPECT FRONT OIL SEAL

Check that the front oil seal is not worn, damaged or cracked. Replace the oil seal as follows, if necessary:

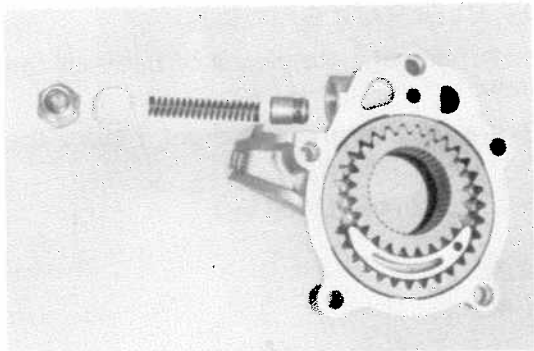
- (a) Using a small screwdriver, remove the seal.
- (b) Using a driver*, drive in the new seal.

*SST 09223-50010 or Commercial driver

ASSEMBLY AND INSTALLATION OF OIL PUMP (See illustration on page 4-44)

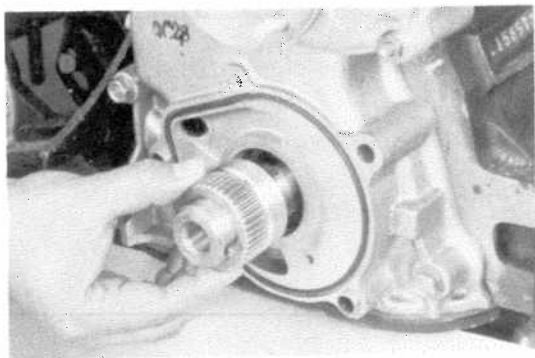
1. ASSEMBLE OIL PUMP ASSEMBLY

- (a) Install relief valve piston and the spring in the body, and screw on the relief valve plug with the gasket.
- (b) Insert the drive and driven gears into the pump body.



2. INSTALL OIL PUMP DRIVE SPLINE AND O-RING

- (a) Slide the pump drive spline onto the crankshaft.
- (b) Place the O-ring into the groove.

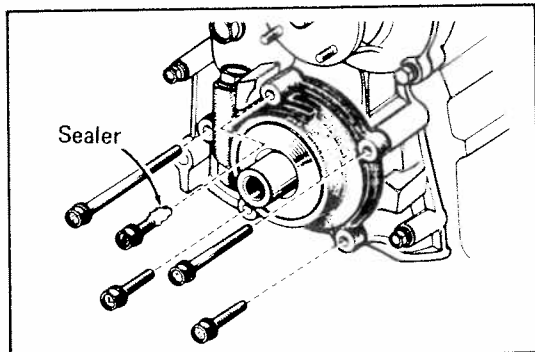


3. INSTALL OIL PUMP

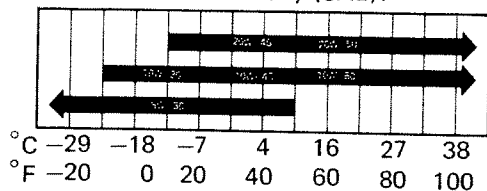
Apply the sealer to the upper bolt and tighten five bolts.

4. INSTALL FOLLOWING ITEMS:

- (a) Clean oil screen with four bolts
- (b) Clean oil pan and new gasket (See step 10, page 4-24)
- (c) Crankshaft pulley (See step 5, page 4-23)
- (d) Drive belts (See page 4-43)



Recommended Viscosity (SAE):



OIL PRESSURE CHECK

1. CHECK OIL QUALITY

Check the oil for deterioration, entry of water, discoloring or thinning.

If oil quality is poor, replace.

Use API grade SF, fuel-efficient and recommended viscosity oil.

2. CHECK OIL LEVEL

The oil level should be between the L and F marks on the level gauge. If low, check for leakage and add oil up to the F mark.

3. REMOVE OIL PRESSURE SWITCH

4. INSTALL OIL PRESSURE GAUGE

5. START ENGINE

Start engine and warm it up.

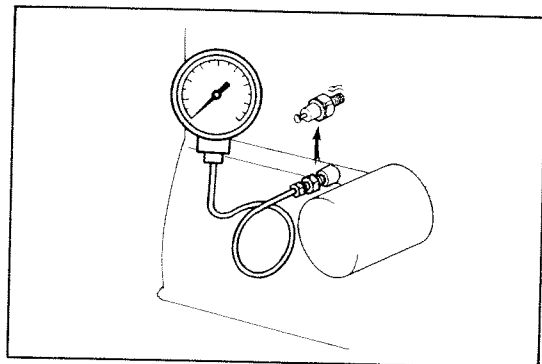
6. MEASURE OIL PRESSURE

Oil pressure:

At idle speed More than 0.3 kg/cm²
(4.3 psi)

At 3,000 rpm 2.5 — 5.0 kg/cm²
(35.6 — 71.1 psi)

CAUTION: Check for oil leakage after reinstalling oil pressure switch or sender gauge.



— MEMO —
