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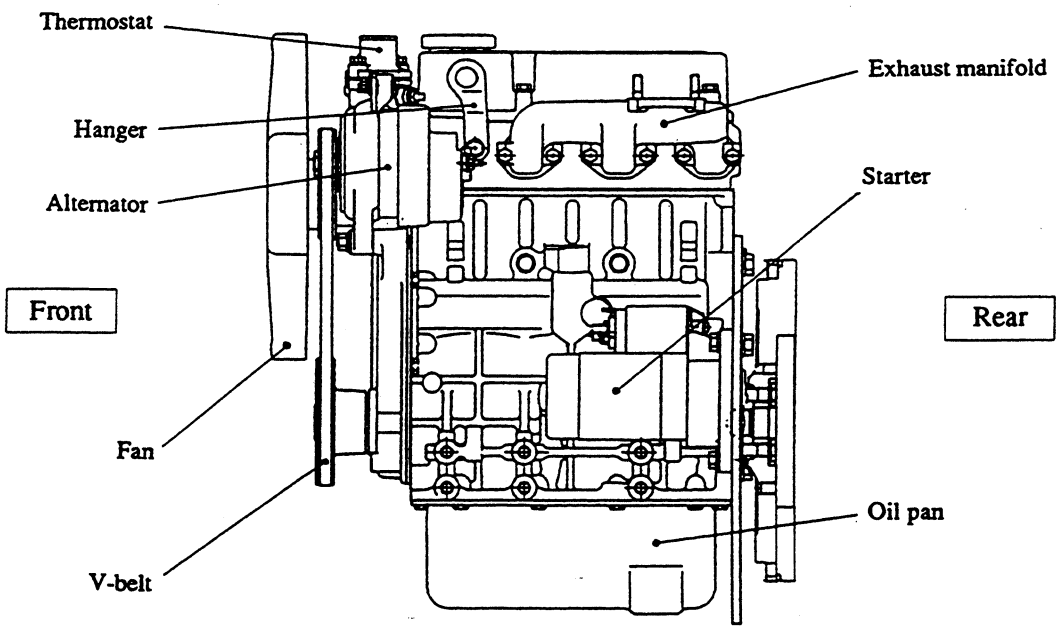
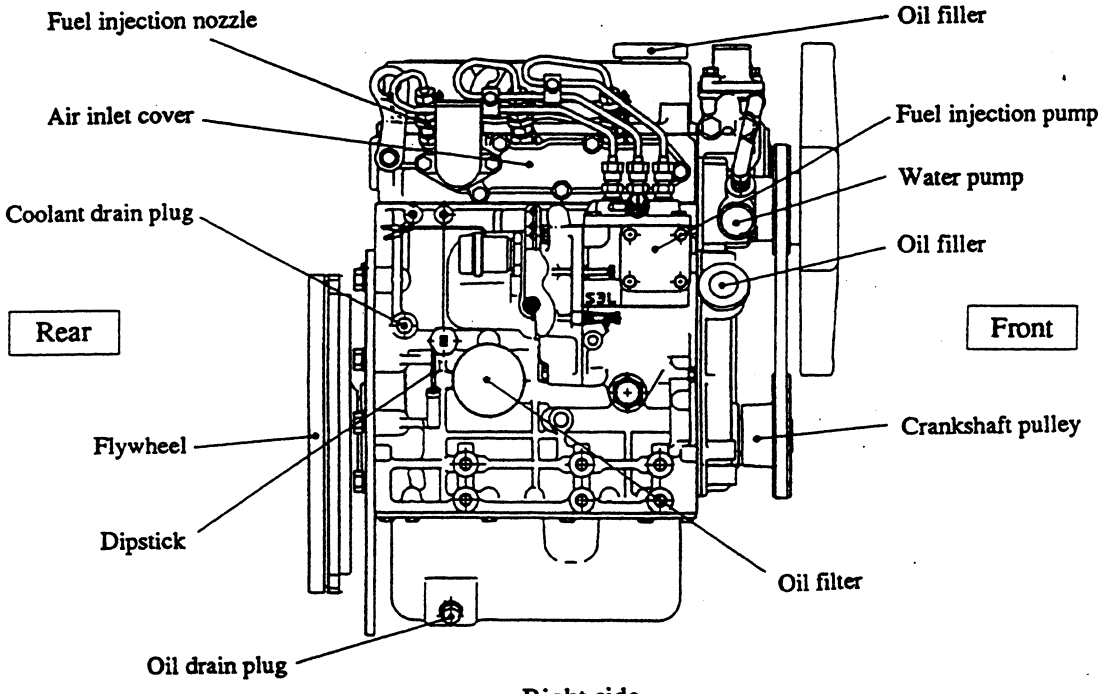
COMPONENT LOCATION

S3L/S3L2

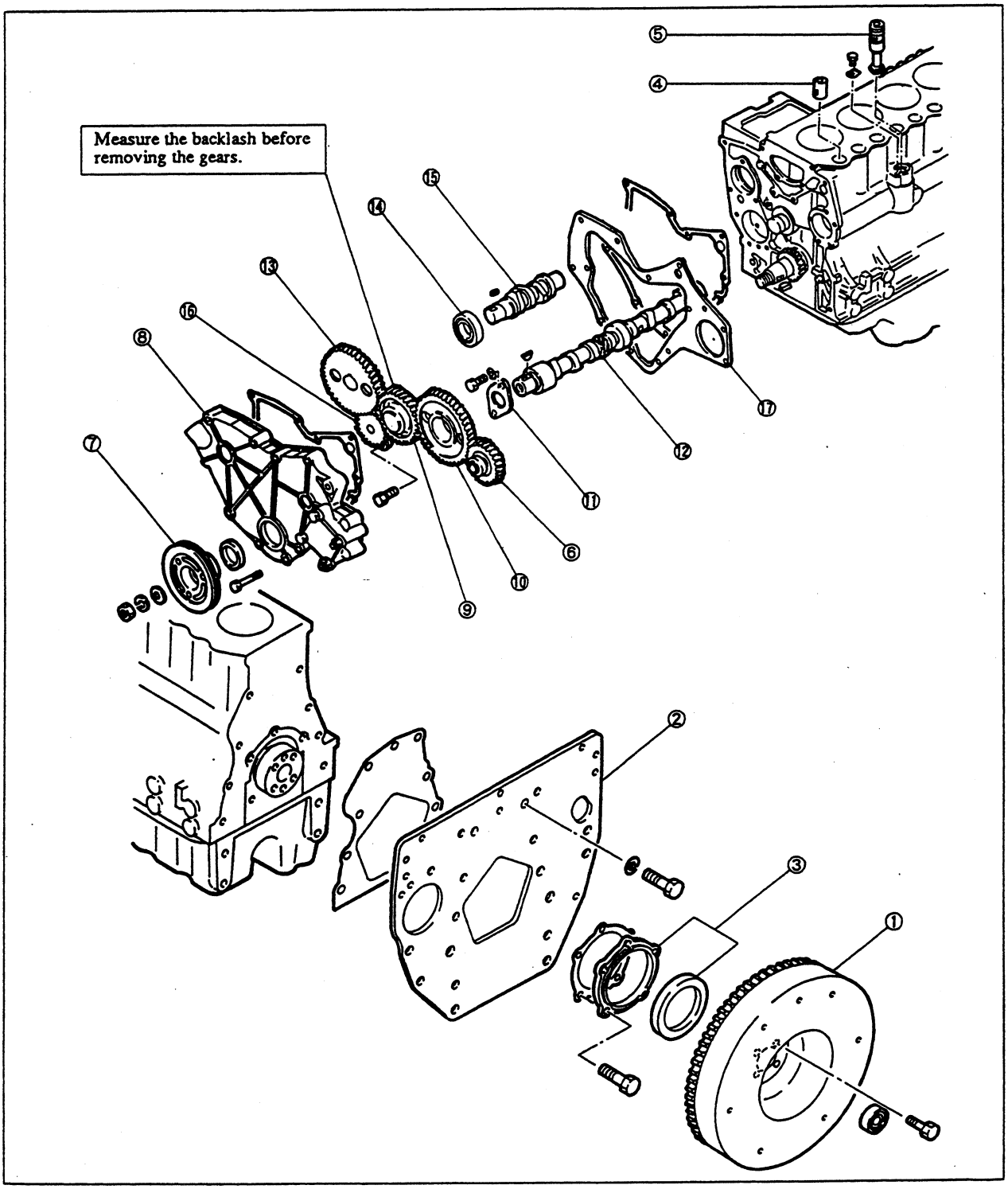


Left side



Right side

TIMING GEARS AND FLYWHEEL



① Flywheel
② Rear plate
③ Oil seal case; oil seal
④ Tappet
⑤ Speedometer driven gear
⑥ P.T.O. gear
⑦ Crankshaft pulley
⑧ Timing gear case
⑨ Idler gear
(Remove ⑩ thru ⑫ as an assembly.)
⑩ Camshaft gear
⑪ Thrust plate
⑫ Camshaft
(Remove ⑬ thru ⑮ as an assembly.)
⑬ Fuel injection pump camshaft gear
⑭ Bearing
⑮ Fuel injection pump camshaft
⑯ Oil pump
⑰ Front plate

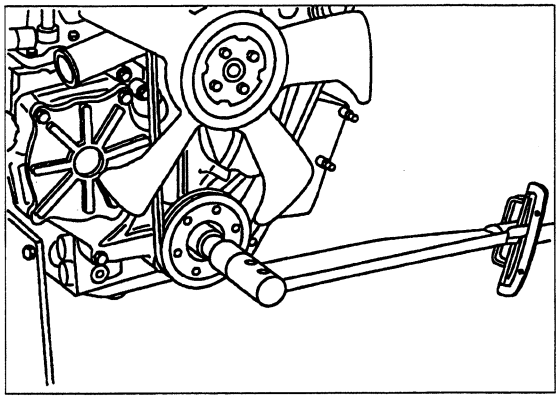
1. Flywheel removal

(1) Have someone hold the crankshaft pulley with a wrench to prevent the flywheel from rotating.

(2) Remove one of the bolts that hold the flywheel in position.

⚠ WARNING

Always signal each other to prevent possible personal injury.



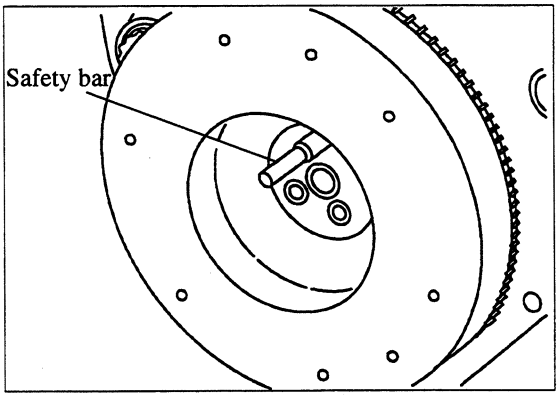
Holding flywheel

(3) Install a safety bar (M12 x 1.25) into the threaded hole in the flywheel from which the bolt was removed in Step (2). Remove the remaining bolts.

(4) Hold the flywheel by hands and withdraw it from the crankshaft. Joggling the flywheel back and forth will facilitate removal.

⚠ WARNING

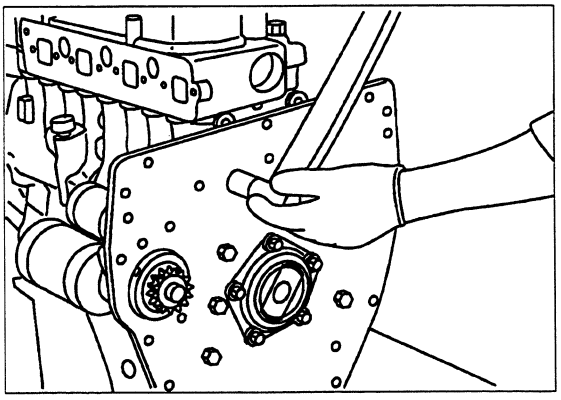
When removing the flywheel, wear heavy gloves to avoid hand injury.



Removing flywheel

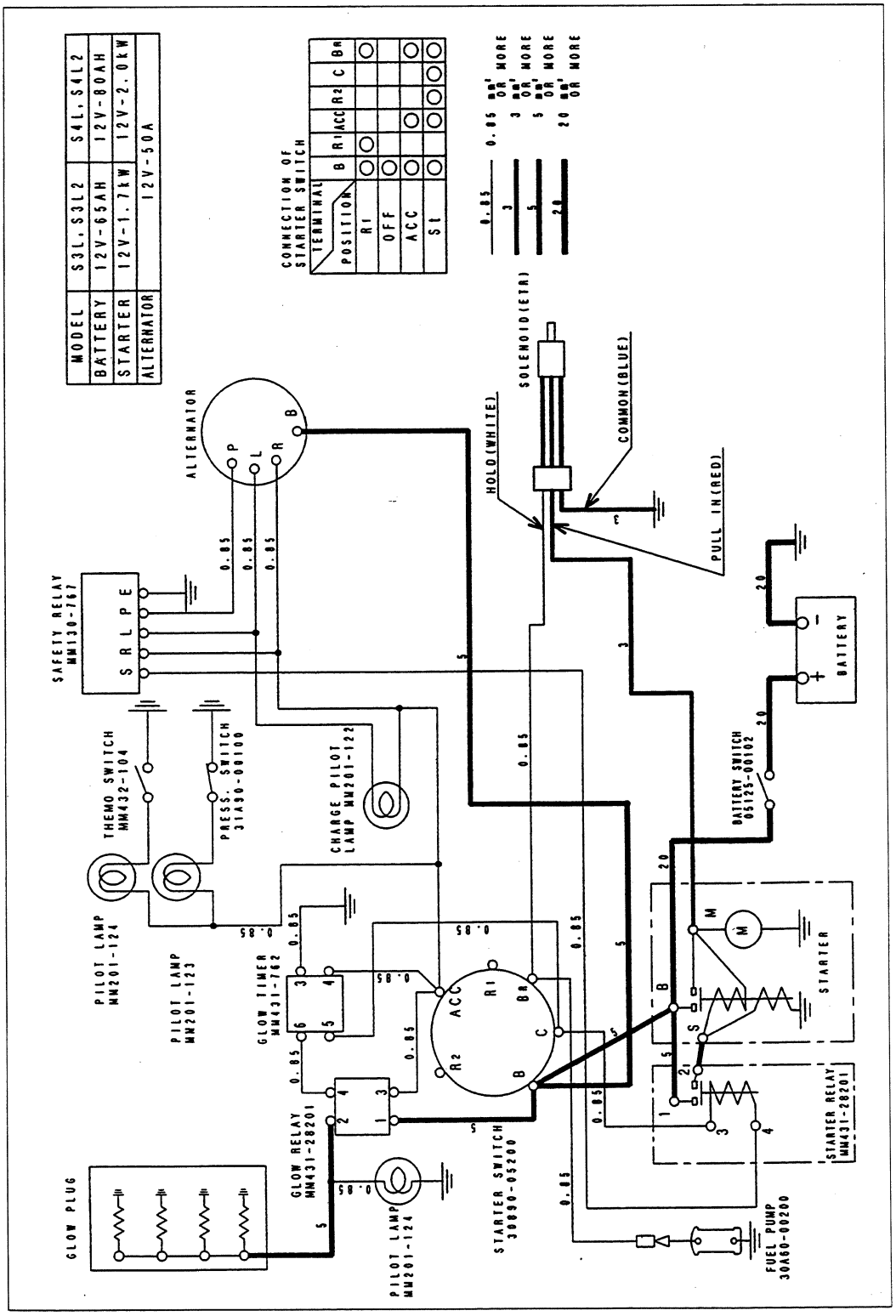
2. Rear plate removal

The rear plate is doweled in position. Pull the plate as straight as possible when removing it.



Removing rear plate

< Solenoid ETR type >



(1) Figure indicates a nominal size of automotive low-tension line (JIS C 3406).

(2) This schematic shows the electrical system of the standard engine equipped with a key shut down solenoid and glow plugs.

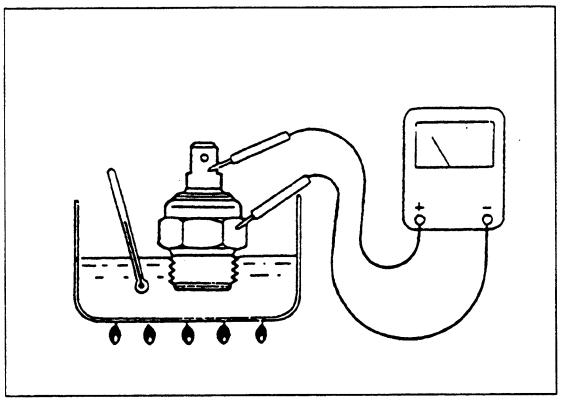
3. Thermoswitch (standard)

Hang the thermoswitch in the pan of oil with its temperature sensing end below the surface of oil and measure the resistance while heating the oil as shown in the illustration. If the resistance is incorrect, replace the thermoswitch.

Resistance at 120°C (248°F)	30 m
Temperature at which switch is turned ON	111 ± 3.5°C (232 ± 6.3°F)

⚠ WARNING

Oil in the pan is hot. Any contact can cause severe burns.



Testing thermoswitch

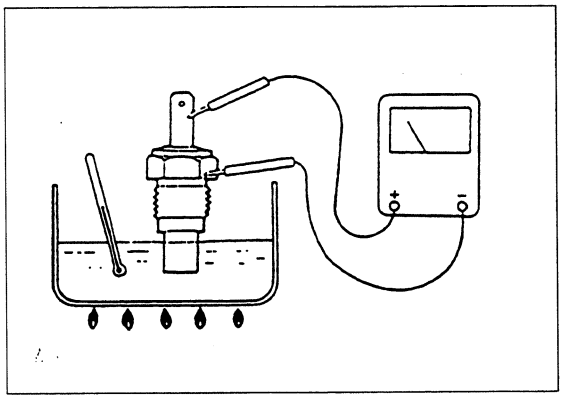
4. Thermounit (standard)

Hang the thermounit in the pan of antifreeze with its temperature sensing end below the surface of antifreeze and measure the resistance while heating the antifreeze as shown in the illustration. If the resistance is incorrect, replace the thermounit.

Standard	50°C (122°F): 80 ± 10 80°C (176°F): 29.5 ± 2.5 120°C (248°F): 10 ± 0.3

⚠ WARNING

Antifreeze in the pan is hot. Any contact can cause severe burns.



Testing thermounit

FUEL INJECTION TIMING

1. Preparation

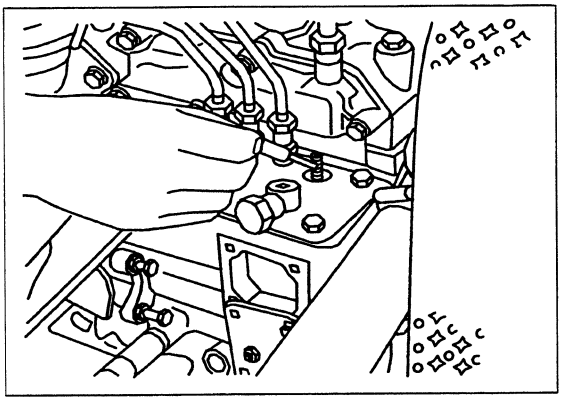
(1) Close the fuel filter valve.

(2) Disconnect the No. 1 fuel injection pipe from the cylinder head and injection pump.

(3) Remove No. 1 delivery valve holder from the injection pump. Remove the delivery valve and spring from the holder. Restore the delivery valve holder only to the injection pump.

(4) Connect the fuel injection pipe to the injection pump.

(5) Hold the speed control lever in the low speed position.



Removing delivery valve and spring

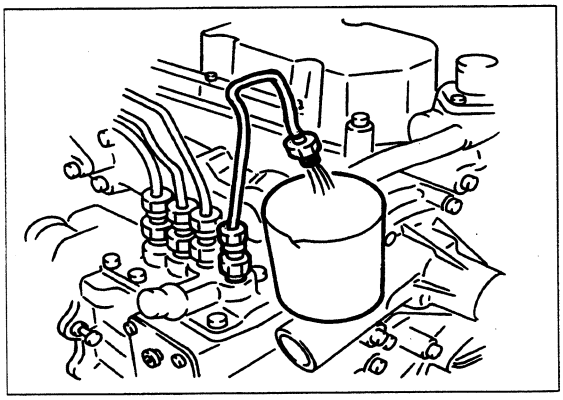
2. Inspection

2.1 Fuel flow method

(1) Open the fuel filter valve. Turn the starter switch key to ON position.

NOTE

Fuel will come from the injection pipe with high pressure when the starter switch key is turned to ON position if the engine is equipped with an electric fuel pump. Direct fuel flow into the container.

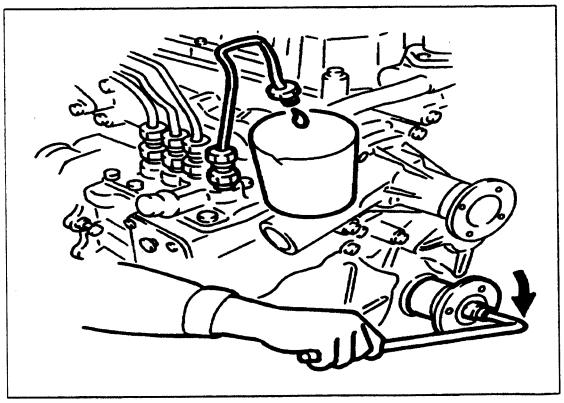


Fuel coming from injection pipe

(2) Slowly turn the crankshaft clockwise, looking at the free end of the injection pipe. The instant fuel stops coming out is the fuel injection timing.

NOTE

Turn the crankshaft in reverse direction just a little and do Step (2) again to verify the injection timing.



Fuel stops coming from injection pipe

ELECTRICAL SYSTEM

1. Starter

1.1. Testing before disassembly

(1) Clearance between pinion and housing (pinion clearance)

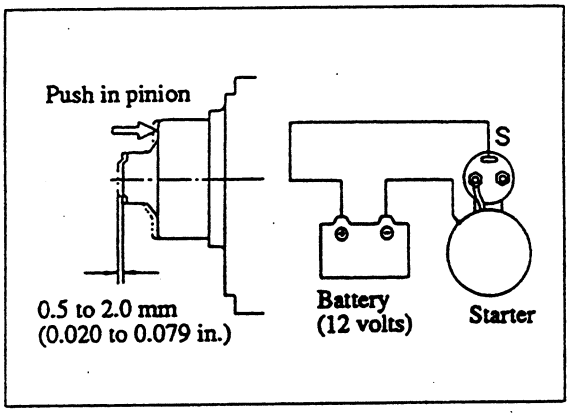
(a) Connect the starter to a 12 volt battery as shown in the illustration to cause the pinion to shift into cranking position and remain there.

⚠ CAUTION

Due to the amount of current being passed through the solenoid series winding, this test must be made within 10 seconds.

(b) Push the pinion toward the commutator end by hand to measure its free movement (pinion clearance).

(c) The pinion clearance must be 0.5 to 2.0 mm (0.020 to 0.079 in.). If the clearance is out of this range, make an adjustment to it by adding or removing the packings on the magnetic switch. Adding the packings will decrease the clearance.

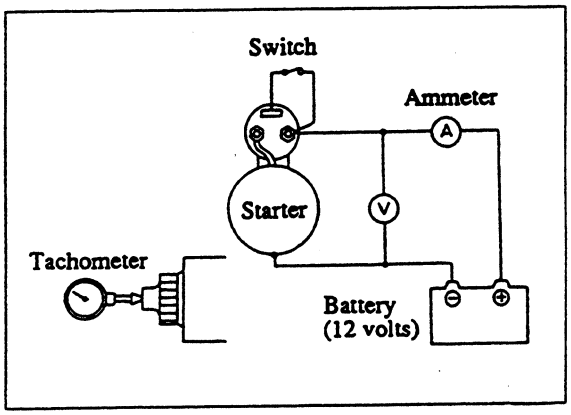


Connections for measuring pinion clearance

(2) No-load characteristics

(a) Connect the starter to a 12 volt battery with an ammeter capable of indicating several hundred amperes as shown in the illustration.

(b) Close the switch to make sure the pinion shifts into cranking position properly and the starter runs at speeds higher than is specified. If the current draw and/or operating speed is out of the standard, disassemble the starter for inspection and repairs.



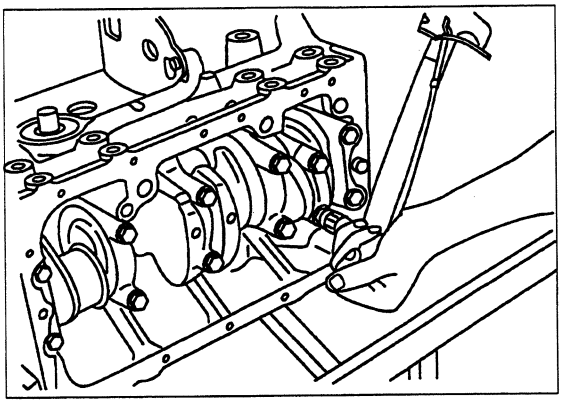
Connections for testing no-load characteristics

4. Connecting rod cap removal

(1) Lay the cylinder block on its side.

(2) Put identification on each connecting rod and cap combination as to its location in the engine.

(3) Remove the caps.

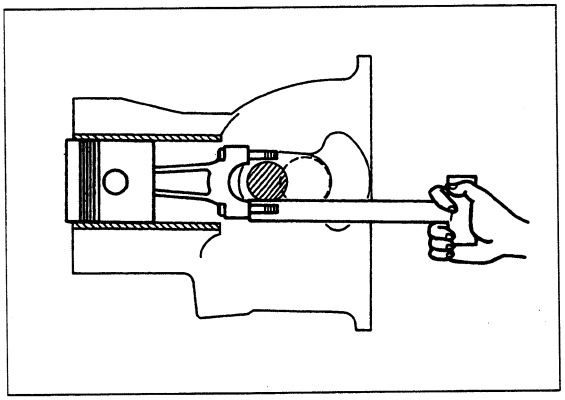


Removing connecting rod caps

5. Piston removal

(1) Turn the crankshaft until the piston is at top center.

(2) Push the piston and connecting rod away from the crankshaft with the handle of a hammer or the like until the piston rings are above the cylinder. Remove the piston and connecting rod. Do Steps (1) and (2) for the removal of the other pistons.



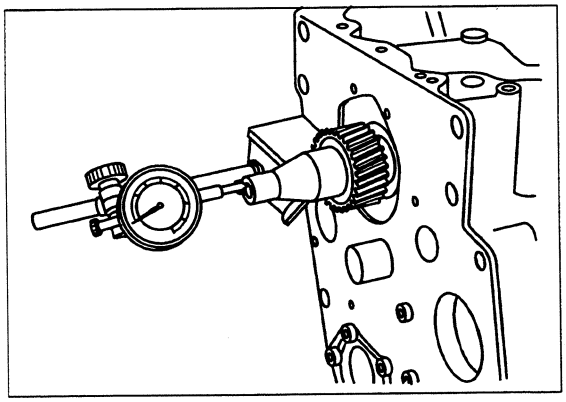
Removing piston

6. End play measurement for crankshaft

Set a dial indicator so that it will touch the end of the crankshaft and measure the end play. If the end play exceeds the limit, replace No. 3 flanged bearing.

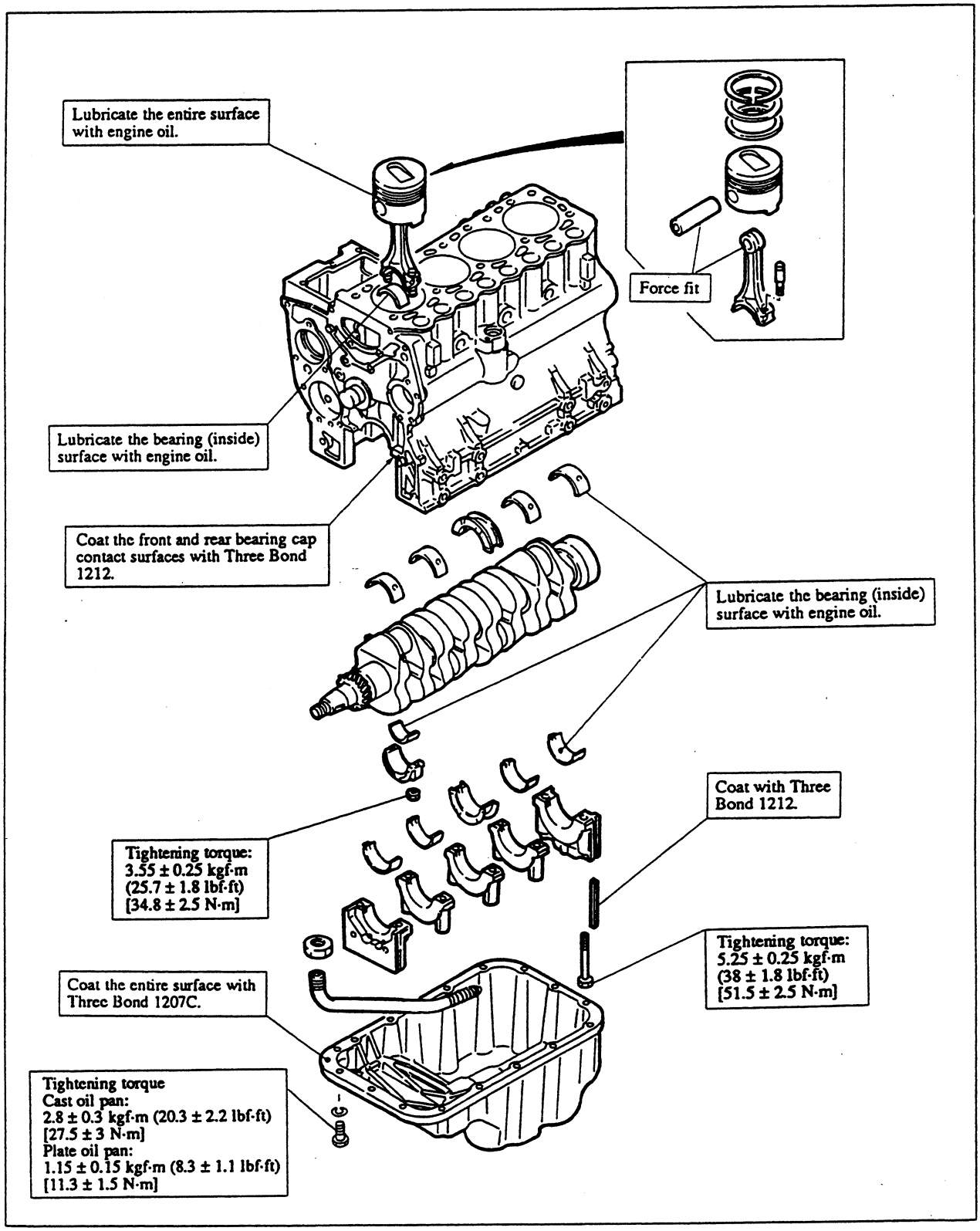
Unit: mm (in.)

Item	Standard	Limit
End play for crankshaft end play	0.050 to 0.175 (0.001 97 to 0.006 89)	0.500 (0.019 69)



Measuring end play for crankshaft

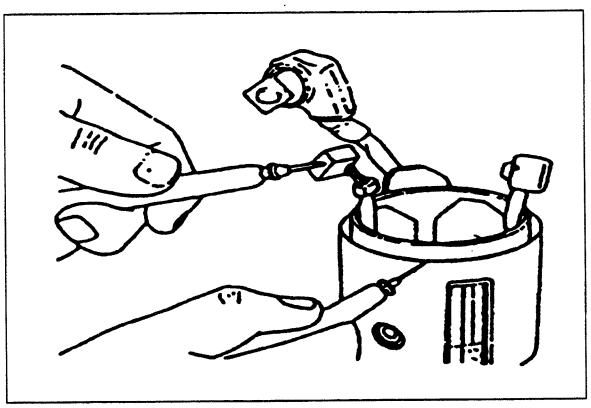
CYLINDER BLOCK, CRANKSHAFT, PISTONS AND OIL PAN



Inspection points

(b) Coil Gound Test

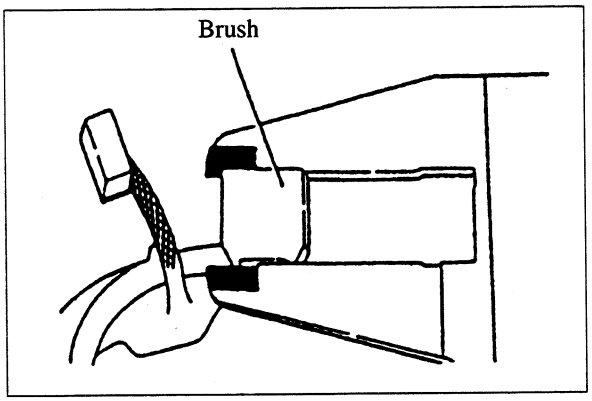
Check whether continuity exists between the yoke and each brush. If continuity exists, the coil is grounded and must be checked for defective insulation. If repair is impossible, replace the yoke assembly.



(3) Brushes and Brush Holders

(a) Brush Wear

Measure the length of the brush. If the measurement is smaller than the limit, replace the brush. If the brush is worn unevenly or has a rough contact surface, rectify the problem with fine emery paper (#300–500).

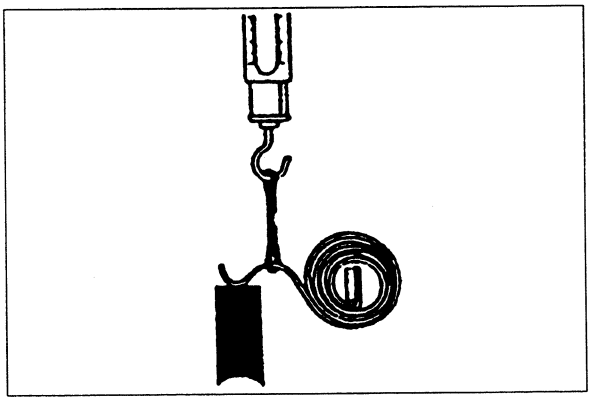


Unit: mm (in.)

	Standard value	Limit
Brush length	18 (0.71)	11 (0.43)

(b) Brush Spring Force

With a new brush installed, pull the brush spring with a spring balance and read the load at the point where the spring leaves the brush. Replace the spring if its force is lower than the limit.

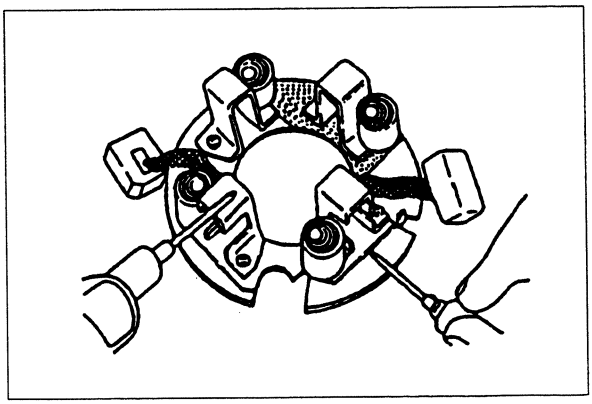


N {kgf} (lbf)

	Standard value	Limit
Brush spring force	26.7 – 36.1 {2.7 – 3.7} (6.0 – 8.3)	14.7 {1.5} (3.3)

(c) Brush Holder Insulation Test

Check whether continuity exists between the (+) brush holder and the (–) brush holder plate. If continuity exists, replace the brush holder assembly.



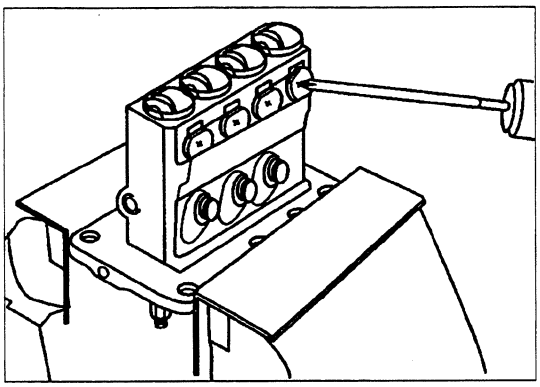
Disassembly procedure

(1) Tappet removal

(a) Hold the injection pump in a vise with the side that has tappets up.

(b) Straighten the lock plate away from the tappet guide pin with a screwdriver.

(c) Rotate the tappet guide pin 180° to unlock it from the housing.



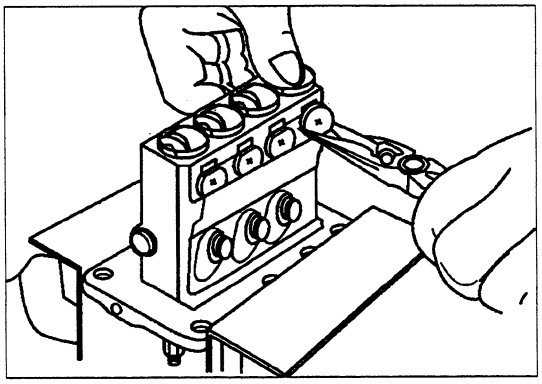
Removing tappet guide pins

(d) Remove the tappet guide pin with a needle-nose pliers while pushing down on the tappet. Remove the tappet.

(e) Do Steps (b) through (d) again for remainder of the tappets.

⚠ CAUTION

The tappet can be thrown from the housing when the tappet guide pin is removed. Hold the tappet to prevent it from falling.



Removing tappets

(2) Plunger removal

(a) Remove the tappet adjusting shim.

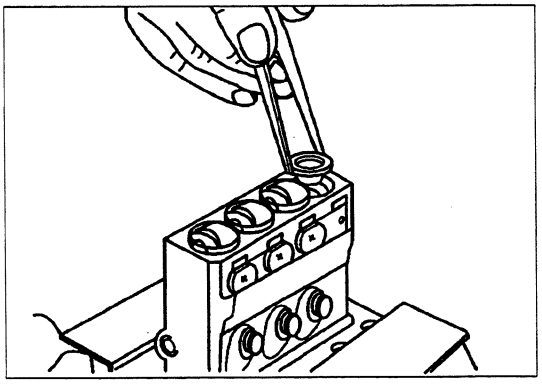
(b) Remove the lower spring seat and plunger with a tweezers.

(c) Remove the plunger spring.

(d) Remove the upper spring seat and control sleeve.

(e) Do Steps (a) through (d) again for remainder of the plungers.

(f) Remove the control rack.



Removing plungers

3. Adjustment

(1) If the fuel injection timing is incorrect, change the thickness of shims under the fuel injection pump. An increase or decrease of the shims by 0.1 mm (0.004 in.) will vary the timing by 1°.

(2) Increase the thickness of the shims to retard the timing or decrease it to advance the timing.

Adjustment range	Standard ±1.5°

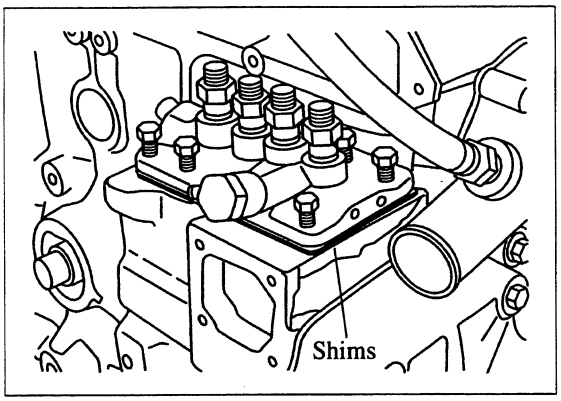
Four kinds of shims are available in thicknesses 0.2 mm (0.007 9 in.), 0.3 mm (0.011 8 in.), 0.4 mm (0.015 7 in.) and 0.8 mm (0.031 5 in.). These shims have no identification; measure the thickness of each shim with a calipers before using it.

⚠CAUTION

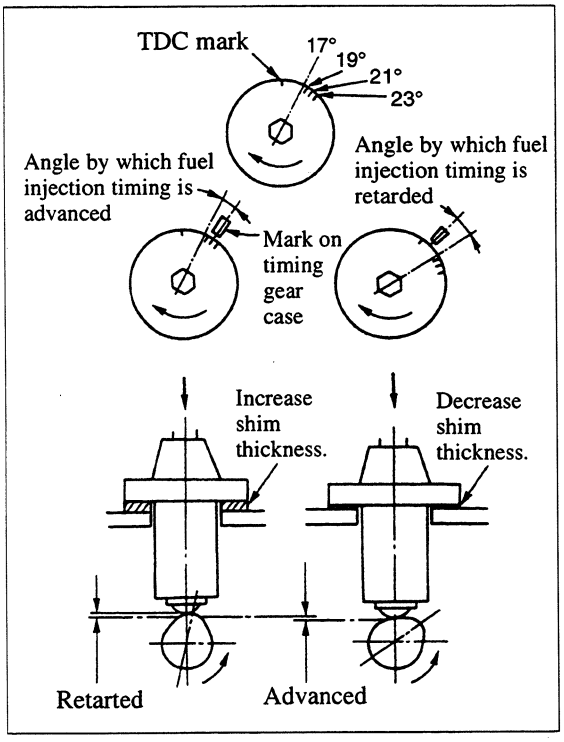
Apply sealant to both faces of each shim to prevent oil leaks.

(3) After the timing has been adjusted, make sure it is correct.

(4) Close the fuel filter valve and restore the delivery valve and injection pipe to the original state.

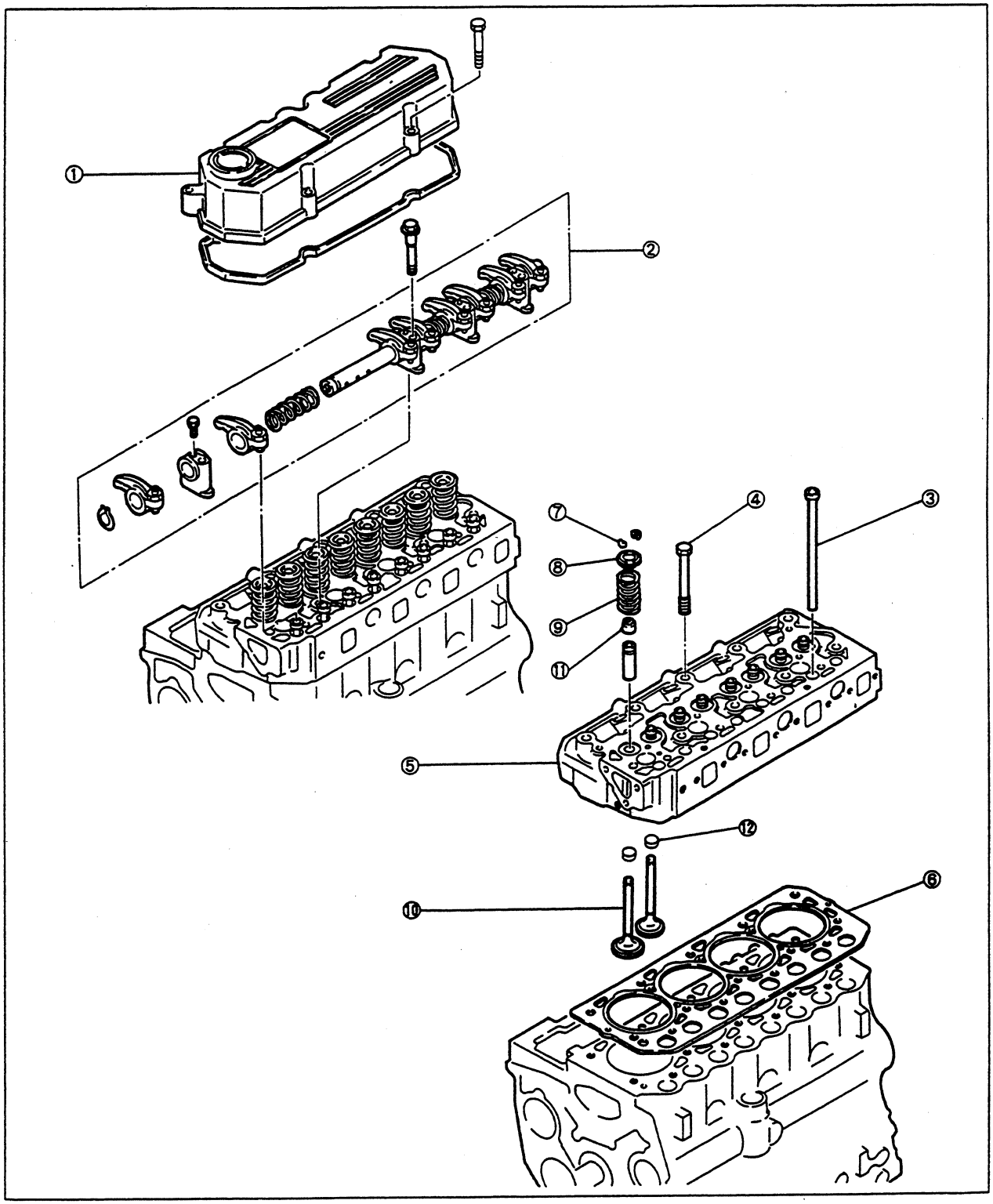


Adjusting fuel injection timing



Adjusting fuel injection timing

CYLINDER HEAD AND VALVE MECHANISM

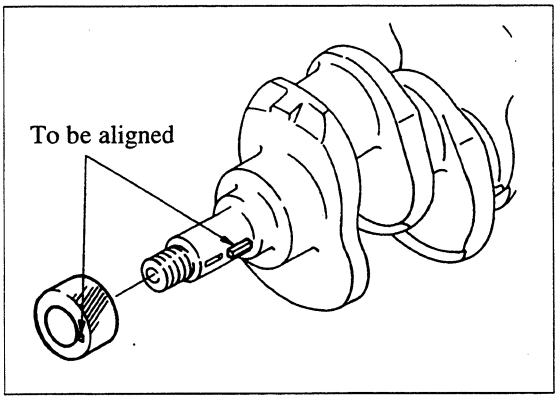


① Rocker cover
② Rocker shaft assembly
③ Valve push rod
④ Cylinder head bolt
⑤ Cylinder head
⑥ Cylinder head gasket
⑦ Valve lock
⑧ Valve retainer
⑨ Valve spring
⑩ Valve
⑪ Valve stem seal
⑫ Valve cap

(5) Crankshaft gear installation

(a) Install the key in position on the crankshaft.

(b) Install the gear in position with its keyway in alignment with the key as shown in the illustration.



Installing crankshaft gear

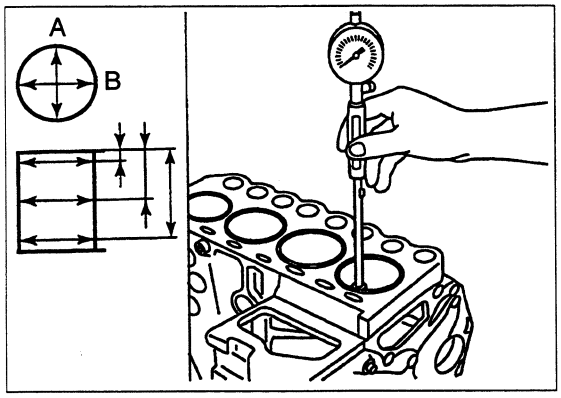
4. Cylinder block

(1) Bore

Measure the bore at the top, middle and bottom points on axes A and B with a cylinder bore gauge as shown in the illustration. If any one of the cylinders exceeds the limit, hone out all the bores for oversize pistons.

Unit: mm (in.)

Piston and piston ring		Bore	
Size	Size code	Standard	Limit
Standard	STD	$78^{+0.03}_{0}$ ($3.07^{+0.001\ 2}_{0}$)	Standard: +0.2 (+0.008)
0.25 (0.009 8) oversize	25	$78.25^{+0.03}_{0}$ ($3.080\ 7^{+0.001\ 2}_{0}$)	
0.50 (0.019 7) oversize	50	$78.50^{+0.03}_{0}$ ($3.090\ 5^{+0.001\ 2}_{0}$)	
Taper and out-of-round		0.01 (0.000 4) maximum	—



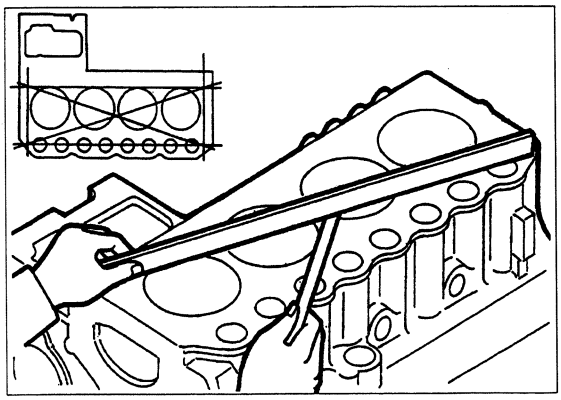
Measuring bore in cylinder block

(2) Warpage of top face

Using a heavy accurate straight edge and a feeler gauge, check the top face for warpage in two positions lengthwise, two crosswise and two widthwise as shown in the illustration. If warpage exceeds the limit, reface the top face with a surface grinder.

⚠ CAUTION

The maximum permissible amount of stock to be removed from the cylinder head and block by grinding is 0.2 mm (0.008 in.) in total.



Checking cylinder block top face for warpage

Unit: mm (in.)

Item	Standard	Limit
Warpage of cylinder block top face	0.05 (0.002 0) maximum	0.10 (0.003 9)