DAIHATSU

TERIOS

J100

EM

TO INDEX

ENGINE MECHANICAL

JEM00001-00000

NO. 9710-JE

ENGINE TUNE-UP

NOTE:

- The adjustments or checks of this section is performed normally when the engine is in a hot condition.
- “Hot engine condition” denotes a condition in which the cooling water temperature is 75 - 85°C and the engine oil temperature is above 65°C.
- Warm up the engine thoroughly. However, do not perform the adjustment while the idle-up VSV is still functioning.
- Ensure that all accessory switches are turned OFF.
- On the automatic transmission vehicle, the gear shift lever is placed in the [N] or [P] range.
- On the manual transmission vehicle, the gear shift lever is placed in the neutral range.
- Connect the engine revolution meter for measuring the engine revolution speed. If your engine revolution meter is of such a type as to be connected to the negative terminal of the ignition coil, connect the following SST to the diagnosis connector.
  SST: 09991-87402-000

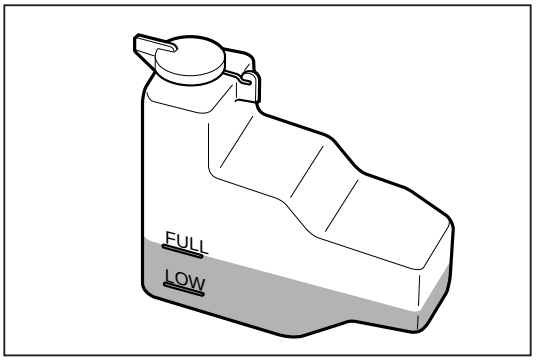
- Apply the parking brake fully.
- Set the steering wheel to the straight ahead direction.
- Be sure that the removed parts for adjustment or checks should be reinstalled.

JEM00002-00000

1. Inspection of engine coolant

Check to see if coolant level is between the LOW and FULL lines of the reserve tank.
If coolant level is near the LOW level or bellow the LOW level, add the coolant up to the full level.
WARNING:

- Never open the radiator cap when the engine is still hot.
  Failure to observe this caution will cause you to get scalded.



JEM00003-00001

NOTE:

- If no coolant is present in the reserve tank or the coolant level is very low, check for water leakage, using a radiator cap tester.
- Here, the coolant refers to the coolant having an adequate freezing protection rating.

Coolant Capacity:
Manual Transmission Vehicle: 5.4 liters
Automatic Transmission Vehicle: 5.3 liters

CAUTION:

- Use a good brand of ethylene-glycol-base antifreeze solution.

NOTE:

- The amount above includes liter for reserve tank.

JEM00004-00000

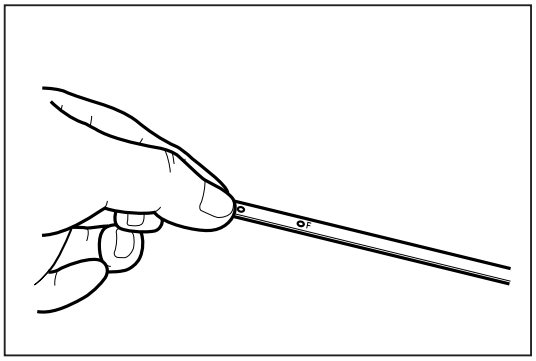
2. Inspection of engine oil

(1) Oil quality check

Check the engine oil for deterioration, ingress of water, discoloring and dilution.

NOTE:

- Park the vehicle or a level surface.
- The amount of oil between the “L” level and the “F” level equals around one liter.



JEM00005-00002

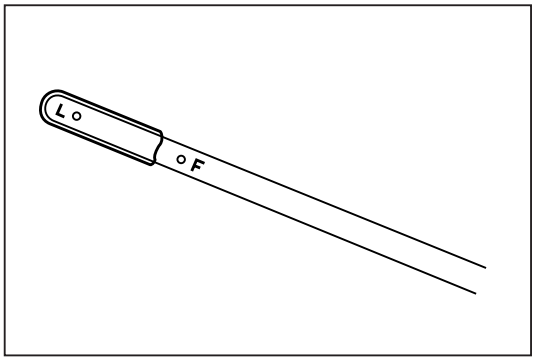
(2) Oil level check

Ensure that the engine oil level should be between the “L” and “F” level an the dipstick.

If the engine oil level is below the “L” level, replenish the specified oil to the “F” level after oil leakage has been checked.

Oil Capacity: Unit: liter

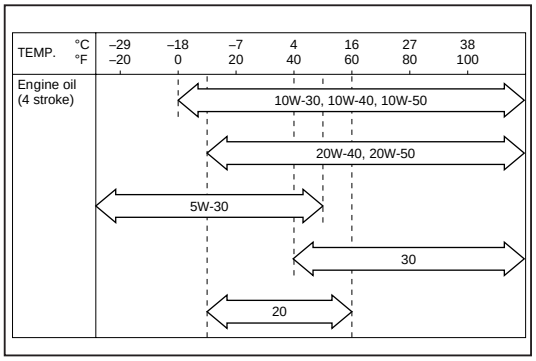
“F” level	3.3
“L” level	2.3
Oil capacity when oil filter replaced	3.5
Full capacity	3.6



JEM00006-00003

NOTE:

- Use API grade SF or higher multigrade viscosity, fuel efficient oil.
- The amount of oil between the “L” level and the “F” level equals around one liter.



JEM00000-00004

3. Inspection of spark plugs

Recommended Spark Plug:

DENSO	NGK
K20TNR-S, K22TNR-S	BKUR6EK, BKUR7EK

NOTE:

- All spark plugs should have the same head range and be ones manufactured by the same manufacture.

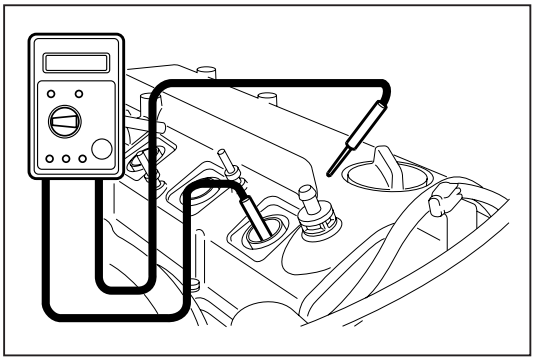
JEM00007-00000

(1) Inspection of electrode
Measure the insulation resistance of the spark plug.
Minimum Insulation Resistance: 15 MΩ

If the measured insulation resistance is less than the specified value, replace the spark plug with a new one after checking the electrode gap and cleaning the spark plug.

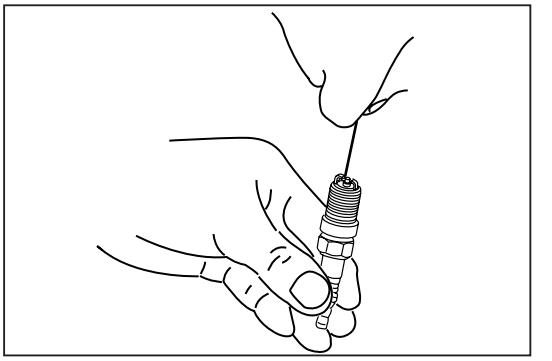
WARNING:

- Since the spark plugs are hot, care must be exercised to avoid getting scalded.


JEM00008-00005

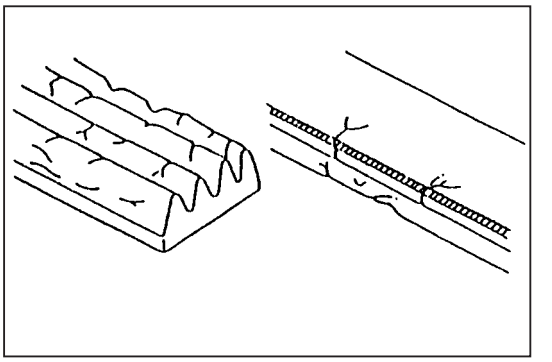
(2) Inspection of electrode gap
Measure the electrode gap, using a plug gap gauge.
Electrode Gap: 0.9 - 1.0 mm

If the electrode gap of a used spark plug is not within the specification, replace the spark plug with a new one.


JEM00009-00006

4. Inspection of drive belt

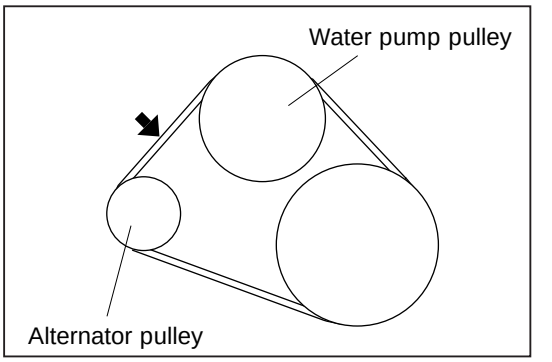
(1) Visual inspection of the drive belt
Visually check the belt for separation of the adhesive rubber above and below the core, core separation from the belt side, severed core, separation of the rib from the adhesive rubber, cracks or separation of the ribs, torn or ribs or cracks in the inner ridges of the ribs.
Replace the drive belt, if necessary.


JEM00010-00007

(2) Inspection of the drive belt tension
Measure the amount of the drive belt deflection when the midpoint of the drive belt between the alternator and the water pump pulley is pushed with a force of 98 N (10 kgf).
Specified Belt Deflection

New Belt: 4 - 5 mm
[with a force of 10 kg applied at the point shown in the figure.]

Used Belt: 5 - 6 mm
[with a force of 10 kg applied at the point shown in the figure.]

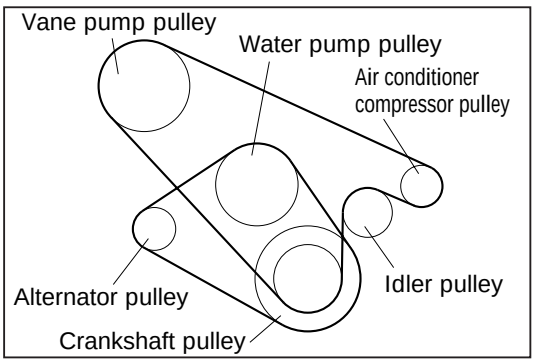


JEM00011-00008

If necessary, adjust the drive belt tension.

NOTE:

- “New belt” refers to a belt which has been used on a running engine for less than five minutes.
- “Used belt” refers to a belt which has been used on a running engine for more than five minutes or more.
- After replacing the drive belt, check that it fits properly in the ribbed grooves, especially in the places difficult to see.
- After installing a new belt, run the engine for about five minutes and then recheck the tension.



JEM00012-00009

5. Inspection and adjustment of valve clearances

The measurement and adjustment of valve clearance are carried out when each of the piston of the No. 1 and No. 4 cylinders is set to the top dead center at the end of compression stroke.

NOTE:

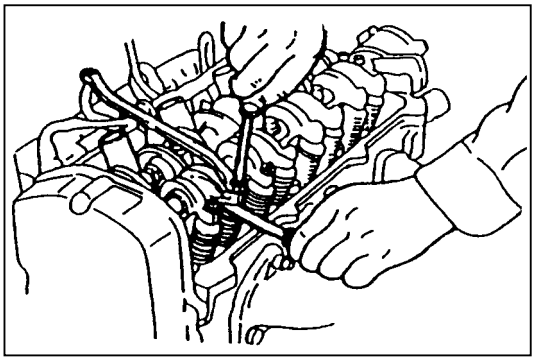
- The valve clearance adjustment is performed normally when the engine is in a hot condition.
  “Hot engine condition” denotes a condition in which the cooling water temperature is 75 - 85°C and the engine oil temperature is above 65°C.
  However, when the engine has been overhauled, it is necessary to adjust the valve clearances while the engine is cold and to readjust the valve clearance in a hot condition after warming up the engine.

JEM00013-00000

NOTE:

- The “O” mark denotes those valves that can be adjusted under that setting.
  Valve Clearances (Hot)
  Intake: 0.25 ± 0.05 mm
  Exhaust: 0.33 ± 0.05 mm
  (Reference)
  Valve Clearances (Cold)
  Intake: 0.18 mm
  Exhaust: 0.25 mm

Tightening Torque (Lock nut): 16.7 - 22.6 N·m



JEM00014-00010

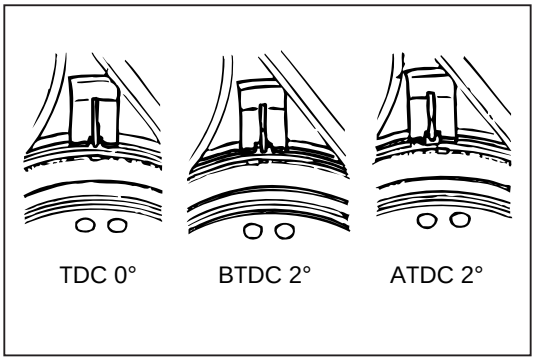
Piston positions		1	2	3	4
When valve rocker arms of No. 1 cylinder are free: (Piston of No. 1 cylinder is at top dead center under compression strok)	Intake	○	○		
	Exhaust	○		○	
When valve rocker arms of No. 4 cylinder are free: (Piston of No. 4 cylinder is at top dead center under compression strok)	Intake			○	○
	Exhaust		○		○

JEM00015-00000

6. Inspection and adjustment of ignition timing

Check to see if the ignition timing mark of the crankshaft pulley is aligned with the indicator of the timing belt cover by using a timing light under the condition that the T terminal has been connected with the ground terminal in the diagnosis connector by the following SST.

SST: 09991-87403-000



JEM00016-00011

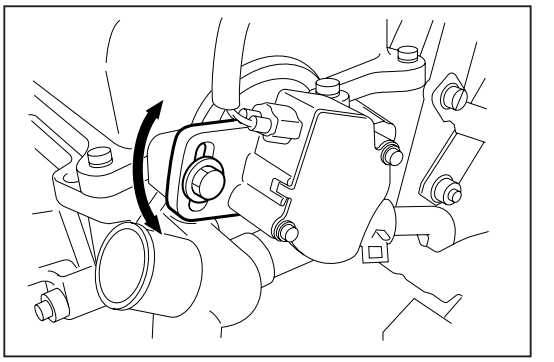
NOTE:

- The ignition timing inspection or adjustment is performed normally when the engine is in a “Hot” condition.
  The “Hot engine condition” denotes a condition in which the cooling water temperature is 75 - 85°C and the engine oil temperature is above 65°C.
- Care must be exercised to ensure that no connection is made on terminals except for those specified.
  Even a slight contact with the other terminals will cause serious malfunction.

If the ignition timing mark is not aligned with the indicator of the timing belt cover, adjust the ignition timing by turning the cam angle sensor.

REFERENCE:

- If the cam angle sensor is turned clockwise, the timing will be advanced. Conversely, if the can angle sensor is turned counterclockwise, the ignition timing will be retarded.



JEM00017-00012

7. Inspection and adjustment of idle speed

Preparation to be made prior to idle speed adjustment.

- Check and adjust the ignition timing.
- Apply the parking brake fully.
- Warm up the engine thoroughly.
- All accessory switches are turned OFF.
- The air cleaner element is installed.
- All vacuum hoses are connected.
- Ensure that the intake system exhibits no air leakage.
- Ensure that the exhaust system exhibits no air leakage.
- On the automatic transmission vehicle, the shift lever is placed in the [N] or [P] range.
- On the manual transmission vehicle, the shift lever is placed in the neutral range.
- Position the steering wheel to the straight-ahead direction.

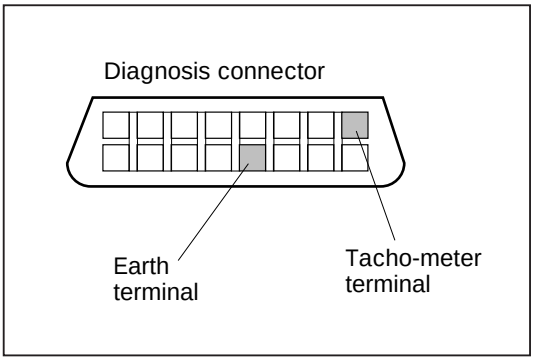
NOTE:

- Do not perform the engine idle speed adjustment, while the idle-up VSV is operating.
  Prior to the adjustment of the idle speed, be sure to check that the idle-up VSV is not operating.

JEM00018-00000

Measure the engine idle speed, using a tachometer which is connector to the “REV” terminal of the diagnosis connector.
NOTE:

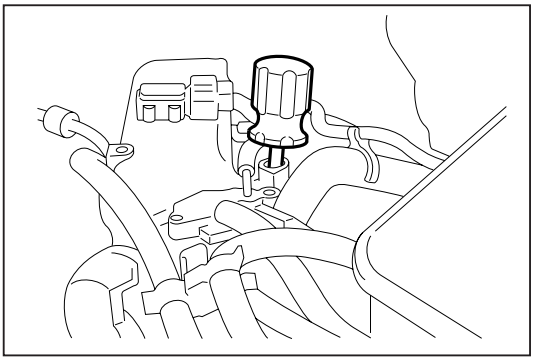
- Never allow the “REV” terminal to touch the ground. It could result in damage of the ignition system.
- As some tachometers are not compatible with this ignition system, it is recommended to confirm the compatibility with your unit before its use.
  Specified Idle Speed:
  MT: 800 ± 50 rpm
  AT: 850 ± 50 rpm



JEM00019-00013

If the measured engine idle speed is not within the specified value, adjust the engine idle speed by turning the idle adjusting screw placed at the throttle body.
NOTE:

- When the idle adjusting screw is turned clockwise, the idle speed will be decreased, whereas when the idle adjusting screw is turned counterclockwise the idle speed will be increased.


JEM00020-00014

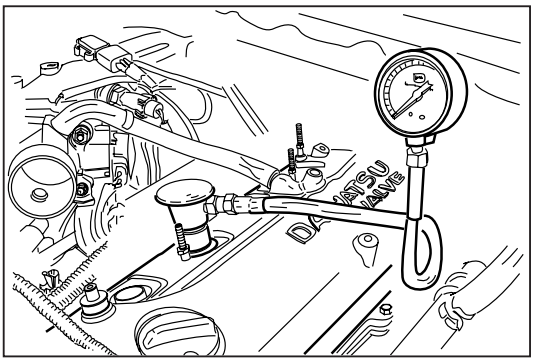
8. Compression check
NOTE:

- After completion of the engine tune-up, if the engine exhibits lock of power, excessive oil consumption or poor fuel economy, measure the cylinder compression pressure.

JEM00021-00000

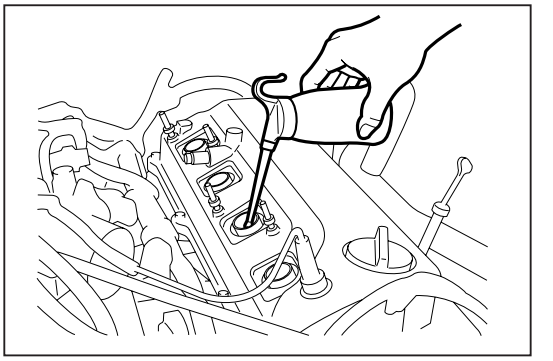
Measure the cylinder compression pressure for each cylinder, using a compression gauge which is inserted into the spark plug hole.
NOTE:

- Depress the accelerator pedal fully while measuring the compression pressure.
- Always use a fully charged battery so that at least a revolution speed of 300 rpm may be attained.
  Compression Pressure:
  1373 kPa (14 kgf/cm^2)/at 300 rpm
  Minimum Pressure:
  1030 kPa (10.5 kgf/cm^2)/at 300 rpm
  Difference in Reading Between Cylinders:
  147 kPa (1.5 kgf/cm^2)/at 300 rpm


JEM00022-00015

If the compression of one or more cylinders is low, pour a small amount of engine oil into that cylinder through the spark plug hole and measure the cylinder compression again.

- If adding oil helps the compression to improve, chances are that the piston rings and/or cylinder bores are worm or damaged.
- If the pressure remains low after the operation has been performed, the valves may be sticking or seated un properly, or there may be leakage post the gasket.



JEM00023-00016

9. Checking of CO/HC concentrations

Preparation to be made prior to check of CO/HC concentrations.

- Apply the parking brake fully.
- Check and adjust the ignition timing.
- Check and adjust the idle speed.
- Warm up the engine thoroughly.
- All accessory switches are turned OFF.
- The air cleaner element is installed.
- All pipes and vacuum hose are connected.
- Ensure that the intake system exhibits no air leakage.
- Ensure that the exhaust system exhibits no gas leakage.
- On the automatic transmission vehicle, the shift lever is placed in the [N] or [P] range.
- On the manual transmission vehicle, the shift lever is placed in the neutral position.
- Position the steering wheel to the straight-ahead direction.
- Be sure to prepare the CO/HC meter by following the instruction of its manufacturer, before it is put into use.

NOTE:

- This check is used only to determine whether or not the idle HC/CO emission complies with the regulations.

Measure the HC/CO emission by inserting a sampling pipe of the HC/CO meter into the exhaust pipe.
Wait at least one minute before the measurement so as to allow the concentrations to stabilize.
Complete the measurement within three minutes.
If the HC/CO concentrations do not conform to the regulations, see the following table for possible causes.

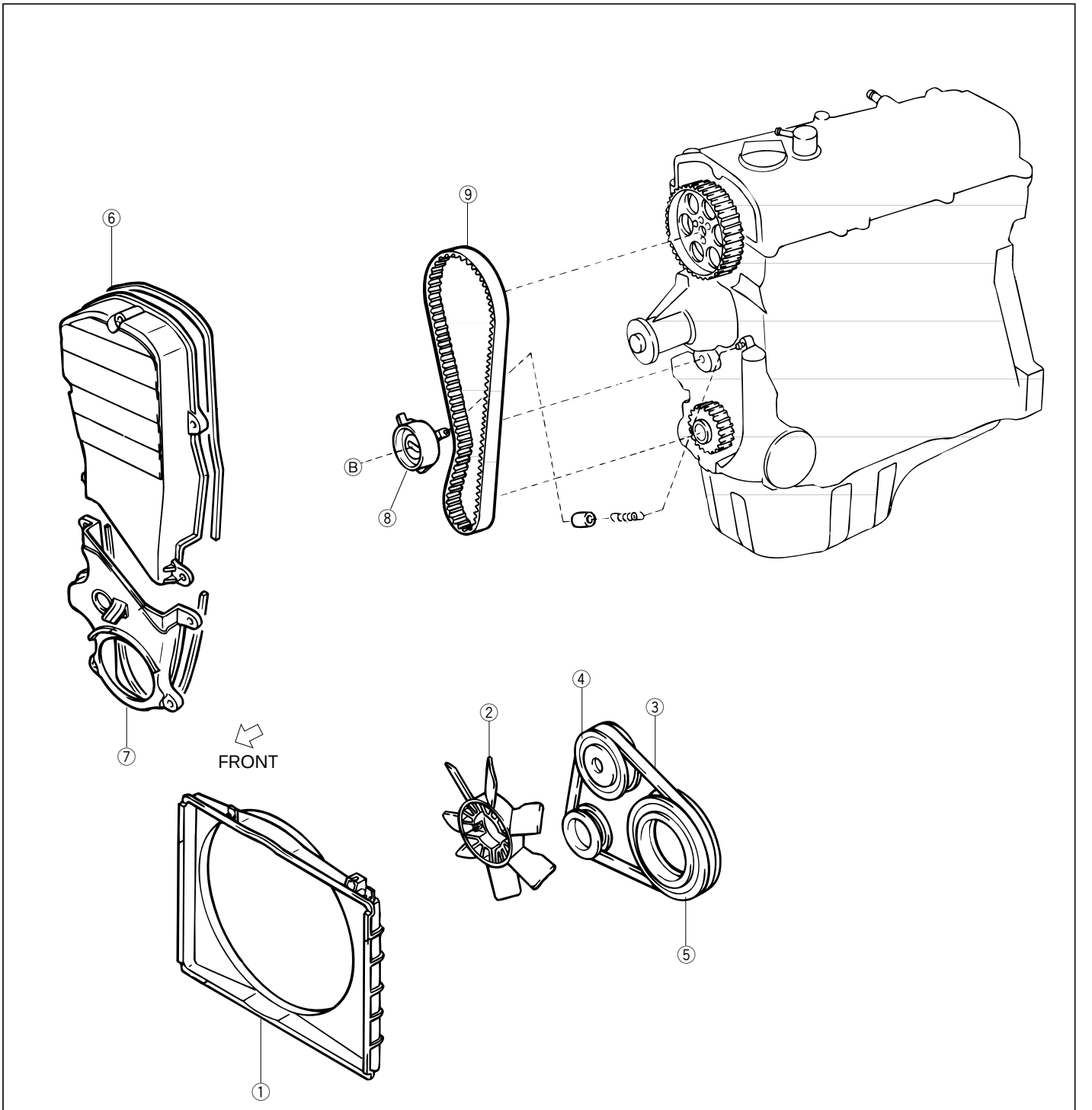
Trouble Shooting List

HC	CO	Problems	Possible causes
High	Normal	Rough idle	1. Faulty ignition • Incorrect ignition timing • Fouled, shorted or improperly gapped spark plugs • Open or crossed high tension cords 2. Incorrect valve clearance 3. Leaky exhaust valves 4. Leaky cylinder
High	Low	Rough idle (Fluctuation in HC reading)	1. Lean mixture causing misfire
High	High	Rough idle (Black smoke from exhaust)	1. Restricted air filter 2. Faulty EFI system • Faulty pressure regulator • Clogged fuel return line • Defective water temp. sensor • Defective air temp. sensor • Faulty throttle position sensor • Faulty pressure sensor • Faulty ECU • Faulty oxygen sensor

JEM00024-00000

TIMING BELT

COMPONENTS

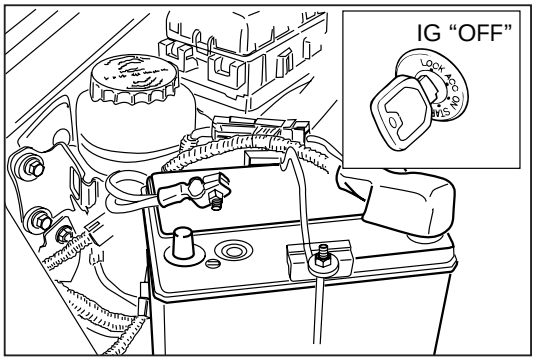


① Fan shroud
② Fan & fluid coupling
③ V-ribbed belt
④ Water pump pulley
⑤ Crankshaft pulley assembly
⑥ Timing belt upper cover
⑦ Timing belt lower cover
⑧ Timing belt tensioner subassembly
⑨ Timing belt

JEM00025-00017

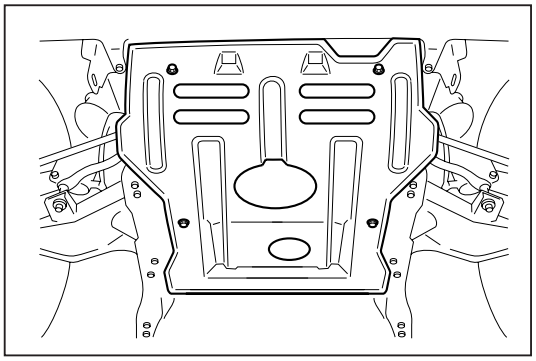
REMOVAL

1. Disconnect the battery ground cable from the negative (–) terminal of the battery.



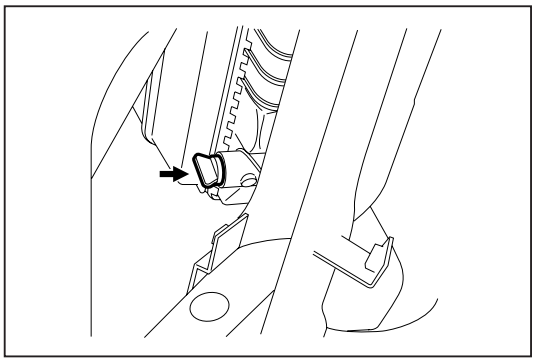
JEM00026-00018

2. Remove the engine undercover.



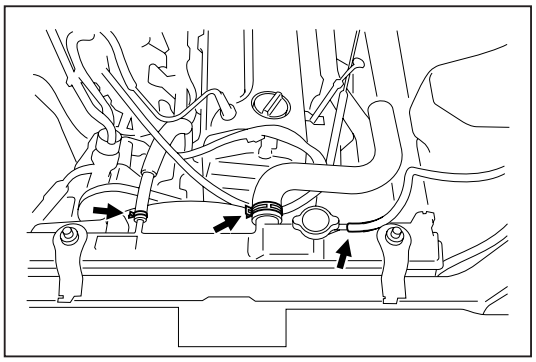
JEM00027-00019

3. Removal of fan and fluid coupling
   (1) Drain the coolant by loosening the drain plug and the radiator cap.
   WARNING:
   - Never open the drain plug and the radiator cap when the coolant is still hot.
     Failure to observe this caution will cause you to get scalded.



JEM00028-00020

   (2) Disconnect the water hose from the radiator upper side.

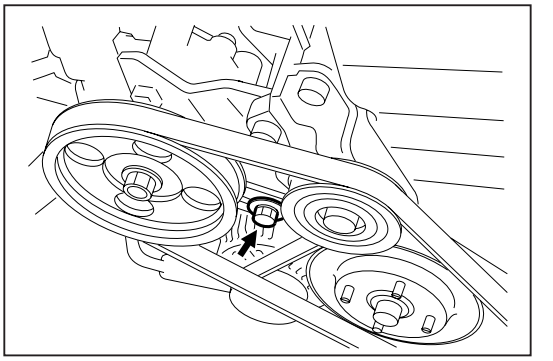


JEM00029-00021

   (3) Loosen the attaching nuts of the fluid coupling.
   (4) Remove the fan and the fluid coupling together with the fan shroud by loosening the attaching bolts.

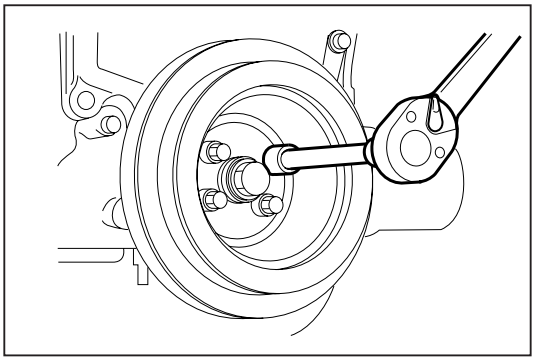
JEM00030-00000

4. Remove the power steering vane pump drive belt by loosening the power steering vane pump attaching bolts.
5. Remove the alternator drive belt.



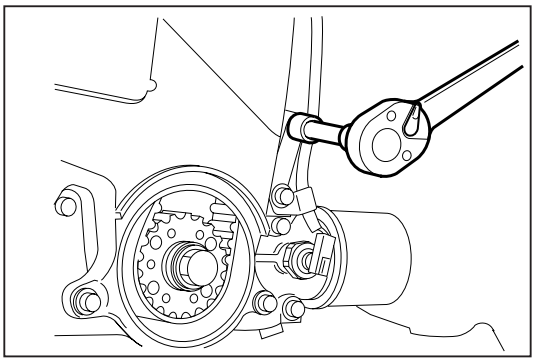
JEM00031-00022

6. Remove the crankshaft pulley.
   NOTE:
   - Place the shift lever in the 4th gear position so as to prevent the rotation of the crankshaft in the case of manual transmission-equipped model.
   - On the automatic transmission vehicle, prevent the crankshaft from being rotated by inserting a screwdriver or the like into the ring gear at the rear end section of the cylinder block.



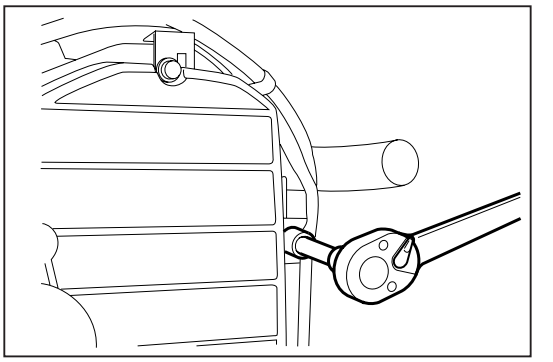
JEM00032-00023

7. Disconnect the connector of the oil pressure switch and loosen the attaching bolt of the oil pressure switch wire bracket.



JEM00033-00024

8. Remove the timing belt cover by removing the attaching bolts.



JEM00034-00025

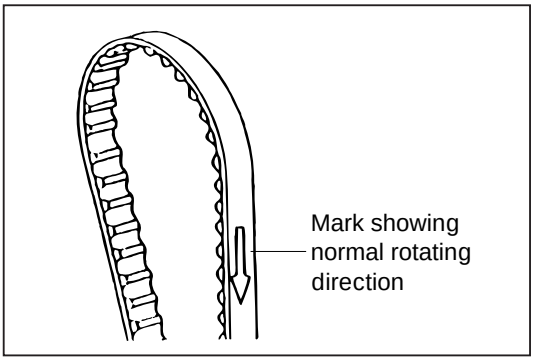
9. Removal of timing belt

NOTE:

- Prior to removal of the timing belt, put an arrow mark indicating the normal rotating direction on the belt, using a chalk or the like.

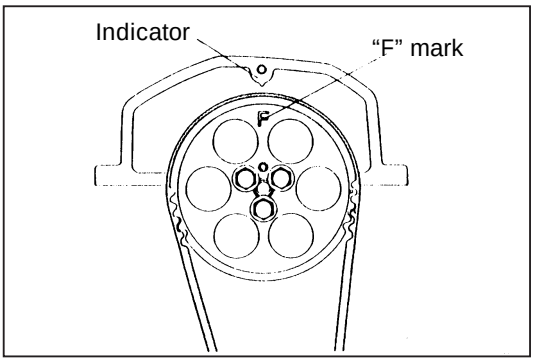
CAUTION:

- Do not try to pry the timing belt with a screwdriver or the like during the removal or installation.
- Do not allow the belt to come into contact with oil, water or dust.
- Do not bend the belt at a sharp angle or turn the belt inside out, for it is very vulnerable to bending.
- Do not utilize the tension of the timing belt pulley when loosening the set bolt of the camshaft timing belt pulley.



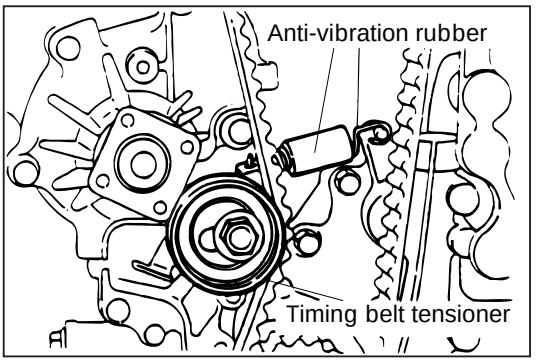
JEM00035-00026

(1) Rotate the crankshaft until the “F” mark of the crankshaft timing belt pulley is aligned with the indicator of the cylinder head cover.



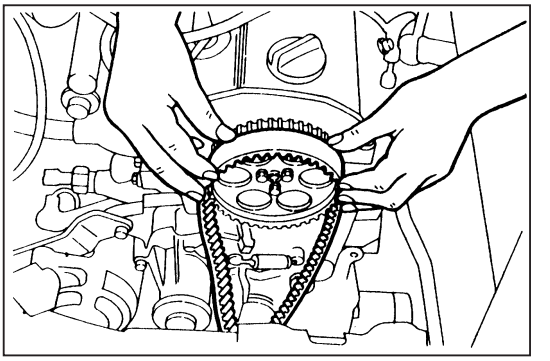
JEM00036-00027

(2) Loosen the attaching bolt of the timing belt tensioner. Move the tensioner to the left as far as it will go and tighten the bolt temporarily.



JEM00037-00028

(3) Remove the timing belt.

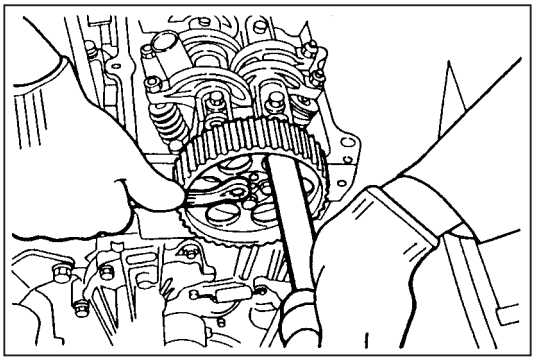


JEM00038-00029

10. Removal of camshaft timing belt pulley
    (1) Remove the timing belt.
    (2) Remove the cylinder head cover.

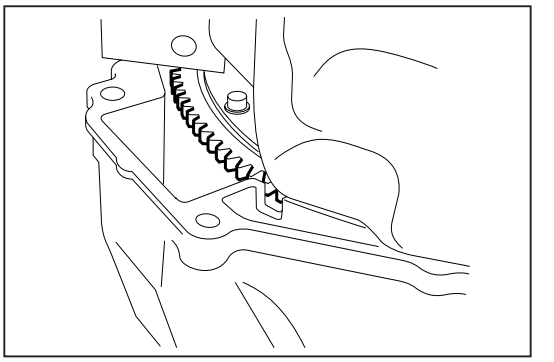
JEM00039-00000

    (3) Removal of camshaft timing belt pulley
    While preventing the camshaft timing belt pulley from turning using a suitable iron rod, remove the three attaching bolts.
    Then, remove the camshaft timing belt pulley.



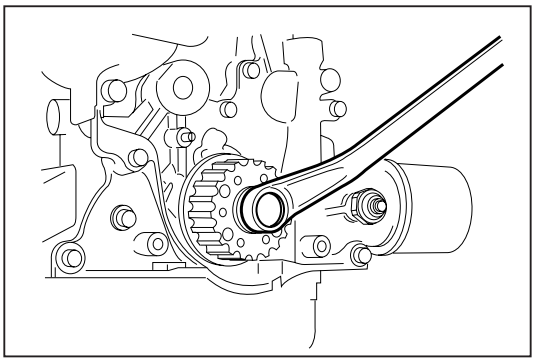
JEM00040-00030

11. Removal of crankshaft timing belt pulley
    (1) Remove the timing belt.
    (2) Removal of crankshaft timing belt pulley
        ① Remove the power train stiffener and prevent the ring gear from turning with a suitable screwdriver or the like.



JEM00041-00031

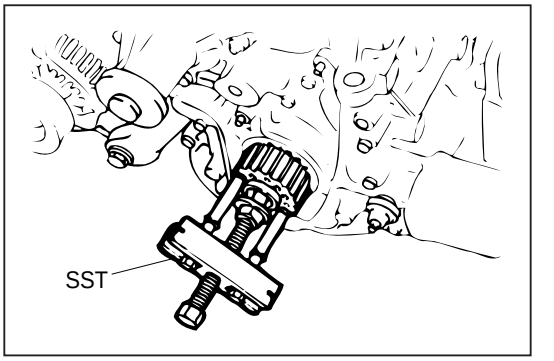
        ② While performing the operation described in the step ①, remove the set bolt of the crankshaft timing belt pulley.



JEM00042-00032

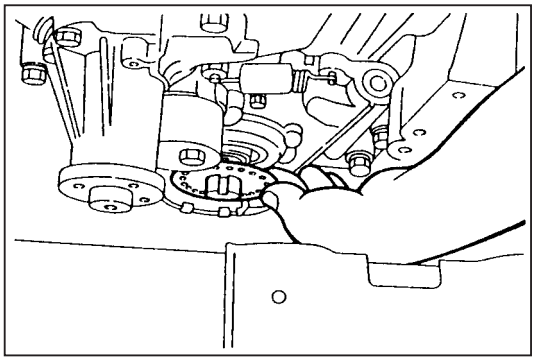
        ③ Remove the crankshaft timing belt pulley.

NOTE:
- If any difficulty is encountered in removing the crankshaft timing belt pulley, lightly screw in the set bolt of the crankshaft timing belt pulley. Then, remove the pulley, using the following SST.
  SST: 09609-20011-000



JEM00043-00033

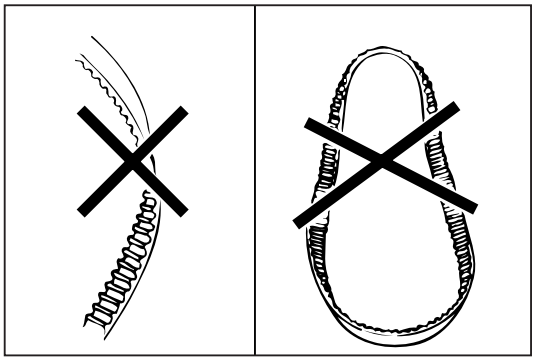
(3) Remove the timing belt pulley flange.



JEM00044-00034

INSPECTION

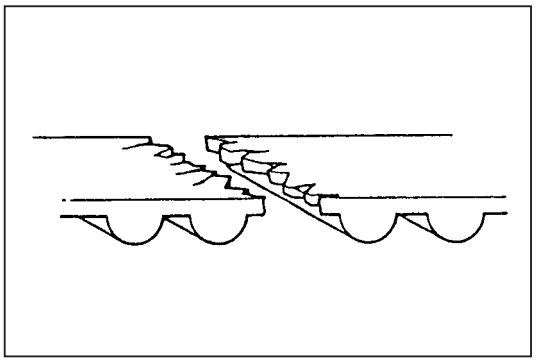
1. Inspection of timing belt
   CAUTION:
   - Do not bend, twist or turn the belt inside out.
   - Do not allow the belt to come into contact with oil, water or steam.



JEM00045-00035

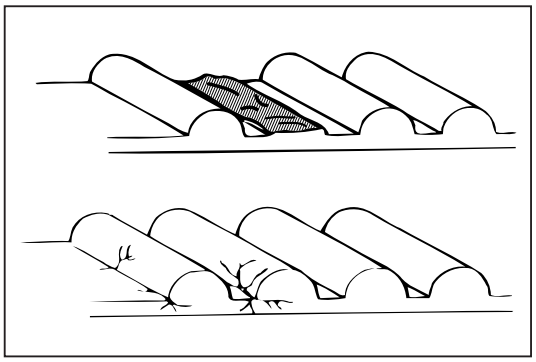
If there are damages, as shown in the figures, check the following points and replace the timing belt, if necessary.

(1) Premature separation
- Check for proper installation.
- Check the timing belt cover gaskets for damage and check for correct installation.



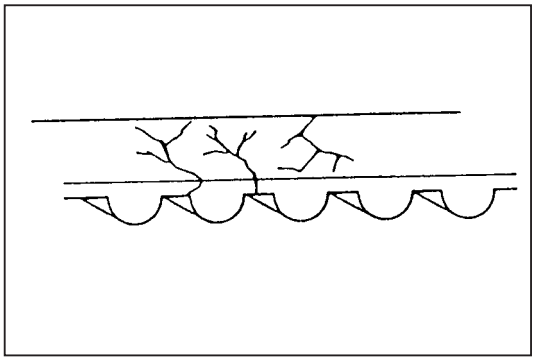
JEM00046-00036

(2) If the belt teeth are cracked or damaged, check to see if the camshaft is seized.



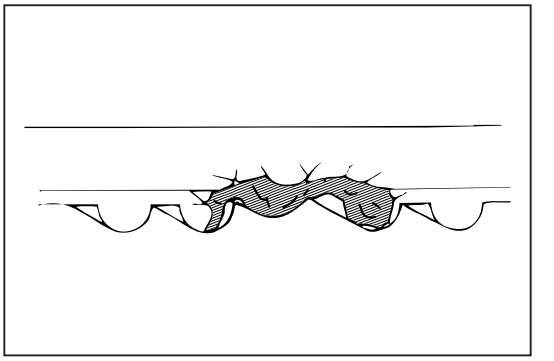
JEM00047-00037

(3) If there is noticeable wear or cracks on the belt surface, check to see if there are nicks on one side of the idler pulley lock.



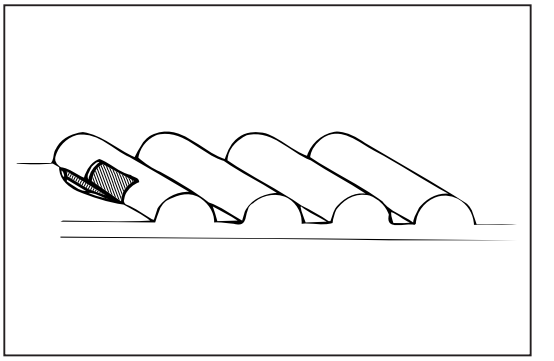
JEM00048-00038

(4) If there is wear or damage on only one side of the belt, check the pulley flange.



JEM00049-00039

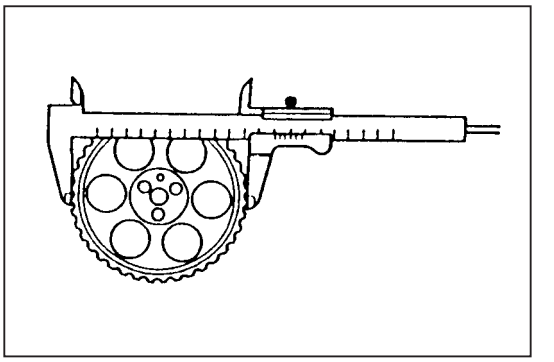
(5) If there is noticeable wear on the belt teeth, check the timing cover gasket for damage and check for correct gasket installation. Check for foreign material on the pulley teeth.



JEM00050-00040

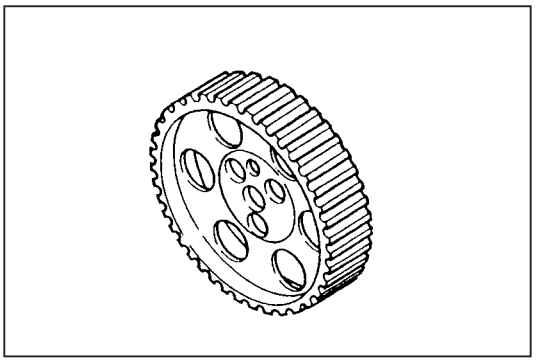
2. Inspection of camshaft timing belt pulley
   (1) Measure the maximum width of the timing belt pulley, using vernier calipers.
   Wear Limit of Camshaft Timing Belt Pulley: 119.8 mm

   If the measured value is less than the specified value, replace the timing belt pulley with a new one.



JEM00051-00041

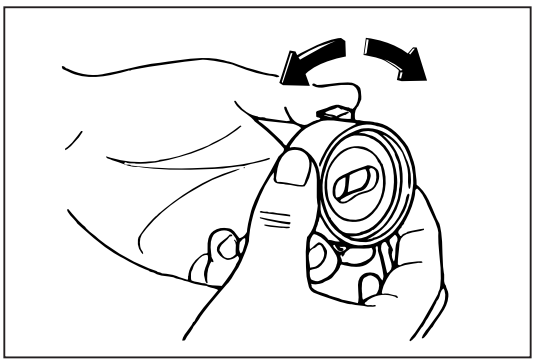
   (2) Visually inspect the timing belt pulley for damage.
   If any damage is present, replace the timing belt pulley with a new one.



JEM00052-00042

3. Inspection of timing belt tensioner
   If the timing belt tensioner is damaged, check to see if the bearing exhibits an excessive play.
   NOTE:
   - Check the timing belt pulleys for smooth turning.
   - Check the belt contact surface for damage.

   If necessary, replace the idler pulley.
   CAUTION:
   - Never wash the timing belt tensioner.

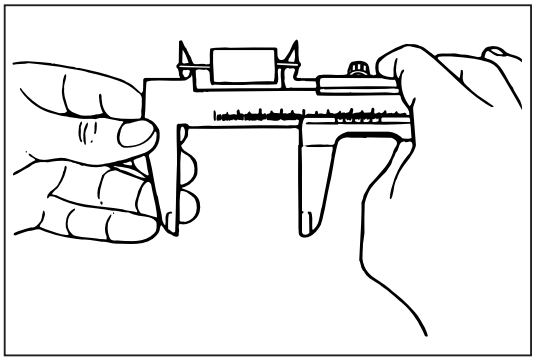


JEM00053-00043

4. Inspection of tension spring
   (1) Check the free length of the spring
   Free Length: 46.5 mm or less

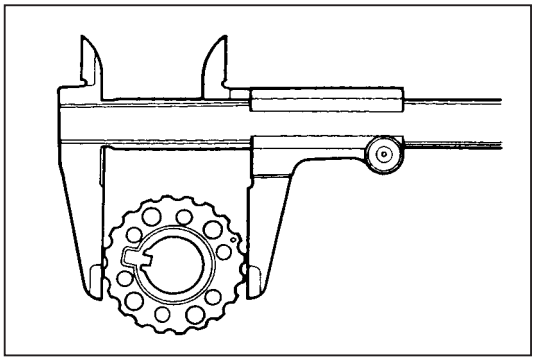
   (2) Check the tension of the spring at the specified installation length.
   Specified Value:
   29.4 ± 3 N at 50.9 mm

   If the tension does not conform to the specification, replace the spring.

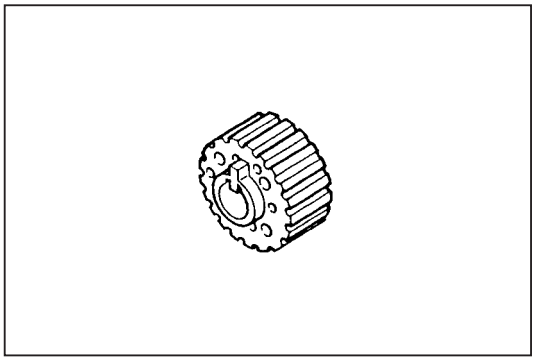

JEM00054-00044

5. Inspection of crankshaft timing belt pulley and flange
   (1) Measure the maximum width of the timing belt pulley, using vernier calipers.
   Wear Limit of Crankshaft Timing Belt Pulley: 59.3 mm

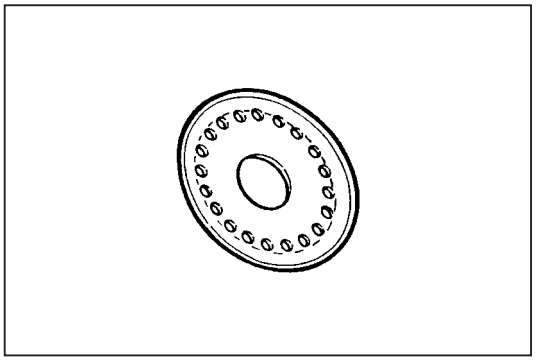
   If the measured value is less than the specified value, replace the timing belt pulley with a new one.


JEM00055-00045

   (2) Visually inspect the crankshaft timing belt pulley for damage. If any damage is present, replace the crankshaft timing belt pulley.


JEM00056-00046

   (3) Visually inspect the crankshaft timing belt pulley flange for bend, wear and other damage.
   If any damage is present, replace the crankshaft timing belt pulley flange.


JEM00057-00047

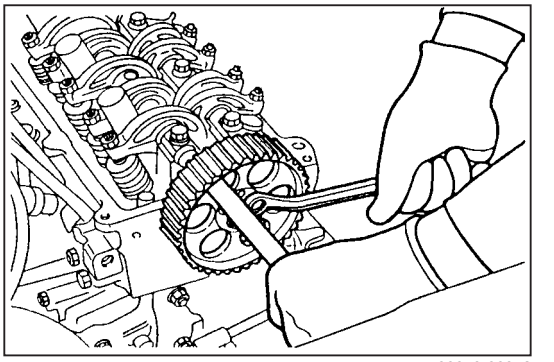
INSTALLATION

1. Installation of camshaft timing belt pulley
   (1) Install the camshaft timing belt pulley on the camshaft in such a way that the “F” mark can be seen and the locating pin hole is aligned.

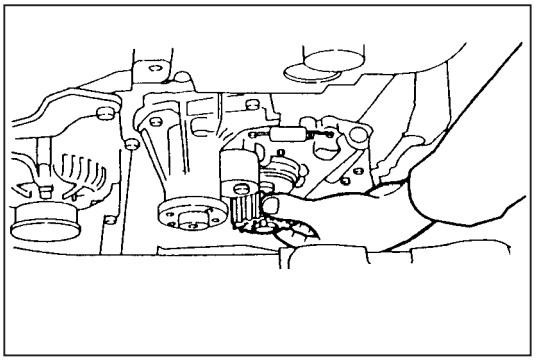
JEM00058-00000

(2) Install the attaching bolts of the camshaft timing belt pulley, while preventing the pulley from turning by inserting an iron rod into the hole of the pulley.
Tightening Torque: 14.7 - 21.6 N·m

NOTE:
- Do not turn the camshaft independently.
- Be very careful not to damage the gasket attaching surface of the cylinder head.
- The bolts and bolt holes should be dry during the tightening.

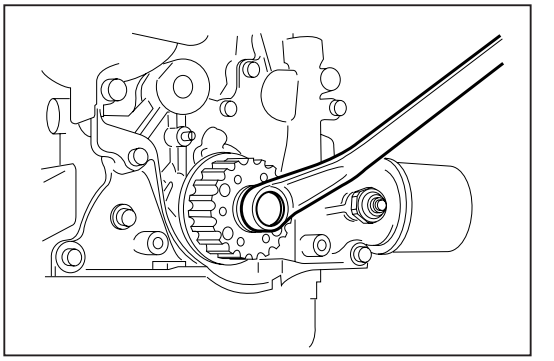

JEM00059-00048

2. Installation of crankshaft timing belt pulley
(1) Install the crankshaft timing belt pulley flange with its recessed side facing toward the oil pump side (Protrusion side facing toward the crankshaft timing belt pulley side).
(2) Install the crankshaft timing belt pulley on the crankshaft by aligning it with the key groove.
(3) Install the set bolt of the crankshaft timing belt pulley.

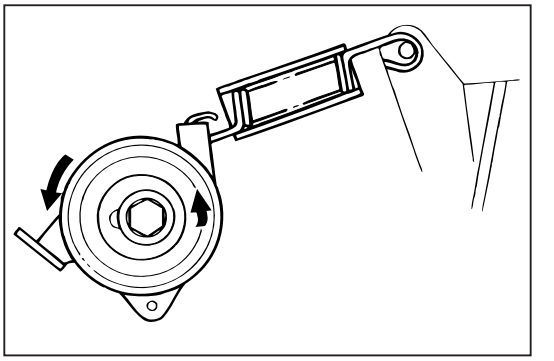

JEM00060-00049

(4) Tighten the set bolt of the crankshaft timing belt pulley, while preventing the ring gear from turning with a suitable screwdriver or the like.
Tightening Torque: 88.3 - 98.0 N·m

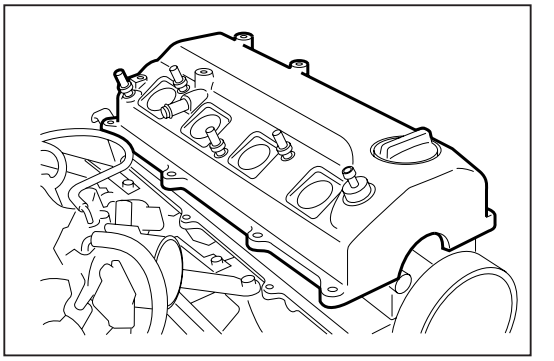
NOTE:
- Never allow the crankshaft to turn.


JEM00061-00050

3. Attach the tension spring to the timing belt tensioner.
Hang the tension spring hook on the pin. Assemble the timing belt tensioner in place and install the bolt.
CAUTION:
- Hang the spring hook securely on the pin groove.
- Ensure that the pin at the oil pump is fitted into the pin hole of the timing belt tensioner.

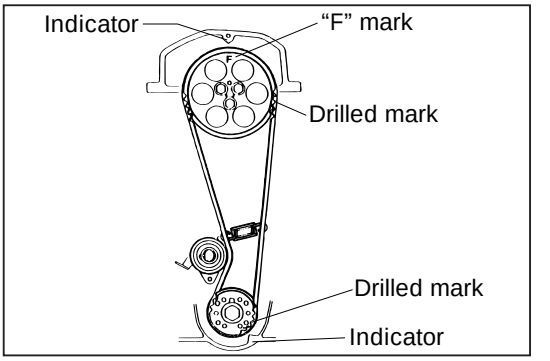

JEM00062-00051

4. Installation of timing belt
(1) Temporarily install the cylinder head cover.


JEM00063-00052

(2) Align the drilled mark of the camshaft timing belt pulley with the top surface line of the cylinder head.
(3) Align the drilled mark of the crankshaft timing belt pulley with the indicator.
(4) Assemble the timing belt in such a way that the two mating marks on the timing belt may be aligned with the corresponding drilled marks on the crankshaft timing belt pulley and camshaft timing belt pulley.

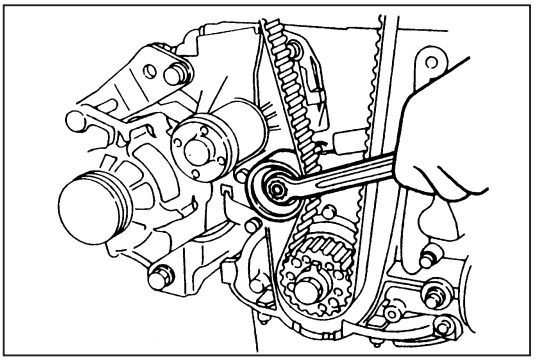
CAUTION:
- Do not allow the belt to come into contact with oil, water or dust.
- Do not try to pry the timing belt with a screwdriver or the like.
- When the timing belt is reused, there should exist 35 teeth of the belt between the drilled marks of the crankshaft timing belt pulley and camshaft timing belt pulley.
- When the timing belt is reused, the arrow mark which was put during the disassembly comes in a rotational direction of the timing belt.



JEM00064-00053

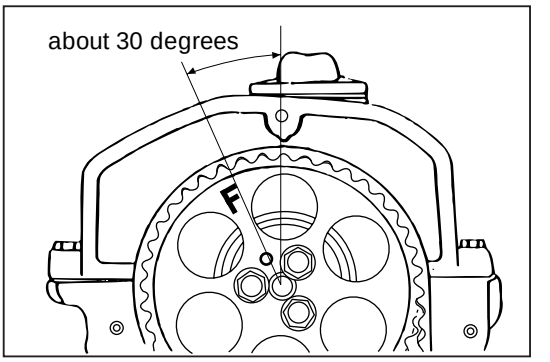
(5) Loosen the attaching bolt of the timing belt tensioner. Apply tension to the timing belt. Temporarily tighten the attaching bolt.

NOTE:
- Ensure that the belt exhibits no slack at the tension side of the belt (the side opposite to the tensioner).


JEM00065-00054

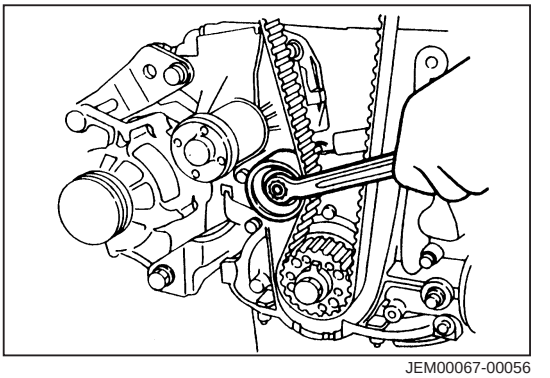
(6) Rotate the crankshaft 1.9 turns in the normal direction so that the "F" mark of the camshaft timing belt pulley comes at a point three teeth in the camshaft timing belt pulley before the indicator of the cylinder head cover.

NOTE:
- At this time, never turn the crankshaft reversely.
- Make sure that the belt is not tilted between the crankshaft timing belt pulley and the camshaft timing belt pulley.
- If the crankshaft should be reversed or the timing belt should be tilted, turn the crankshaft two more turns.



JEM00066-00055

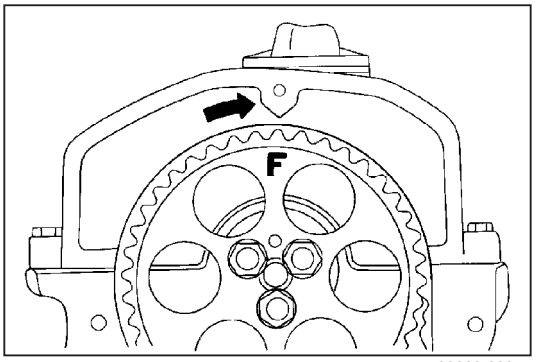
(7) Make the tensioner free by loosening the attaching bolt of the timing belt tensioner.


JEM00067-00056

(8) Turn the crankshaft further in the normal direction until the “F” mark of the camshaft timing belt pulley is aligned with the indicator of the cylinder head cover.

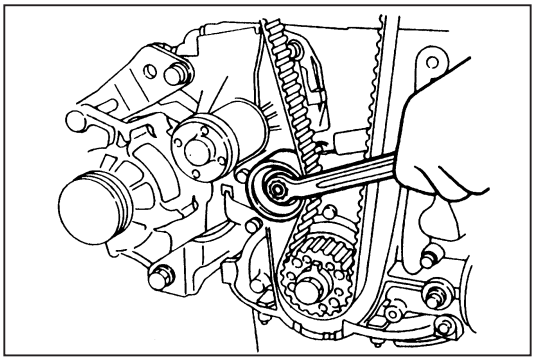
NOTE:

- Never turn the crankshaft reversely.
- Never turn the crankshaft beyond the point where the “F” mark of the camshaft timing belt pulley is aligned with the indicator.
- If the crankshaft should be reversed or turned beyond that point, temporarily tighten the tensioner attaching bolt and repeat the operations from the step (5) onward.



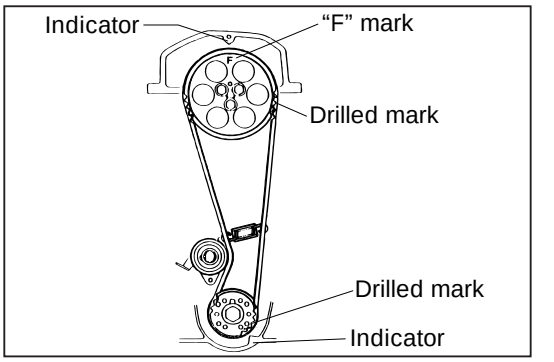
JEM00068-00057

(9) Tighten the attaching bolt of the timing belt tensioner to the specified torque.
Tightening Torque: 29.4 - 44.1 N·m


JEM00069-00058

(10) Ensure that the drilled marks of the crankshaft timing belt pulley and camshaft timing belt pulley are aligned with the corresponding indicators.

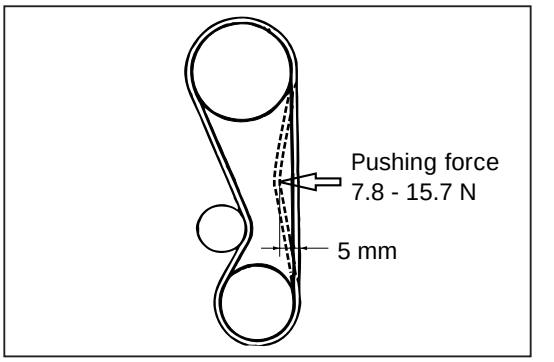
If the drilled mark is not aligned with the indicator, repeat the operations from the step (2) onward.



JEM00070-00059

5. Checking of timing belt tension
When the midpoint of the belt at the tension side is pushed 5 mm, ensure that the pushing force is within the specified value.
Specified Pushing Force:
7.8 - 15.7 N When belt is deflected 5 mm

If the belt does not conform to the specification, repeat the operations from the step 13 (4) onward.

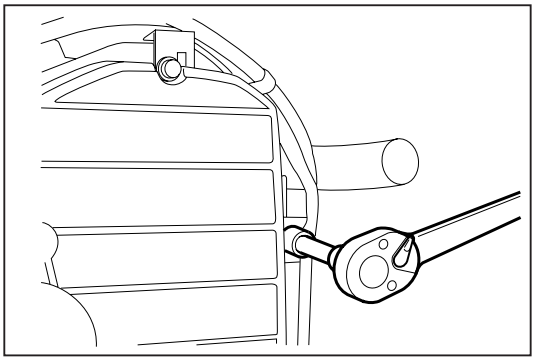


JEM00071-00060

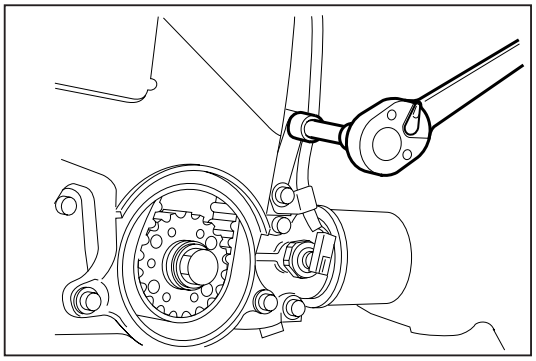
6. Install the timing belt lower cover and upper cover.
Tightening Torque: 2.0 - 3.9 N·m

CAUTION:

- Care must be exercised as to the length of each bolt.


JEM00072-00061

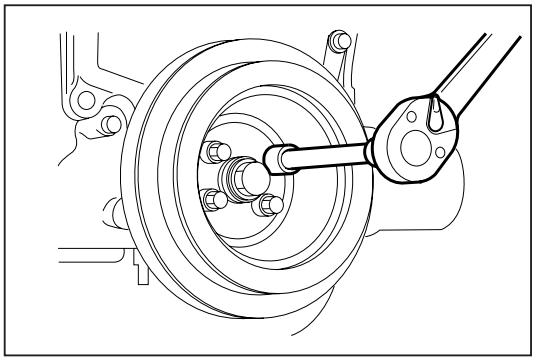
7. Install the oil pressure switch wire and tighten the wire clamps.
8. Connect the oil pressure switch connector.



JEM00073-00063

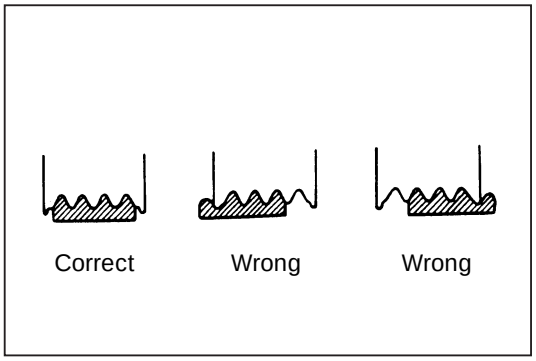
9. Install the crankshaft pulley with the attaching bolt. Tighten the bolt to the specified torque.
   Tightening Torque: 19.6 - 29.4 N·m

   NOTE:
   - Place the gear shift lever in the 4th gear position so as to prevent the rotation of the crankshaft in the case of manual transmission equipped model.
   - On the automatic transmission vehicle, prevent the crankshaft from being rotated by inserting a screwdriver or the like into the ring gear at the rear end section of the cylinder block.



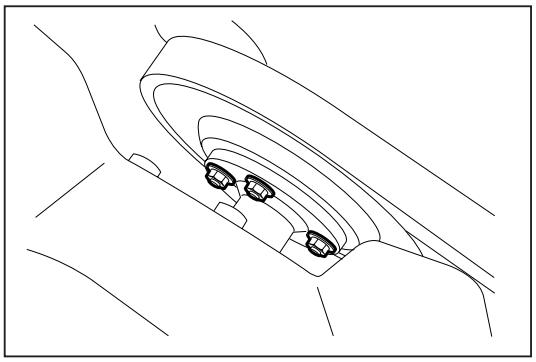
JEM00074-00062

10. Temporarily install the water pump pulley and the drive belt.
11. Install the power steering vane pump drive belt and adjust the belt tension.
    NOTE:
    - Make sure that the V-ribbed belt is fitted properly in the groove of each pulley.



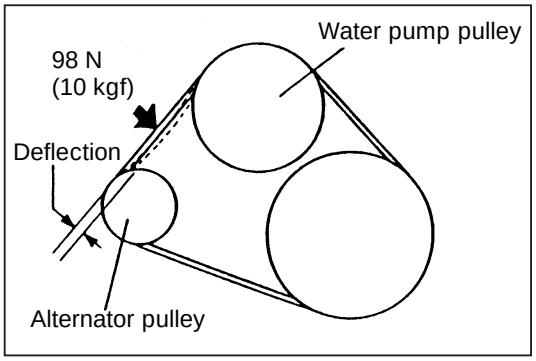
JEM00075-00064

12. Install the fan and the fluid coupling together with the fan shroud.
13. Tighten the fluid coupling attaching nuts.
    Tightening Torque: 9.8 - 17.7 N·m



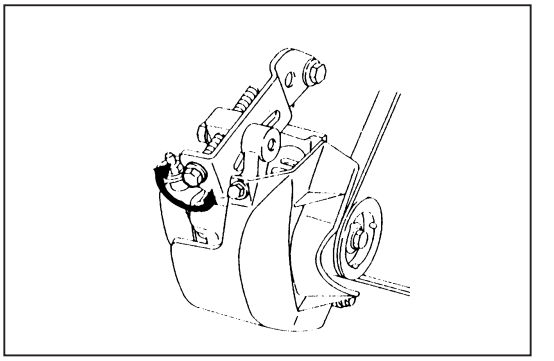
JEM00076-00065

14. Tension adjustment
    (1) Screw in the adjusting bolt, until the deflection of the drive belt meets the specification when you push the midpoint of the drive belt between the water pump pulley and the alternator pulley by applying a force of 98.1 N (10 kgf).



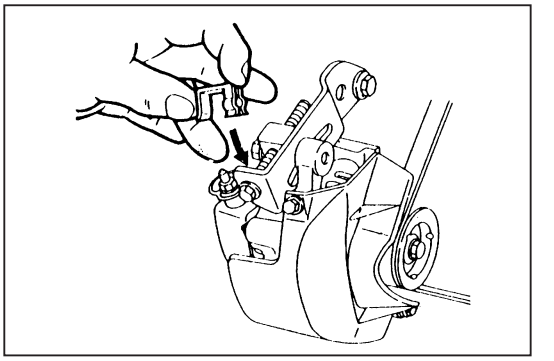
JEM00077-00066

Specified Belt Deflection:
New Belt: 4.0 - 5.0 mm
With a force of 98.1 N (10 kgf) applied to point indicated in figure
Used Belt: 5.0 - 6.0 mm
With a force of 98.1 N (10 kgf) applied to point indicated in figure

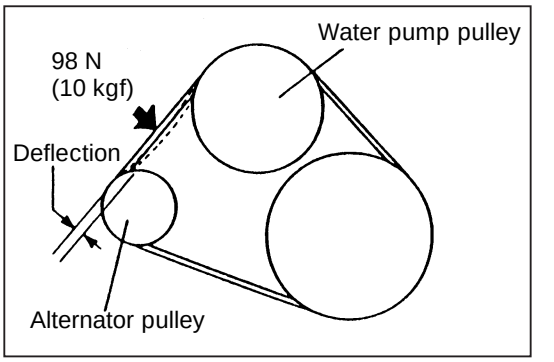

JEM00078-00067

NOTE:
- The used belt denotes a belt which has been used for more than five minutes after it was put into use.

(2) Tighten the alternator attaching bolts.
(3) Install the locking plate of the adjusting bolt.
CAUTION:
- Be sure to install the locking plate securely. Failure to observe this caution could cause falling of the adjusting bolt.

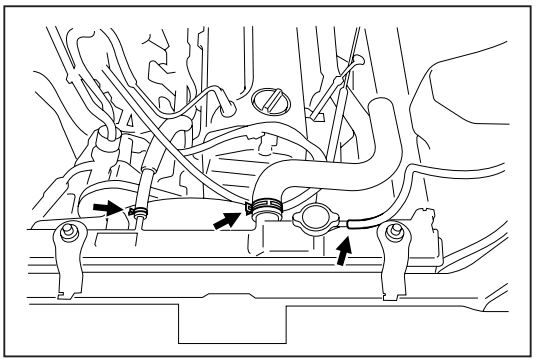

JEM00079-00068

15. Ensure that the belt deflection meets the specification when the midpoint between the water pump pulley and the alternator is pushed with a force of 98.1 N (10 kgf). (See step 14.)
If the deflection does not conform to the specification, perform the adjustment so that the specification may be satisfied.

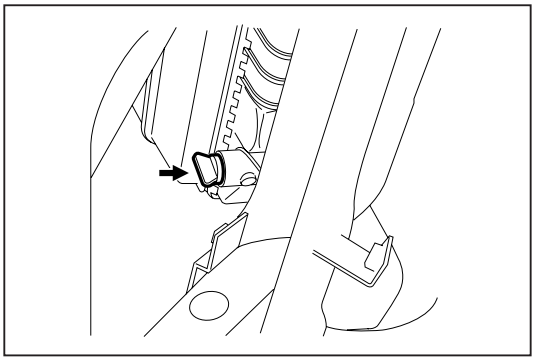


JEM00080-00069

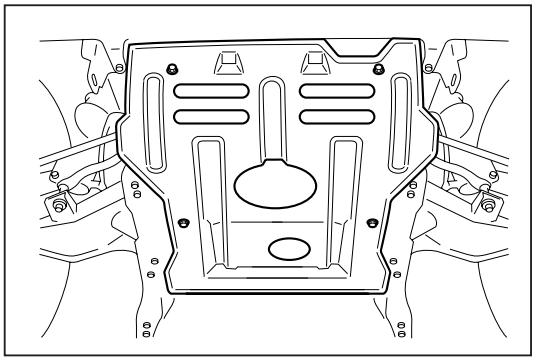
16. Tighten the fan shroud attaching bolts.
17. Connect the water hoses to the radiator.


JEM00081-00070

18. Tighten the drain plug and fill the coolant to the radiator and reserve tank.

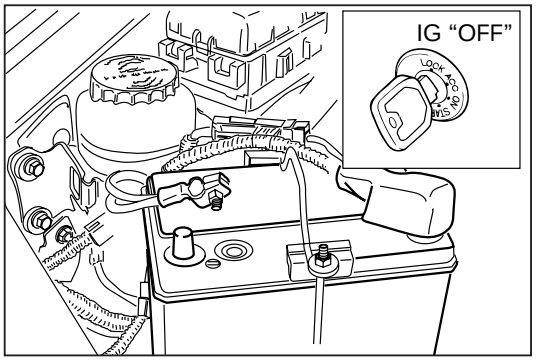

JEM00081-00071

19. Install the engine undercover and tighten the attaching bolts.



JEM00083-00072

20. Connect the ground cable to the negative (–) terminal of the battery.

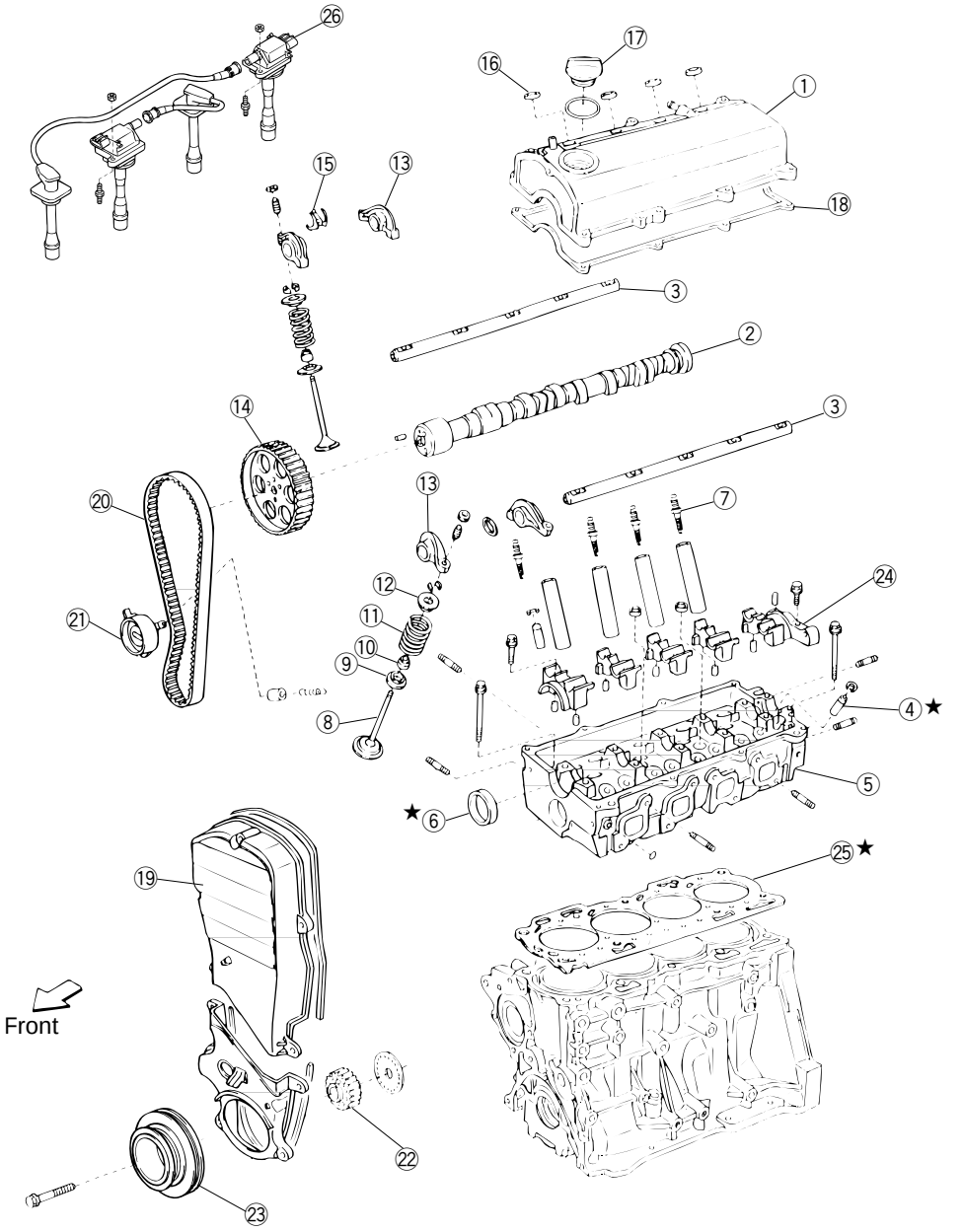


JEM00084-00073

CYLINDER HEAD

COMPONENTS

★ : Non-reusable parts



① Cylinder head cover
② Camshaft
③ Valve rocker shaft
④ Valve guide
⑤ Cylinder head
⑥ Oil seal
⑦ Spark plug
⑧ Valve
⑨ Spring seat
⑩ Valve stem oil seal
⑪ Valve spring
⑫ Valve spring retainer
⑬ Valve rocker arm
⑭ Camshaft timing belt pulley
⑮ Spacer
⑯ Grommet
⑰ Oil filler cap
⑱ Gasket
⑲ Timing belt upper cover
⑳ Timing belt
㉑ Timing belt tensioner
㉒ Crankshaft timing belt pulley
㉓ Crankshaft pulley
㉔ Camshaft cap
㉕ Cylinder head gasket
㉖ Ignition coil

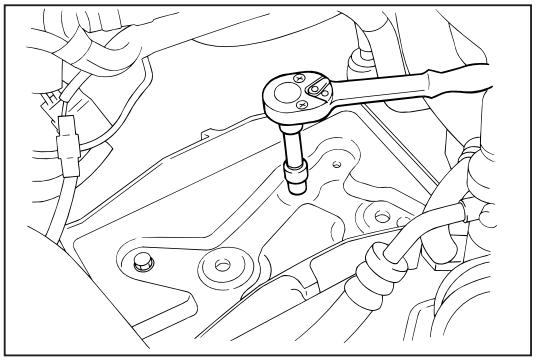
INSTRUCTION PRIOR TO OPERATION

- Install the fender cover to the fenders so that so scratch may be made to the fenders.
- Be sure to read the general information section of the service manual.

JEM00086-00000

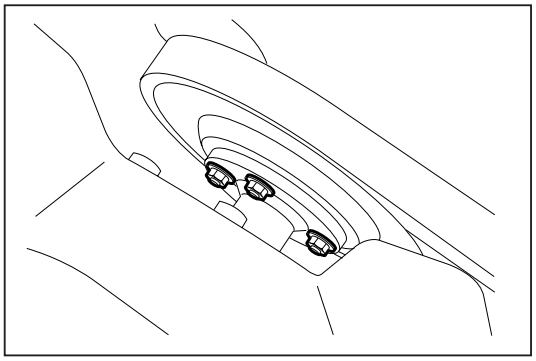
CYLINDER HEAD REMOVAL

1. Remove the battery and the battery carrier.



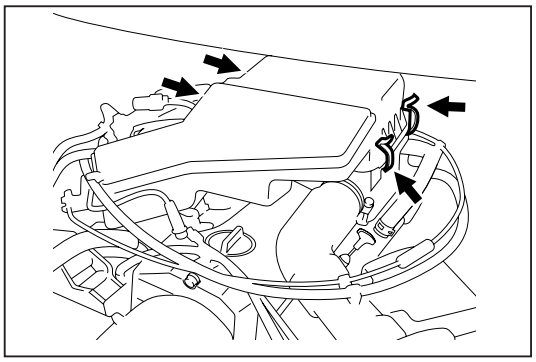
JEM00087-00075

2. Drain the coolant.
3. Remove the cooling fan with the fluid coupling and the fan shroud.
4. Remove the radiator by loosen the attaching bolts.



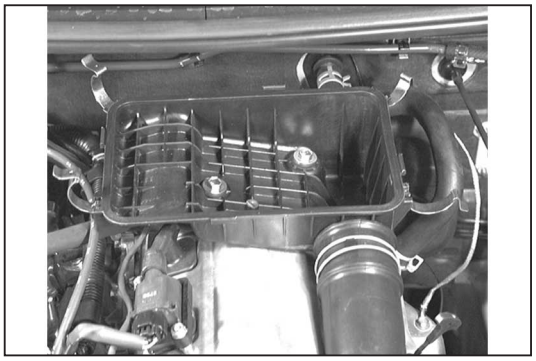
JEM00088-00076

5. Removal of air cleaner.
   (1) Remove the attaching bolt of the air intake hose.
   (2) Remove the accelerator cable and the rubber hoses from the throttle body.
   (3) Release the clips of the air cleaner and remove the air cleaner lower case with air intake hose and the filter element.



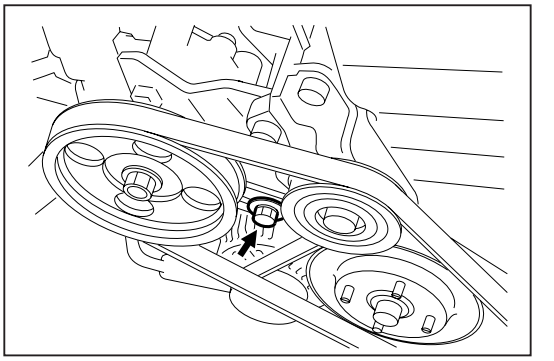
JEM00089-00077

   (4) Remove the air cleaner lower case by loosen the attaching bolts.



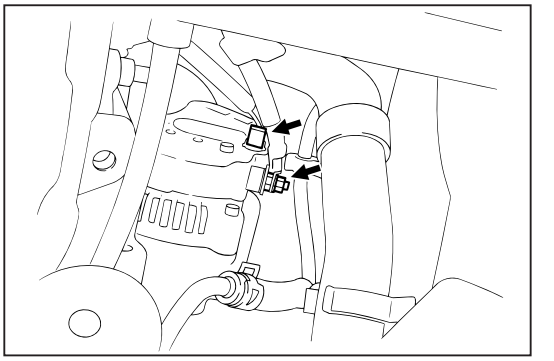
JEM00090-00078

6. Remove the power steering vane pump from the engine. Suspend the removed steering vane pump at body side, using an adequate rope.



JEM00091-00079

7. Removal of alternator
   (1) Remove the connector and the cable at the rear side of the alternator.
   (2) Remove the alternator with the belt tension adjusting bar.

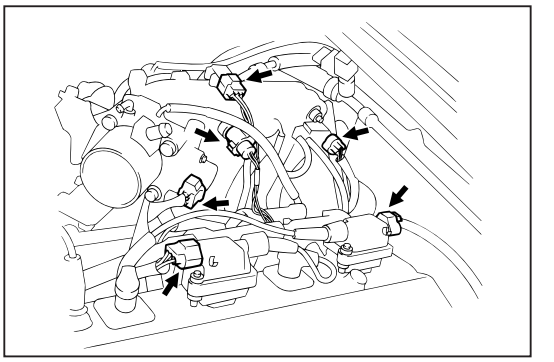


JEM00092-00080

8. Remove the timing belt.

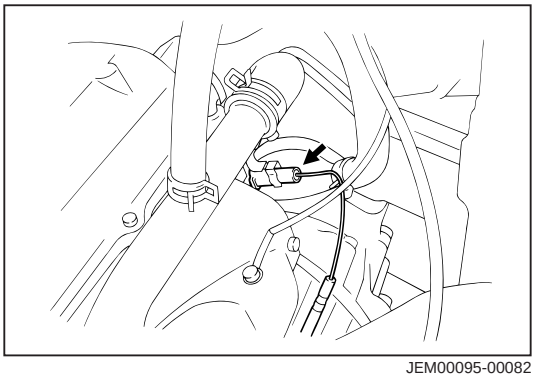
JEM00093-00000

9. Removal of engine wire from cylinder head.
   (1) Disconnect the connector of the engine wire from the following parts.
      ① Ignition coils
      ② Injectors
      ③ Pressure sensor
      ④ Throttle position sensor



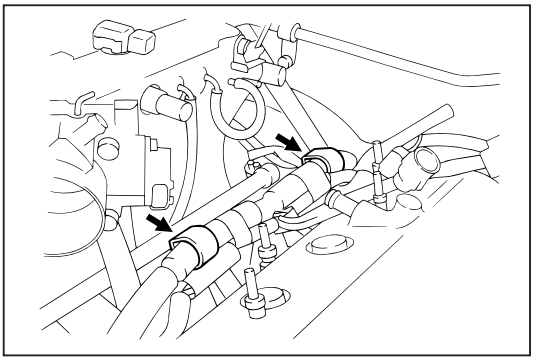
JEM00094-00081

      ⑤ Intake air temperature sensor
      ⑥ Idle-up VSV
      ⑦ Water temperature sensor
      ⑧ Oxygen sensor
      ⑨ Cam angle sensor



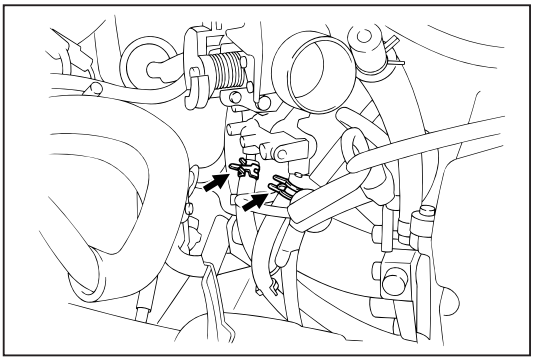
JEM00095-00082

(2) Disconnect the harness clamps by unlocking the clamps.
(3) Remove the engine harness from the cylinder head.



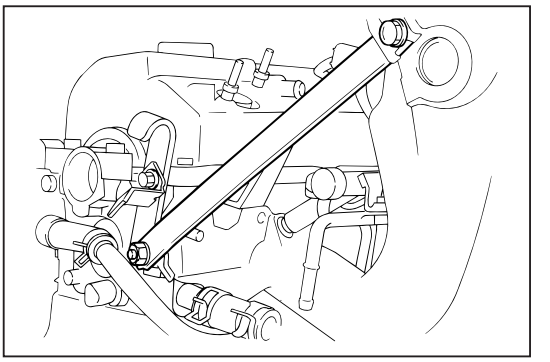
JEM00096-00083

10. Disconnect the water hoses



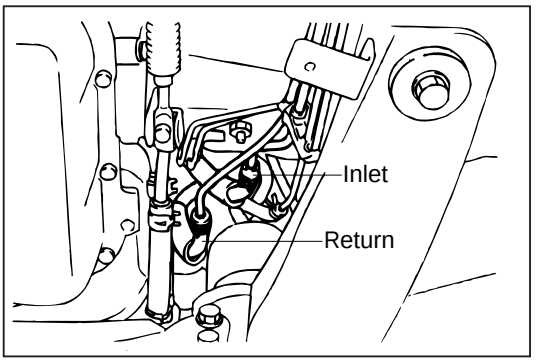
JEM00097-00084

11. Remove the surge tank stay No. 1, No. 2 and No. 3.



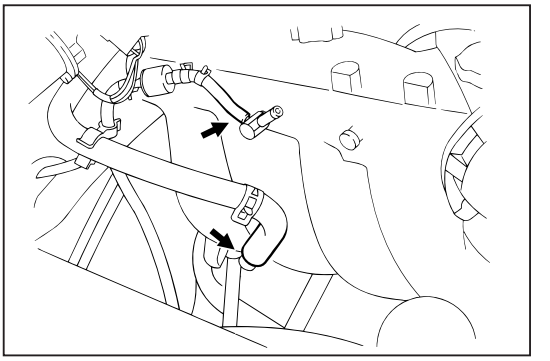
JEM00098-00085

12. Disconnect the fuel inlet hose and return hose.
CAUTION:
- The fuel pressure at inside of the fuel line is approximately 284 kPa higher than the atmospheric pressure.
- Therefore, be sure to gradually pull out the rubber hose so as to prevent fuel from splashing.



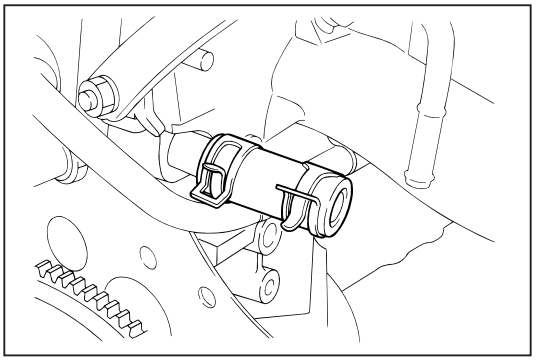
JEM00099-00086

13. Disconnect the rubber hoses for brake booster and VSV.



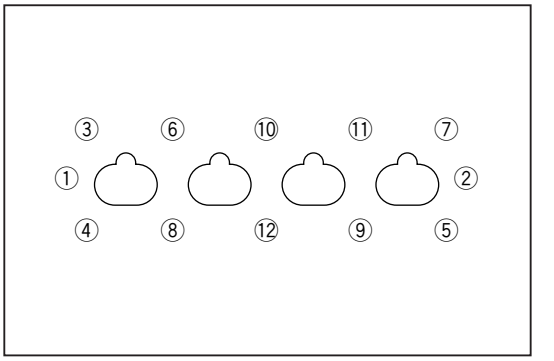
JEM00100-00087

14. Removal of intake manifold
    (1) Disconnect the plugged hose at the cylinder head.



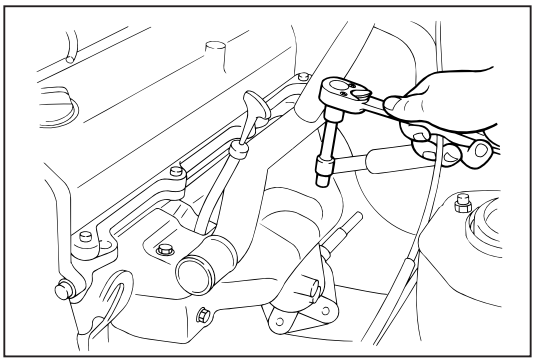
JEM00101-00088

    (2) Remove the attaching bolts and nuts of the intake manifold by loosen them evenly over two or three stage, following the sequence shown in the right figure.
    (3) Slowly detach the intake manifold from the cylinder head while preventing the interference with other parts.



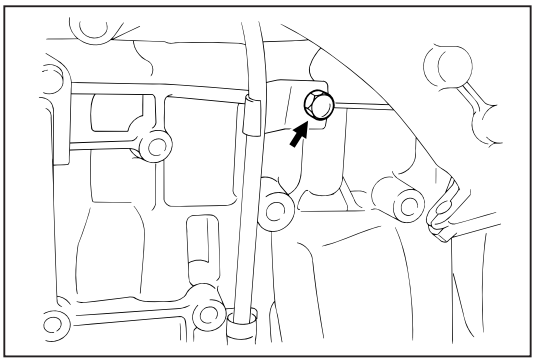
JEM00102-00089

15. Removal of exhaust manifold
    (1) Remove the heat insulator by loosen the attaching bolts.



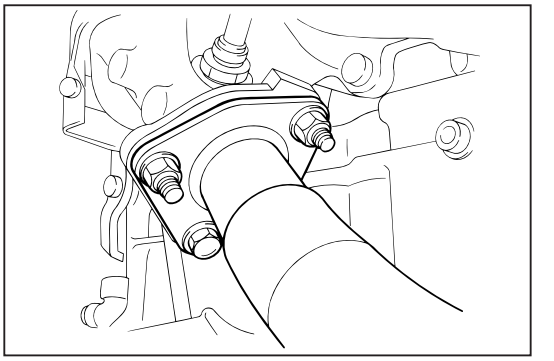
JEM00103-00090

    (2) Remove the oil level gauge.
    (3) Remove the oil level gauge guide by loosen the attaching bolt.



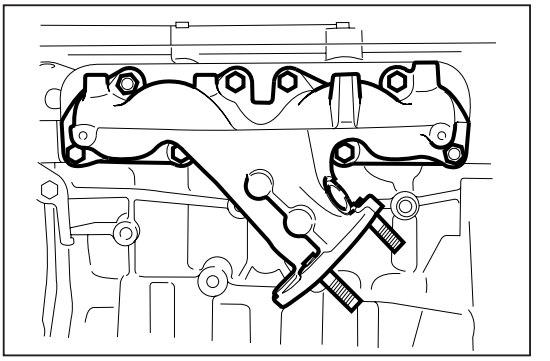
JEM00104-00091

    (4) Remove the front exhaust pipe from the exhaust manifold.

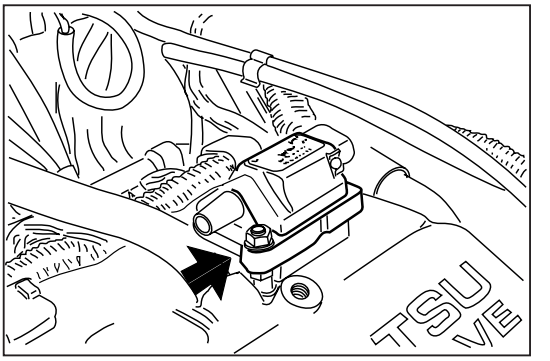


JEM00105-00092

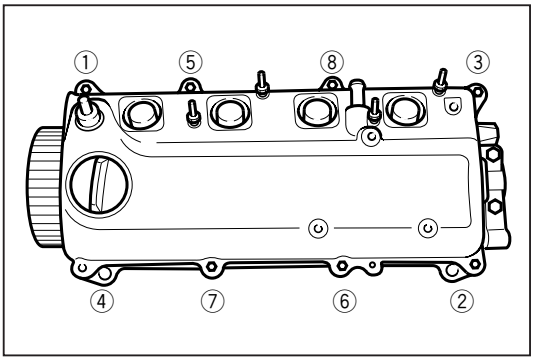
(5) Loosen the exhaust manifold attaching bolts and nuts evenly over two or three stages in the sequence shown in the right figure.
(6) Remove the exhaust manifold from the cylinder head while preventing the interference with other parts.


JEM00106-00093

16. Remove the ignition coil and resistive cords from the cylinder head cover.

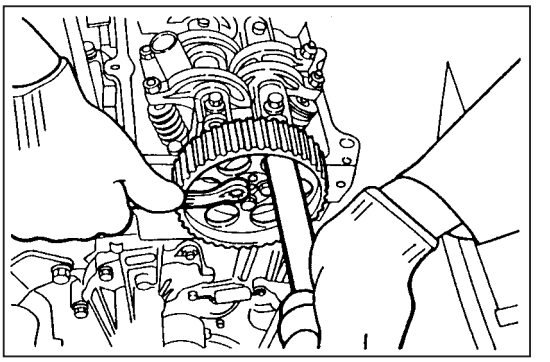

JEM00107-00094

17. Loosen the cylinder head cover attaching bolts evenly over two or three stages in the sequence shown in the right figure.
18. Remove the cylinder head cover.

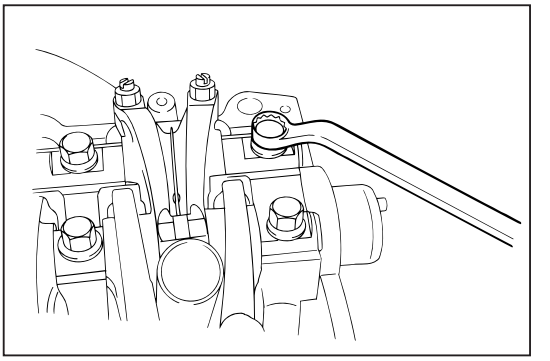


JEM00108-00095

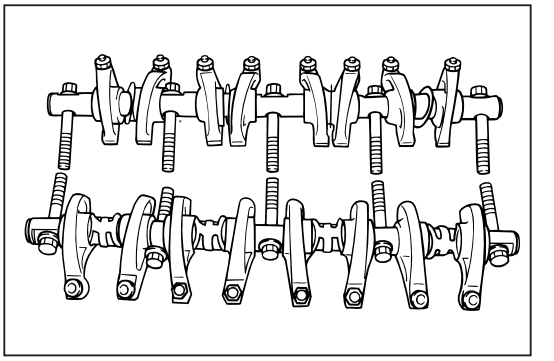
19. Remove the camshaft pulley and cam angle sensor.
CAUTION:
- Do not turn the camshaft independently.
- Do not damage the cylinder head cover gasket surface.


JEM00109-00096

20. Loosen the valve rocker shaft attaching bolts.
21. Remove the valve rocker shaft together with rocker arms from the cylinder head.

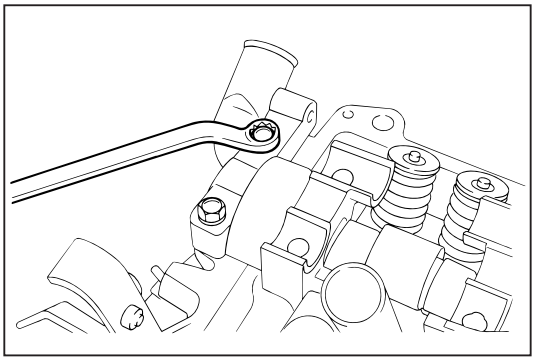

JEM00110-00097

22. Remove the rocker arms, spacers and wave washers from the removed valve rocker shaft.
    NOTE:
    - Arrange the removed parts in oder to so that their respective original installation positions may be known readily.



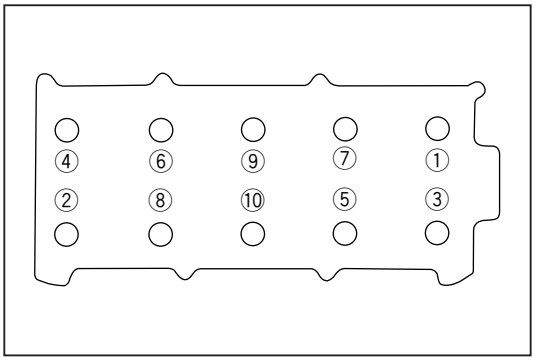
JEM00111-00098

23. Remove the camshaft bearing caps by removing the attaching bolts.
24. Remove the camshaft from the cylinder head.



JEM00112-00099

25. Loosen the cylinder head bolts evenly over two or three stages in the sequence shown in the right figure.
    NOTE:
    - Be certain to loosen the cylinder head bolts. Failure to observe this caution will cause cracks or distortion of the cylinder head, even leading to engine seizure.

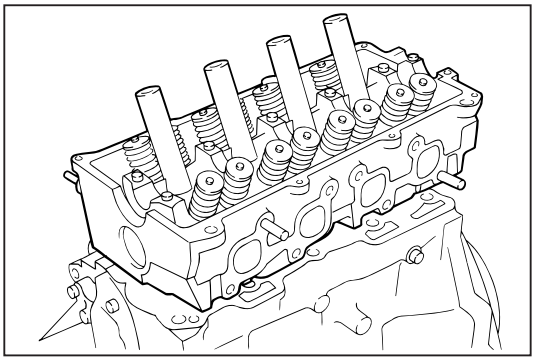


JEM00113-00100

26. Remove the cylinder head bolts.
    REFERENCE:
    - The bolts ① and ③ are shorter the other bolt
      Nominal Length of ① and ③: 110 mm
      Nominal Length of other Bolts: 155 mm

JEM00114-00000

27. Remove the cylinder head from the cylinder block.
    NOTE:
    - Place the cylinder head on two suitable wooden blocks in oder that the cylinder head gasket surface may not be damaged.

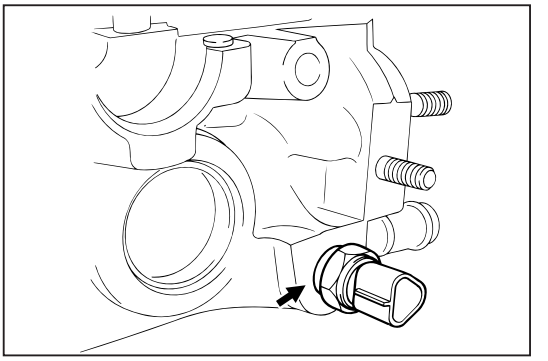


JEM00115-00101

OVERHAUL OF CYLINDER HEAD

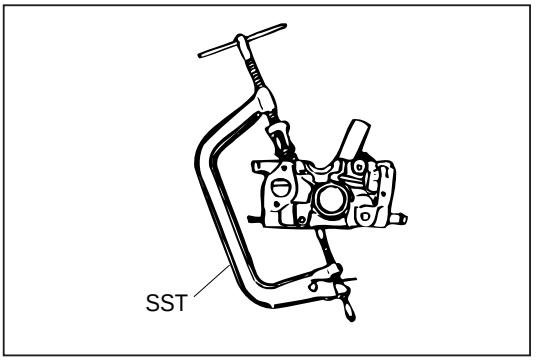
DISASSEMBLY OF CYLINDER HEAD

1. Remove the water temperature sensor gauge from the cylinder head.
2. Remove the engine hanger.



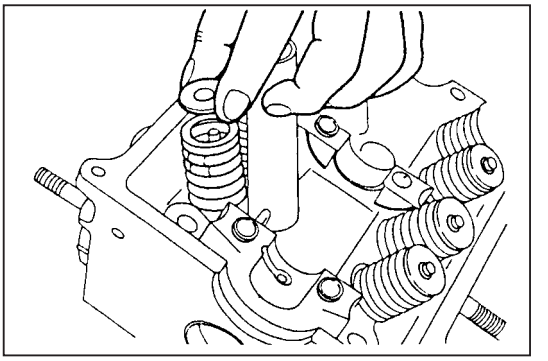
JEM00116-00102

3. Remove the valve spring retainer locks, using the following SST.
   SST: 09202-87002-000



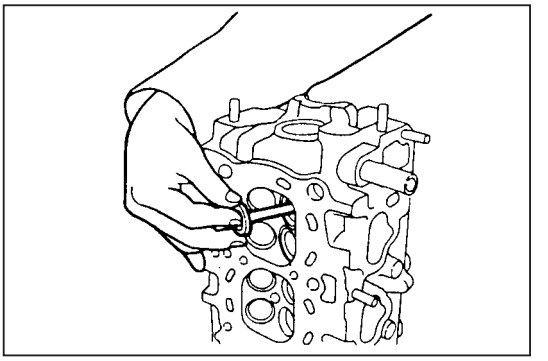
JEM00117-00103

4. Remove the valve springs.
   NOTE:
   - Arrange the removed parts in order so that their installing positions may be known easily.



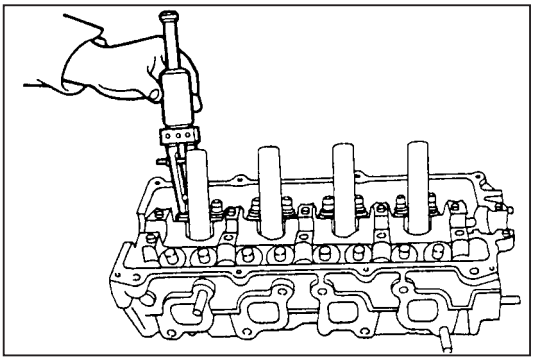
JEM00118-00104

5. Remove the valves.
   NOTE:
   - Arrange the removed parts in order so that their installing positions may be known easily.



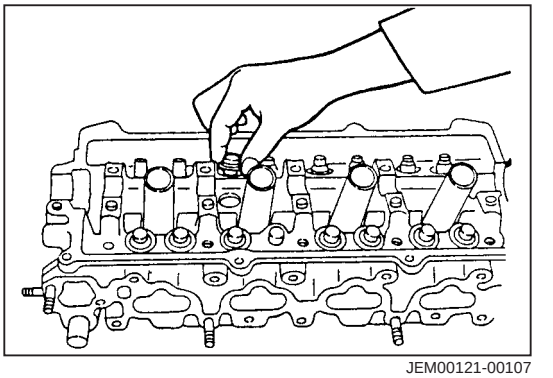
JEM00119-00105

6. Remove the valve stem oil seal by your hand or using the following SST.
   SST: 09201-87704-000

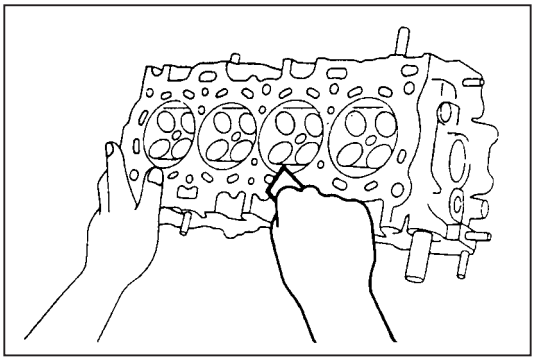


JEM00120-00106

7. Remove the valve spring seats.
   NOTE:
   - Arrange the removed parts in order so that their installing positions may be known easily.

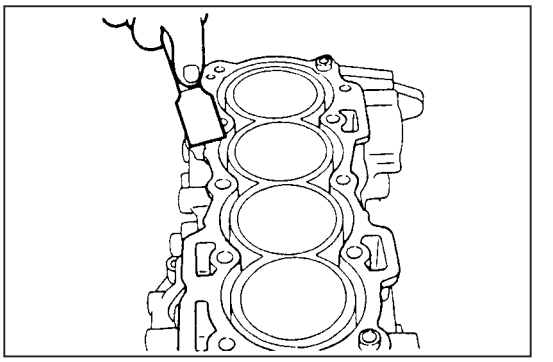

JEM00121-00107

8. Wash the disassembled parts except for electrical parts, plastic parts and grease sealed bearings. Dry them by blowing compressed air.


JEM00122-00108

INSPECTION, CLEANING AND REPAIRS OF CYLINDER HEAD COMPONENTS

1. Cleaning of top of each piston and cylinder block
   (1) Turn the crankshaft until each piston is brought to the top dead center.
   Using a gasket scraper, remove all carbon deposits from the piston tops.
   (2) Using a gasket scraper, remove any remaining gasket material from the top of the cylinder block.
   Blow carbon deposits, water and oil from the bolt holes.

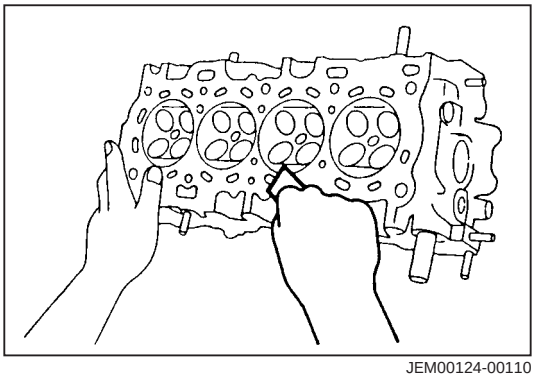

JEM00123-00109

   WARNING:
   - Protect your eyes during the cleaning operation using compressed air.

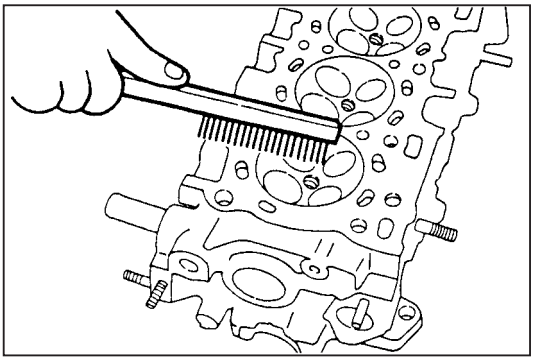
   CAUTION:
   - Do not scratch the gasket surfaces of the piston and cylinder block.

   (3) Set the piston No. 1 to the top dead center.

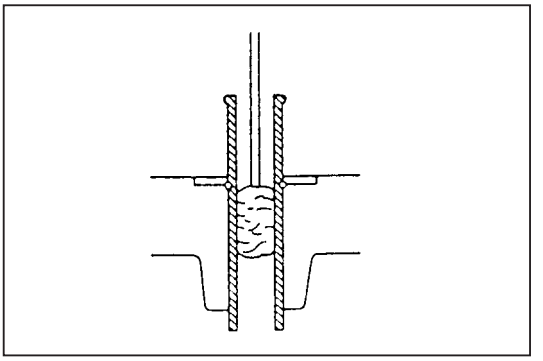
2. Removal of gasket material
   Using a gasket scraper, remove any remaining gasket material from the cylinder head and manifold surfaces.


JEM00124-00110

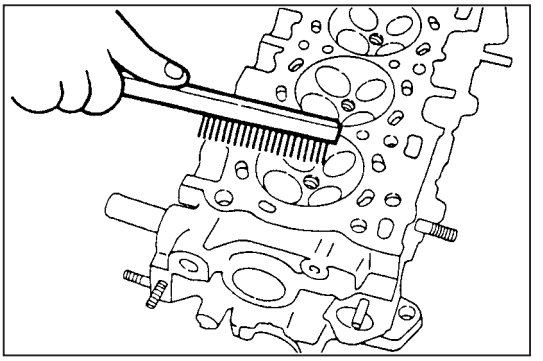
3. Cleaning of combustion chamber
   Using a wire brush, remove all carbon deposits from the combustion chambers.
   CAUTION:
   - Be careful not to scratch the cylinder head gasket contact surfaces.


JEM00125-00111

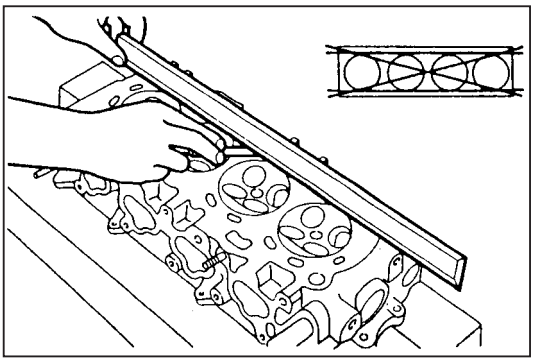
4. Cleaning of valve guide bushings
   Using a valve guide brush and solvent, clean all the valve guide bushings.


JEM00126-00112

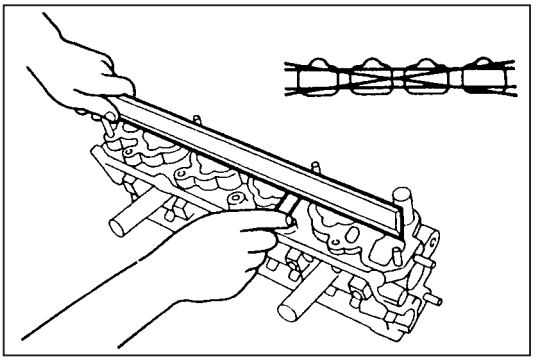
5. Cleaning of cylinder head
   Using a soft brush and solvent, thoroughly clean the cylinder head.

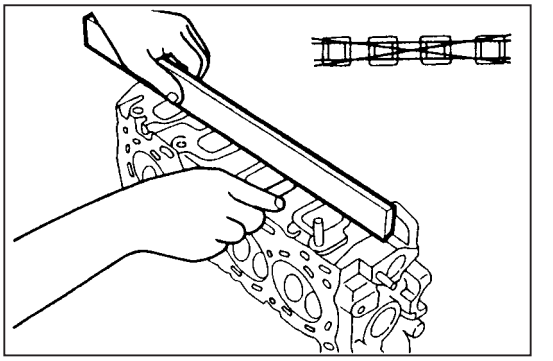

JEM00127-00113

6. Inspection of cylinder head for flatness
   Using a precision straight edge and a feeler gauge, check the gasket surfaces contacting the cylinder block and manifolds for warpage.
   Maximum Surface Warpage
   Cylinder Block Side: 0.10 mm
   Intake Manifold Side: 0.10 mm
   Exhaust Manifold Side: 0.10 mm


JEM00128-00114

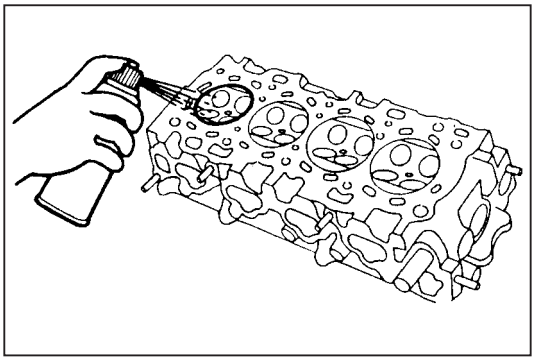
   If surface warpage of the cylinder block side exceeds the maximum limit, replace the cylinder head.


JEM00129-00115



JEM00000-00116

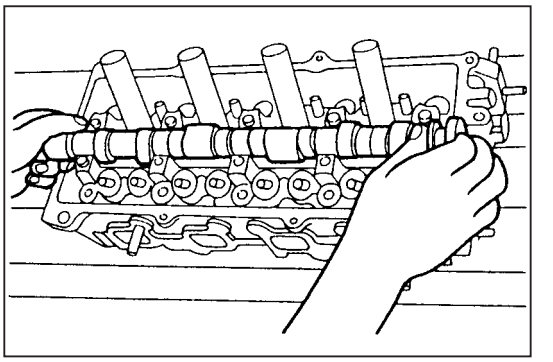
7. Inspection of cylinder head for cracks
   Using a dye penetrant, check the combustion chamber, intake and exhaust ports, cylinder head surface and top of the cylinder head for cracks.
   If a crack is found, replace the cylinder head.



JEM00130-00117

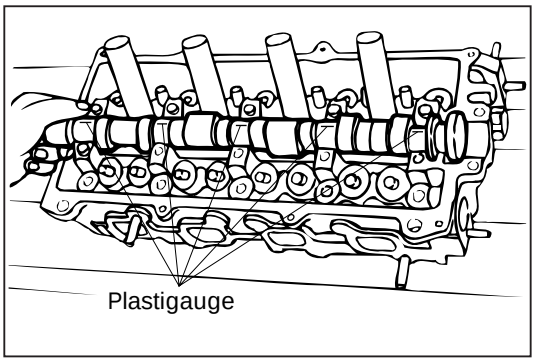
8. Inspection of camshaft oil clearance
   NOTE:
   - Prior to this oil clearance check, the camshaft should be checked for bend in advance.

   (1) Install the camshaft to the cylinder head.



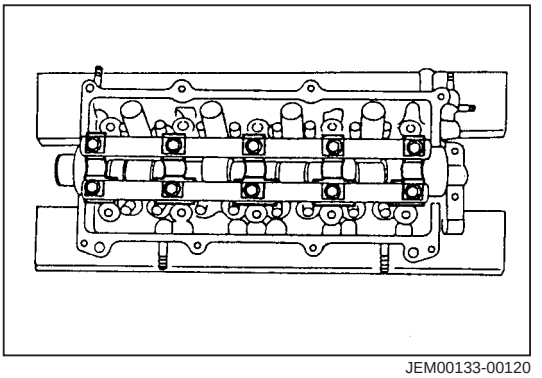
JEM00131-00118

   (2) Place a plastigage on each bearing.



JEM00132-00119

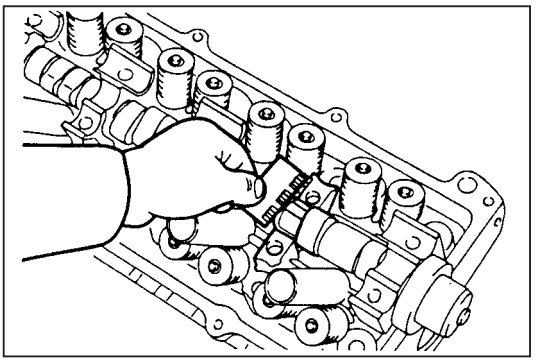
(3) Install the bearing caps and rocker shafts. Tighten them to the specified torque.
Tightening Torque
M10 Bolt: 28.4 - 36.3 N·m/Dry
M8 Bolt: 12.7 - 16.7 N·m/Dry


JEM00133-00120

NOTE:
- Each bearing cap bears a cap number.
- The intake valve rocker shaft can be identified by the recessed sections on it.
- The valve rocker shaft should be installed in such a direction that the side having a wider chamfer comes at the timing belt side.
- Ensure that the bolt holes and bolts are dry when tightening the bolts. (Ensure that no oil or the like gets to the bolt holes and bolts.)

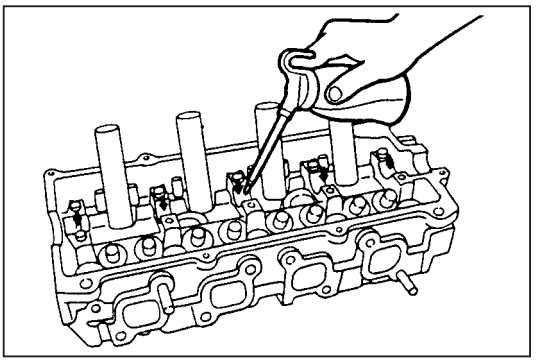
(4) Remove the bearing caps and measure the oil clearance.
Clearance
Specified Value: 0.035 - 0.076 mm
Allowable Limit: 0.17 mm

If the oil clearance exceeds the allowable limit, replace the cylinder head and camshaft as a set.

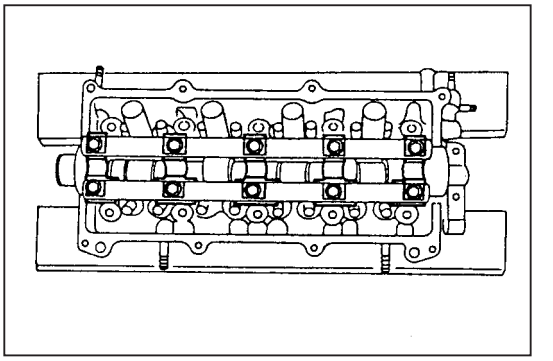

JEM00134-00121

NOTE:
- After completion of the check, remove the plastigages. Wash the camshaft and bearing caps in cleaning solvent.

9. Inspection of camshaft thrust clearance
(1) Apply engine oil to the camshaft journals.


JEM00135-00122

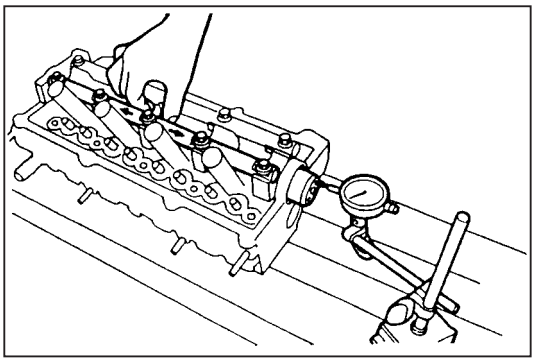
(2) Install the camshaft to the cylinder head. Install the bearing caps and rocker shafts and tighten them to the specified torque.
Tightening Torque
M10 Bolt: 28.4 - 36.3 N·m/Dry
M8 Bolt: 12.7 - 16.7 N·m /Dry


JEM00136-00123

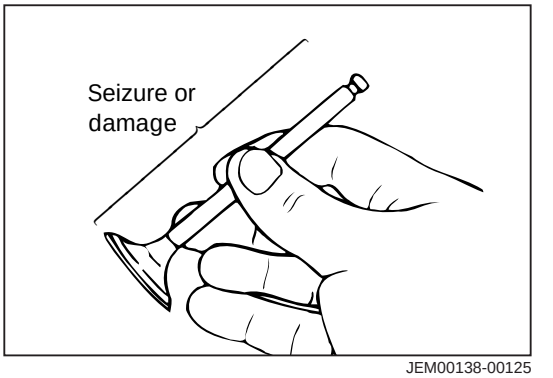
NOTE:
- Each bearing cap bears a cap number.
- The intake valve rocker shaft can be identified by the recessed sections on it.
- The valve rocker shaft should be installed in such a direction that the side having a wider chamfer comes at the timing belt side.
- Ensure that the bolt holes and bolts are dry when tightening the bolts. (Ensure that no oil or the like gets to the bolt holes and bolts.)

(3) With a dial gauge attached to the camshaft, measure the thrust clearance.
Thrust Clearance
Specified Value: 0.1 - 0.25 mm
Allowable Limit: 0.45 mm

If the camshaft thrust clearance exceeds the allowable limit, replace the camshaft and cylinder head as a set.
Reference:
Cylinder Head Thrust Surface Width:
4.10 - 4.20 mm
Camshaft Thrust Surface Width:
3.95 - 4.00 mm

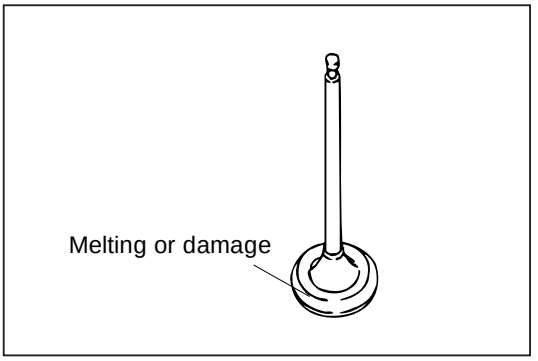

JEM00137-00124

10. Inspection and grinding of valves
(1) Visually inspect the valve stem for seizure or damage.
NOTE:
- If seizure or damage is found, replace the valve and valve guide bush as a set.
- However, this replacement should be performed only after the checks for the valve seat, valve stem and guide bush have been finished.
- The valve guide bush hole must be used for refacing the valve seat. Hence, if the valve guide bush hole exhibits any roughness due to seizure, etc., rectify the hole with an adjustable reamer.



JEM00138-00125

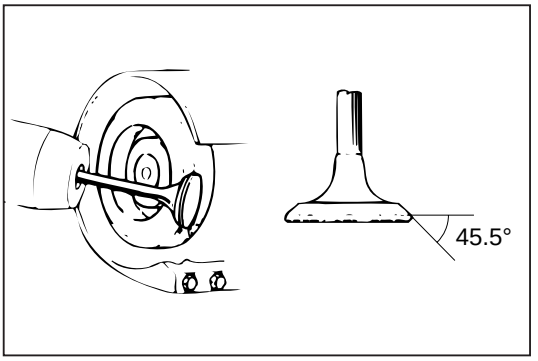
(2) Visually inspect the valve head for melting or damage.
If the valve head exhibits any melting or damage, replace the valve.
If the roughness on the contact surface can be corrected, grind the valve seat contact surface with a valve refacer.



JEM00139-00126

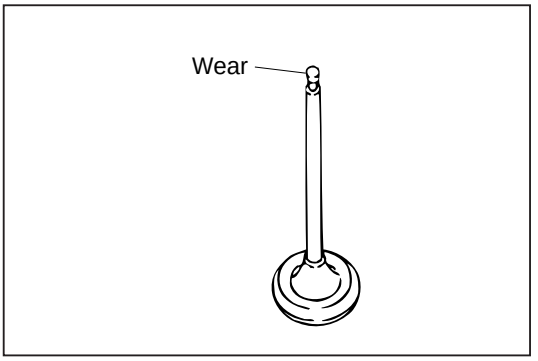
(3) Grind the valves only enough to obtain a smooth contact surface with the valve seat.
Valve Face Angle: 45.5°

NOTE:
- Make sure the valves are ground to the correct valve face angle.



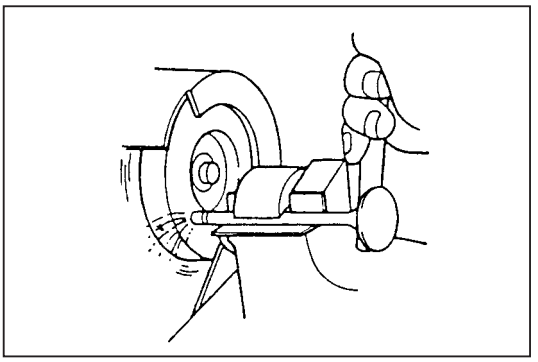
JEM00140-00127

(4) Visually inspect the valve stem end for abnormal wear.



JEM00141-00128

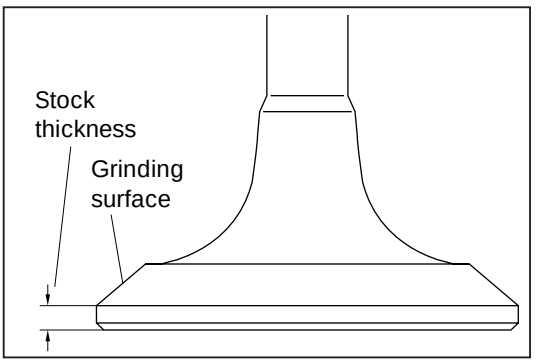
If the valve stem end exhibits abnormal wear, correct the stem end with a valve refacer. However, this correction should be made within a limit of 2 mm from that of standard length.
Reference:
Valve Length (STD)
Intake Valve: 112.8 mm
Exhaust Valve: 114.5 mm


JEM00142-00129

NOTE:
- Be very careful not to allow the valve to be overheated during grinding.

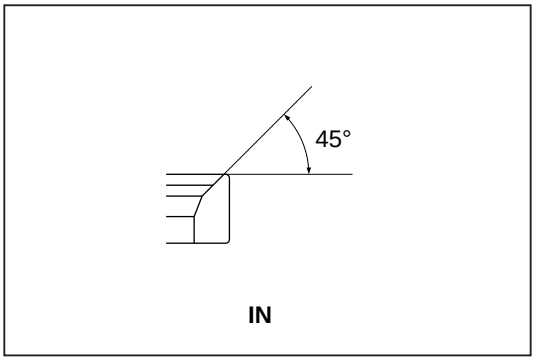
(5) Inspect the valve head for its stock thickness.
Minimum Stock Thickness
Intake Valve: 0.8 mm
Exhaust Valve: 1.0 mm

If the stock thickness of the valve head is less than the minimum stock thickness, replace it with a new one.



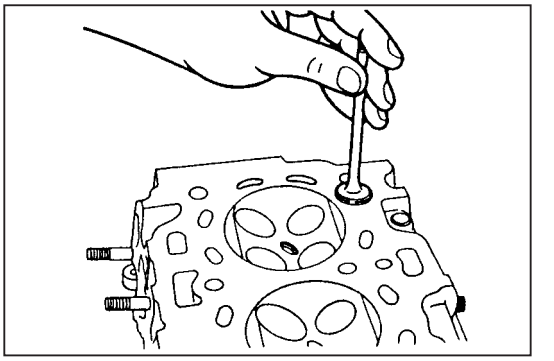
JEM00143-00130

11. Inspection and cleaning of valve seats
    (1) Using a 45-degree valve seat cutter, reface the valve seats. Remove only enough metal stock to clean the seats.
    (2) Apply a thin film of red lead (or white lead) to the valve seat.
    (3) Let the valve drop by its own weight onto the valve seat two or three times.
    (4) Take out the valve.



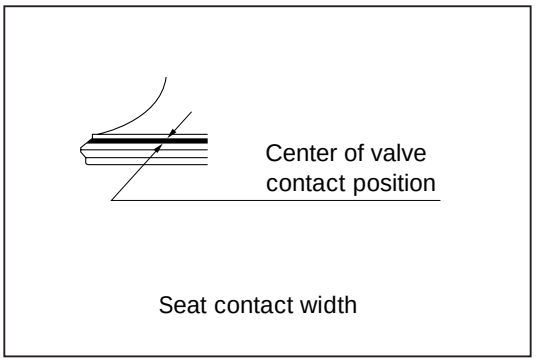
JEM00144-00131

    (5) Inspect the valve face and seat for the following items.
        ① Ensure that the valve seat contact surface of the valve is continuous over the whole circumference. If not, replace the valve.
        ② Ensure that the valve contact surface of the valve seat is continuous over the whole circumference. If not, reface the valve seat.


JEM00145-00132

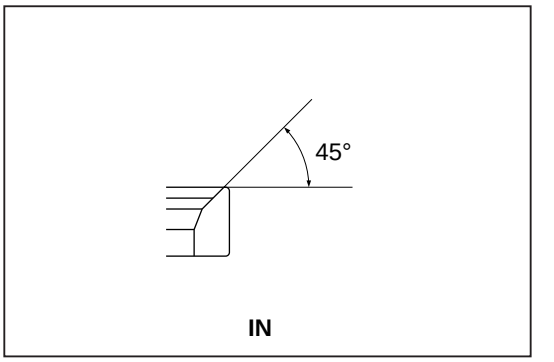
        ③ Measure the width of the contact surface of valve seat.
        Contact Surface of Valve Seat: 1.2 - 1.6 mm

        If not, reface the valve seat.



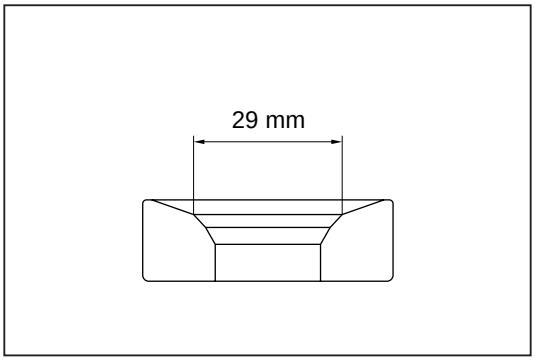
JEM00146-00133

12. Refacing of valve seat
    (1) Refacing procedure for intake valve seats
        ① Using a 45-degree cutter, recondition the roughness on the valve-to-valve seat contact surface, only enough to obtain a smooth surface.



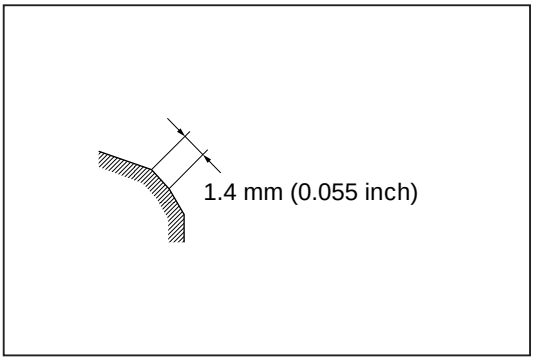
JEM00147-00134

        ② Using a 30-degree cutter, cut the valve seat in such way that the circumference of the surface refaced by the 45-degree cutter may become 29 ± 0.1 mm



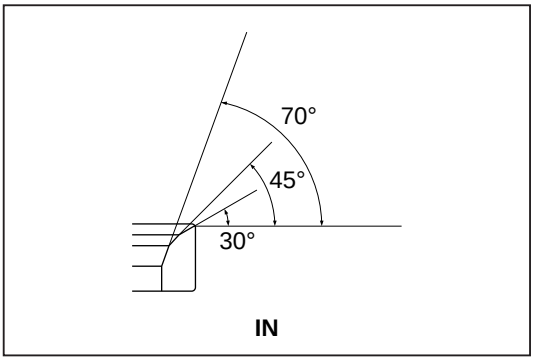
JEM00148-00135

③ Using a 70-degree cutter, cut the seat in such way that the width, of the surface refaced by the 45-degree cutter may became 1.4 mm.



JEM00149-00136

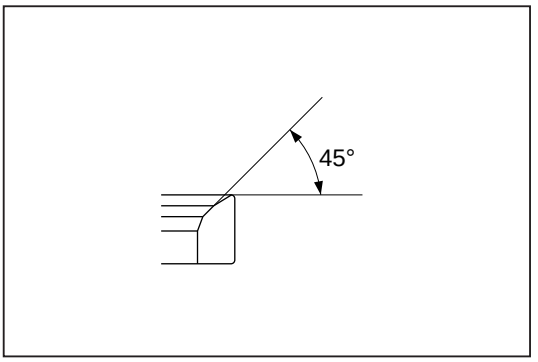
④ Using the 45-degree cutter, remove burrs produced during the refacing by the 30-degree and 70-degree cutters.



JEM00150-00137

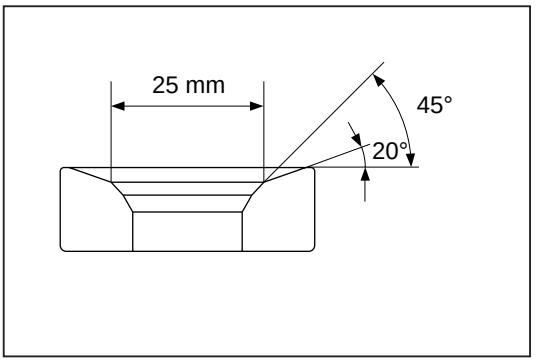
(2) Refacing procedure for exhaust valve seats

① Using a 45-degree cutter, recondition the roughness on the valve-to-valve seat contact surface, only enough to obtain a smooth surface.



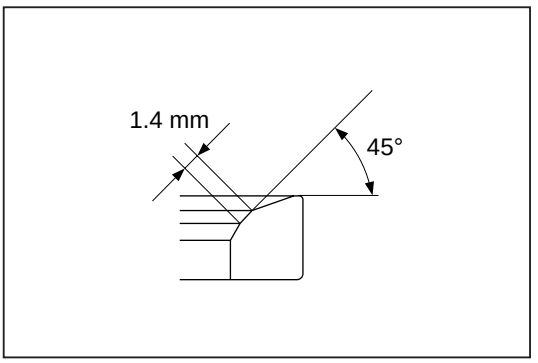
JEM00151-00138

② Using a 20-degree cutter, cut the valve seat in such a way that the circumference of the surface refaced by the 45-degree cutter may become 25 mm.



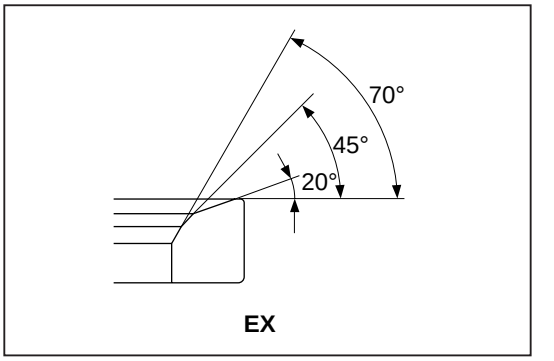
JEM00152-00139

③ Using a 70-degree cutter, cut the valve seat in such a way that the width of the surface refaced by the 45-degree cutter may become 1.4 mm.



JEM00153-00140

④ Using the 45-degree cutter, remove burrs produced during the refacing by the 20-degree and 70-degree cutters.

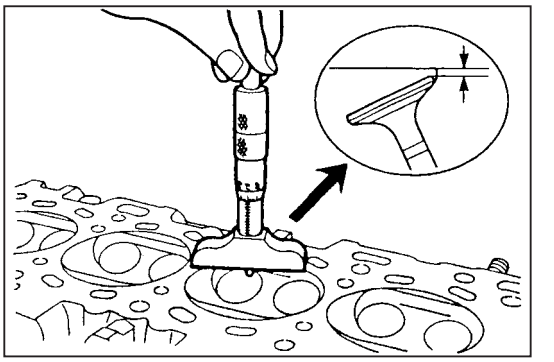


JEM00154-00141

13. Hand lapping of valves
    (1) Perform hand lapping of the valves and valve seats, using an abrasive compound.
    (2) Clean the valves and valve seats after the hand lapping of the valves.

JEM00155-00000

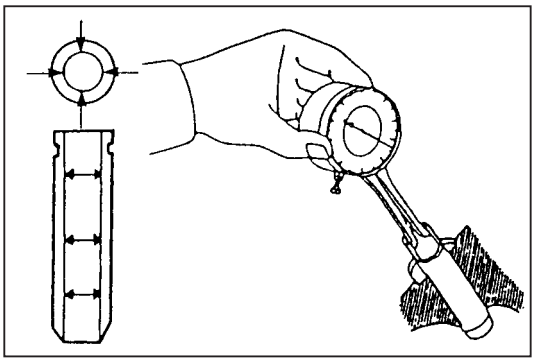
14. Inspection of valve recession
    After the valve seat has been refaced, install the new valve. Measure the distance between the cylinder attaching surface of the cylinder head (attaching surface of the cylinder head gasket) and the upper most section of the valve. Ensure that the distance does not exceed the following maximum limit.
    Maximum Limit
    Intake Valve: 2.775 mm
    Exhaust Valve: 6.026 mm



JEM00156-00142

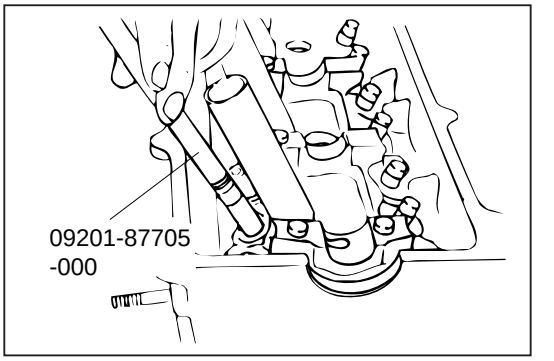
    If the recession exceeds the maximum limit, replace the cylinder head.

15. Inspection of valve stem-to-guide bushing oil clearance
    (1) Using a caliper gauge, measure the inner diameter of the valve guide at six points.
    Record the measured values.



JEM00157-00143

    ① Drive a new valve guide bush into position, until the snap ring contacts the cylinder head, using the following SST.
    SST: 09201-87705-000



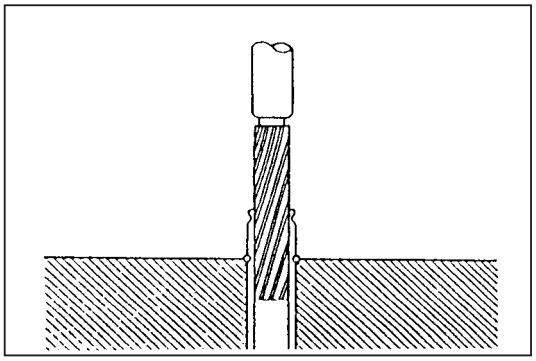
JEM00158-00144

    CAUTION:
    - Be very careful not to give an excessive impact during the installation. Failure to observe this caution will result in valve guide bush cracks.
    - Care should be exercised not to detach the snap ring due to driving the valve guide bush excessively.

② Using an adjustable reamer, ream the valve guide bush to remove any burr or the like.

NOTE:

- This reaming should be made only enough to remove the burr or the like.



JEM00159-00145

③ Inspection of oil clearance
Ensure that the oil clearance meets the specifications.

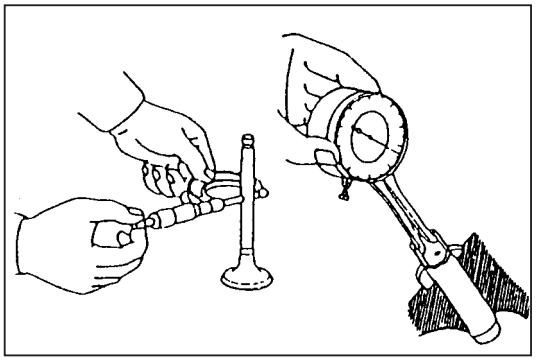
Oil Clearance

Specified Value:

Intake 0.030 - 0.055 mm

Allowable Limit:

Intake 0.08 mm

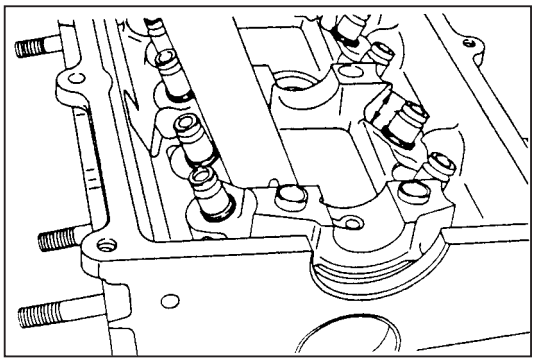


JEM00160-00146

(2) Exhaust valve guide bush

NOTE:

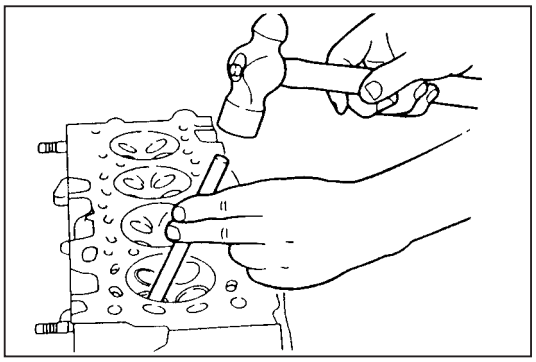
- When the locating ring for the valve guide bush is located 14 mm from the upper end of the valve guide bush, replace the cylinder head.



JEM00161-00147

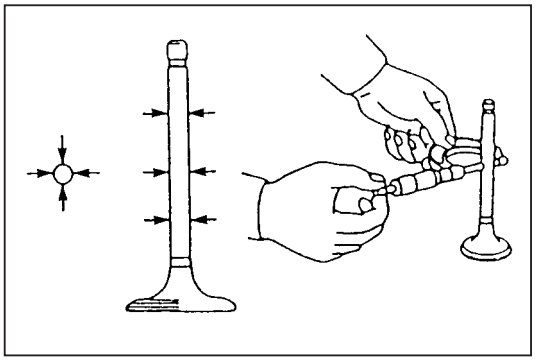
① Drive out the valve guide bush from the combustion chamber side, using the following SST.

SST: 09201-87705-000



JEM00162-00148

(3) Using a micrometer, measure the diameter of the valve stem at six points.
Record the measured values.



JEM00163-00149

(4) Calculation of oil clearance
Calculate the oil clearance of each valve according to the following formula.
Oil clearance = Inner diameter of valve stem guide – Outer diameter of valve stem
Specified Oil Clearance
Intake Valve Side: 0.030 - 0.055 mm
Exhaust Valve Side: 0.035 - 0.060 mm
Allowable Limit
Intake Valve Side: 0.080 mm
Exhaust Valve Side: 0.090 mm

If the calculated oil clearance exceeds the allowable limit, replace the valve guide bush and valve as a set.

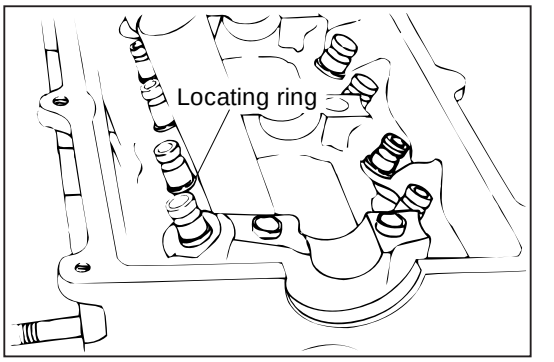
JEM00164-00000

16. Replacement of valve guide bush
CAUTION:
- Removal and installation of the valve guide bush should be carried out while the cylinder head temperature is 80°C - 100°C after heating it gradually.

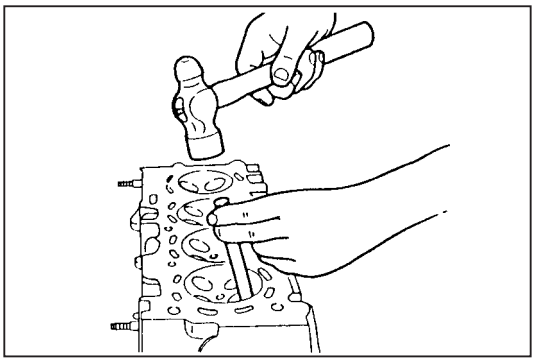
(1) Intake valve guide bush
NOTE:
- If the intake valve guide bush has been already installed with a locating ring, replace the cylinder head.

① Drive out the valve guide bush from the combustion chamber side, using the following SST.
SST: 09201-87705-000

NOTE:
- Be very careful not to tap the cylinder head.

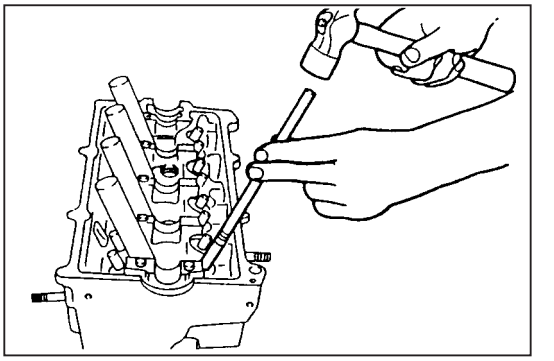


JEM00165-00150


JEM00166-00151

② Drive a new valve guide bush into position, until the snap ring contacts the cylinder head, using the following SST.
SST: 09201-87705-000

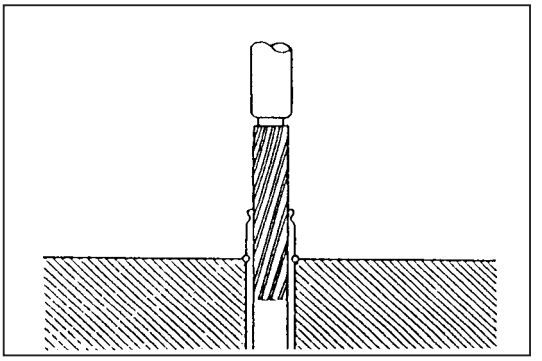
CAUTION:
- Be very careful not to give an excessive impact during the installation. Failure to observe this caution will result in valve guide bush cracks.
- Care should be exercised not to detach the snap ring due to driving the valve guide bush excessively.


JEM00167-00152

③ Using an adjustable reamer, ream the valve guide bush to remove any burr or the like.

NOTE:

- This reaming should be made only enough to remove the burr or the like.



JEM00168-00153

④ Inspection of oil clearance

Ensure that the oil clearance meets the specifications.

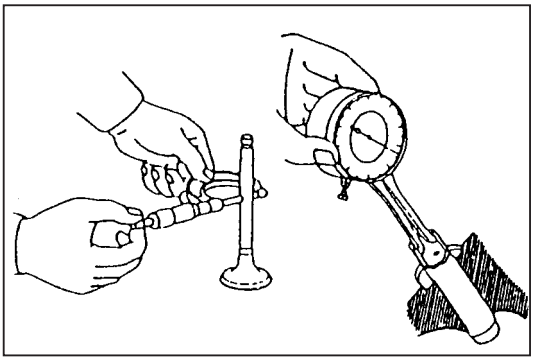
Oil Clearance

Specified Value:

Exhaust 0.035 - 0.060 mm

Allowable Limit:

Exhaust 0.09 mm



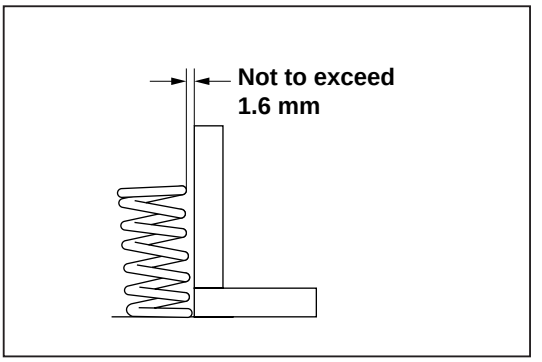
JEM00169-00154

17. Inspection of valve springs

(1) Check the valve spring for squareness, using a steel square.

Maximum Squareness: 1.6 mm

If the squareness exceeds the maximum limit, replace the valve spring.



JEM00170-00155

(2) Measure the valve spring for free length and spring tension, using a spring tester.

Minimum Free Length

Pink Marked Spring: 43.9 mm

Orange Marked Spring: 46.1 mm

Minimum Tension/Installation Height

Pink Marked Spring: 244.9 N/38.0 mm

Orange Marked Spring: 208.9 N/38 mm

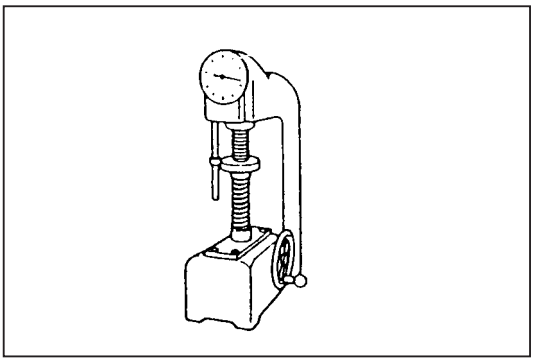
If the minimum free length and/or minimum tension is less than the minimum limit, replace the valve spring.

Reference:

Standard Free Length

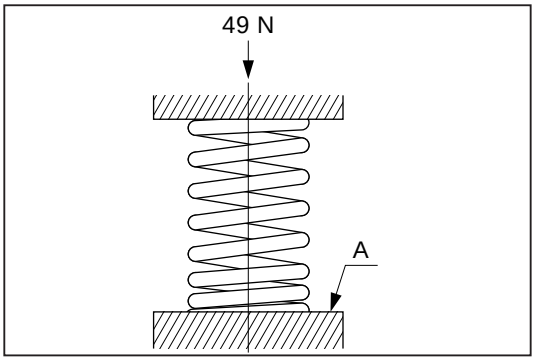
Pink Marked Spring: 45.2 ± 0.5 mm

Orange Marked Spring: About 47.4 mm



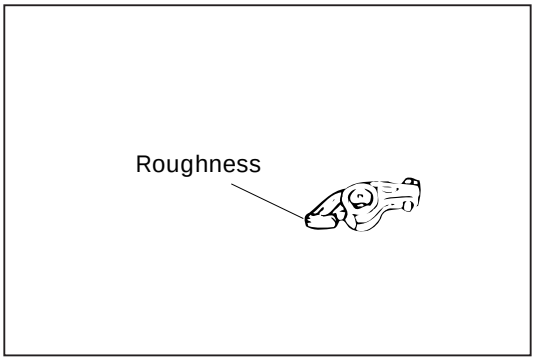
JEM00171-00156

(3) Check of valve spring edge surface for levelness
① Apply a load of 49 N to the valve spring on a spring tester.
② Under the condition ① above, insert a thickness gauge at the arrowheaded point “A” at the right figure.
Here, the thickness gauge should measure 0.07 mm in thickness and 12.5 mm in width. Ensure that the tip-end of the thickness gauge will not reach the center of the coil spring.
If the tip-end of the thickness gauge reaches the center of the coil spring, replace the coil spring with a new part.



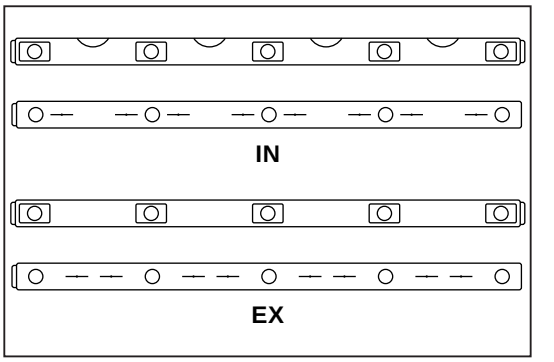
JEM00172-00157

18. Inspection of valve rocker arms and valve rocker shaft
(1) Visually inspect the valve rocker arm for cracks, seizure or wear.
Replace the valve rocker arm, if necessary.
(2) If the valve rocker arm-to-cam contact surface is worn excessively, replace the rocker arm.



JEM00173-00158

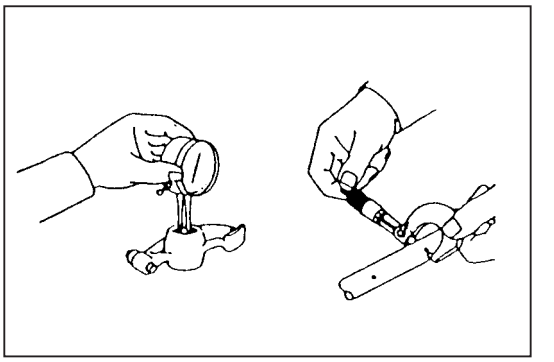
(3) Visually inspect the valve rocker shaft for cracks, seizure or wear.
Replace the valve rocker shaft, if necessary.



JEM00174-00159

(4) Valve rocker shaft-to-valve rocker arm
- Using a dial gauge, measure the inner diameter of the valve rocker arm in two directions, 90 degrees apart from each other.
- Using a micrometer, measure the outer diameter of the valve rocker arm attaching position of the valve rocker shaft in two directions, 90 degrees apart from each other.
- Calculate the oil clearance by subtracting the rocker shaft diameter from the rocker arm diameter.

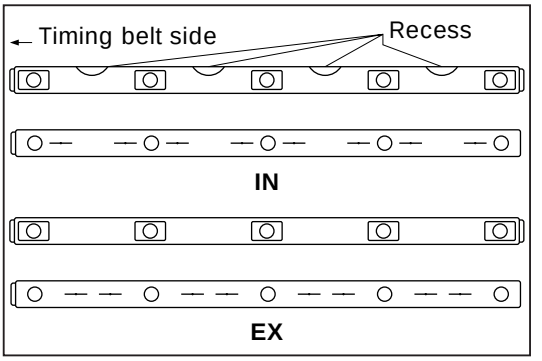
Oil Clearance
Specified Value: 0.012 - 0.053 mm
Allowable Limit: 0.08 mm


JEM00175-00160

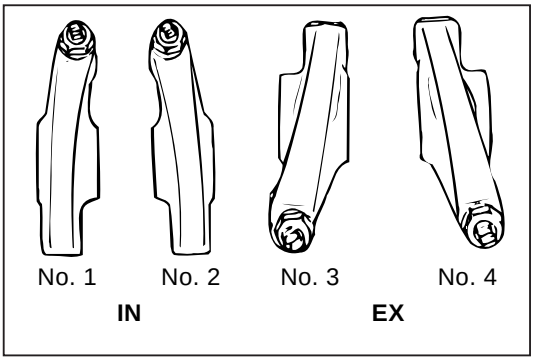
NOTE:
- The measurement of the rocker shaft outer diameter must be performed at the assembling position of each rocker shaft.

Reference:

- Identification of valve rocker shafts
- On the intake valve rocker shaft, recesses for the spark plug tube are provided.
- Also, the oil grooves are provided very closely to the bolt holes.
- On the exhaust valve rocker shaft, the oil grooves are located near the midpoint of the bolt holes.
- Installing direction of valve rocker shaft
  The valve rocker shaft should be installed in such a way that the side having a wider chamfer comes at the timing belt side.
- Identification of valve rocker arm
  The valve rocker arm comes in four kinds; two kinds each for the intake side and exhaust side, as shown in the right figure.
- Specified dimensions of valve rocker shaft and valve rocker arm
  Outer Diameter of Valve Rocker Shaft:
  19.468 - 19.488 mm
  Bore Diameter of Valve Rocker Arm:
  19.500 - 19.521 mm



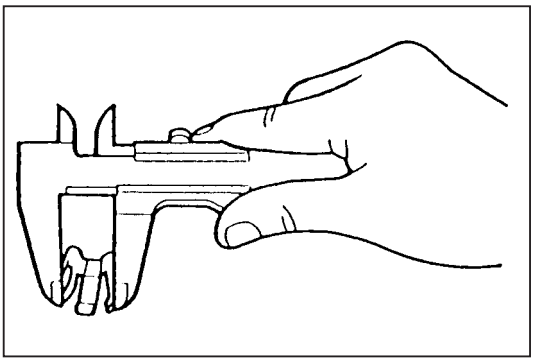
JEM00176-00161



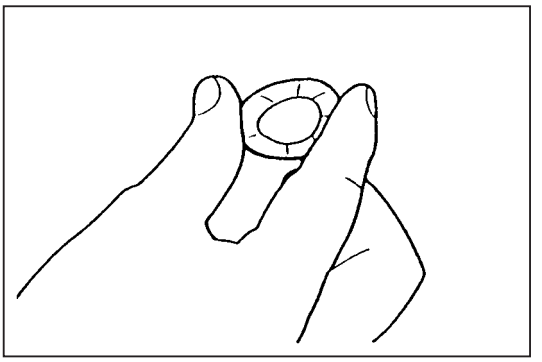
JEM00177-00162

19. Inspection of valve rocker arm, spacer and wave washer
    (1) Measure the free width of the spacer, using vernier calipers.
    Minimum Free Width: 22.0 mm

    Replace the spacer whose free length is less than the minimum free width.

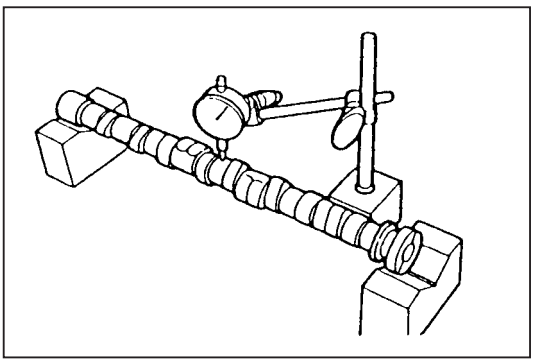

JEM00178-00163

    (2) Visually inspect the wave washer for flattened condition or damage.
    Replace the wave washer, if necessary.

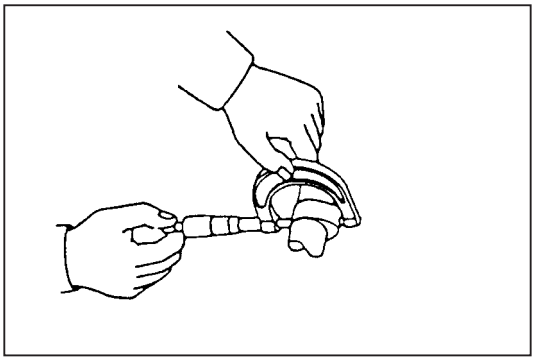

JEM00179-00164

20. Inspection of camshaft
    (1) Checking camshaft for runout
    Support the camshaft at its both ends with V-shaped blocks. Set a dial gauge to the mid-point of the center journal section of the camshaft. Turn the camshaft one turn, making sure that the camshaft will not move in the axial direction. Take a reading on the dial gauge during the turning. Calculate the maximum runout, i.e. the difference between the maximum and minimum readings.
    Maximum Runout: 0.03 mm

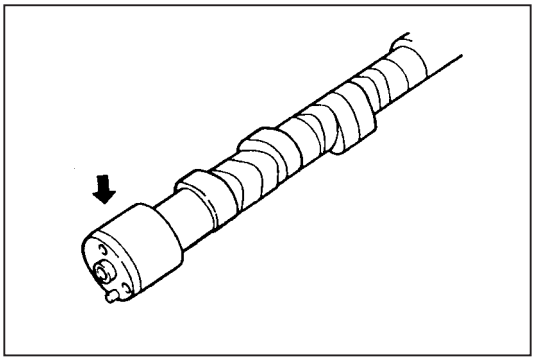
    If the runout exceeds the maximum limit, replace the camshaft.


JEM00180-00165

(2) Checking of cam lobe height
Measure the cam lobe height, using a micrometer.
Specified Cam Lobe Height:
Intake: 33.434 - 33.634 mm
Exhaust: 33.17 - 33.37 mm
Minimum Limit:
Intake: 33.2 mm
Exhaust: 33.0 mm

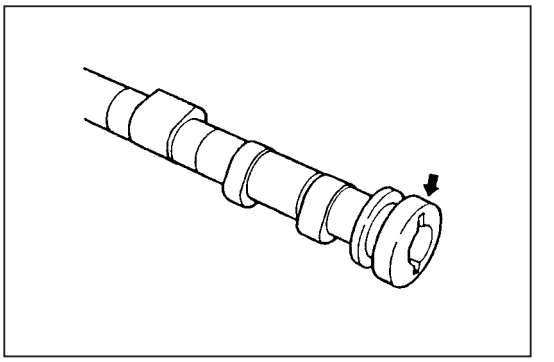

JEM00181-00166

(3) Inspection of oil seal contact surface
Inspect the oil seal contact surface for abnormal wear.
Replace the camshaft if the contact surface exhibits any abnormal wear.


JEM00182-00167

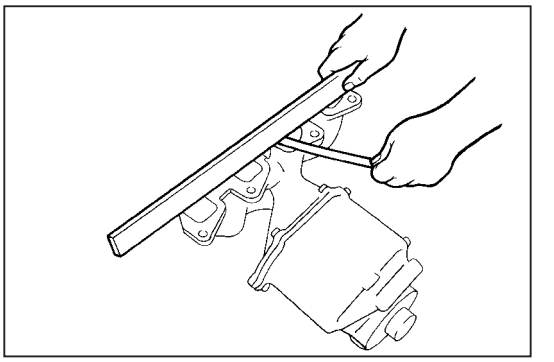
(4) Inspection of groove for driving cam angle sensor
Visually inspect to see if any damage is present at the groove for driving the cam angle sensor.
Replace the camshaft if the groove exhibits any damage.

NOTE:
- If any damage is present, check the cam angle sensor side, too.

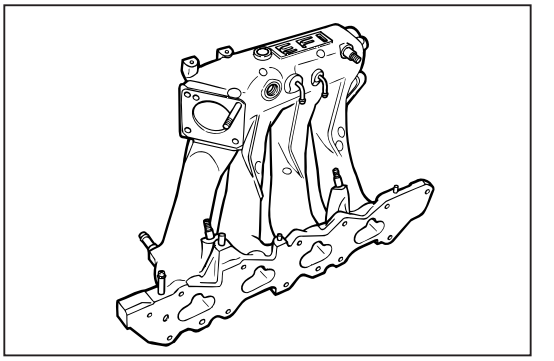

JEM00183-00168

21. Inspection of manifold and surge tank
(1) Check the cylinder head attaching surface of the exhaust manifold for warpage, using a straightedge and a thickness gauge.
Maximum Warpage Limit: 0.1 mm

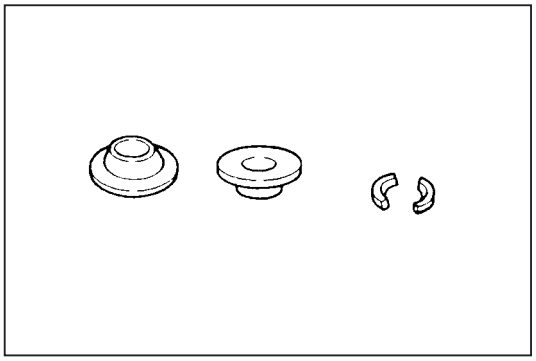
If the warpage exceeds the maximum limit, replace the exhaust manifold No. 1.


JEM00184-00169

(2) Check the contact surface of the intake manifold with the cylinder head.
Maximum Warpage: 0.1 mm


JEM00185-00170

22. Check the valve spring seats, valve spring retainers and valve retainer locks for damage and cracks.
If any damage is present, replace such faulty parts.

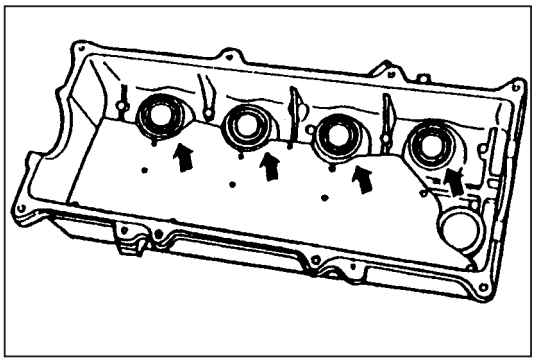


JEM00186-00171

23. Inspection of cylinder head cover
(1) Visually inspect the cylinder head cover gasket for damage.
If any damage is present, replace the cylinder head gasket with a new one.
Install the cylinder head gasket to the cylinder head cover in such a direction that the identification mark may face toward the intake manifold side.

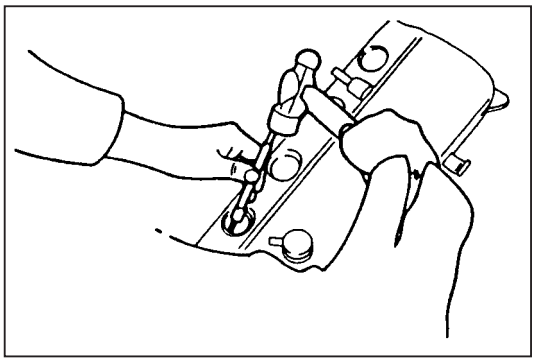
JEM00187-00000

(2) Visually inspect the rubber grommets of the spark plug tubes for damage.
Replace the rubber grommets, as required.



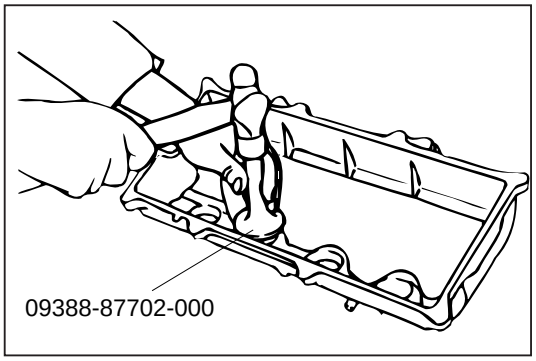
JEM00188-00172

Replacement of spark plug grommet
① Drive out the spark plug grommets, using the slotted pin puller.



JEM00189-00173

② Install a new spark plug grommet, using the following SST.
SST: 09268-87702-000



JEM00190-00174

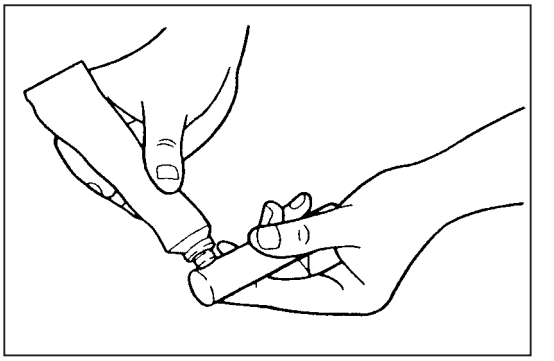
NOTE:
- Make sure that the grommet is not tilted when it is driven into position.
- Be sure to use a suitable wooden piece so as to prevent the cylinder head cover from damage.
- Be very careful not to damage the lip section of the grommet.

ASSEMBLY OF CYLINDER HEAD

NOTE:
- Thoroughly clean all parts to be assembled.
- Before installing the parts, apply new engine oil to all sliding and rotating surfaces.
- Replace all gaskets and oil seals with new ones.

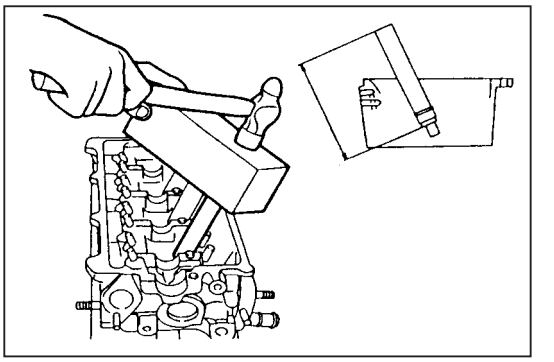
JEM00191-00000

1. Assembly of cylinder head (When a new cylinder head is installed:)
   When a new cylinder head is installed, spark plug tubes and a heater outlet tube have been furnished separately. Assemble these parts, following the procedure given below.
   (1) Wash the cylinder head in cleaning solvent and dry it with compressed air.
   (2) Apply a thin film of the Three Bond 1377B to the cylinder head attaching surfaces for the spark plug tubes.



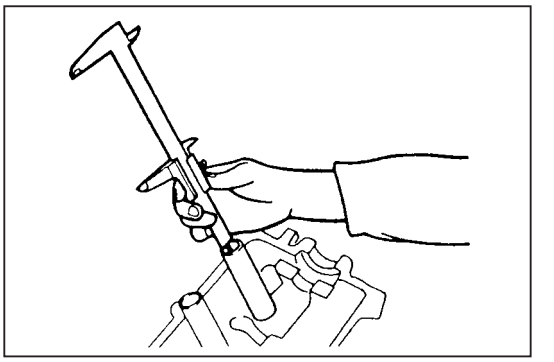
JEM00192-00176

   (3) With a wooden piece or the like placed on the upper end of the spark plug tube, drive the spark plug tube into the cylinder head in such an extent that the distance between the spark plug tightening surface and the upper end of the spark plug tube becomes 139 mm.



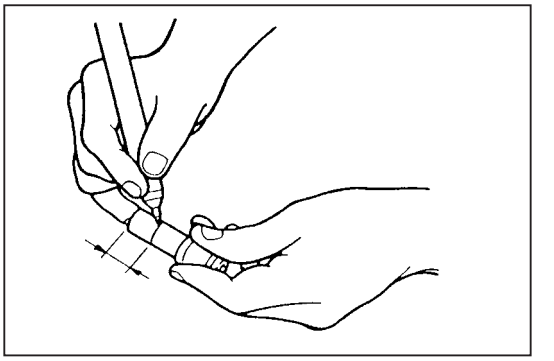
JEM00193-00177

   NOTE:
   - Be very careful not to drive the spark plug too deeply.
   - Be very careful not to damage the upper end of the spark plug tube.
   - When driving the spark plug tube into position, make sure that the tube will not tilt in relation to the cylinder head tube hole.



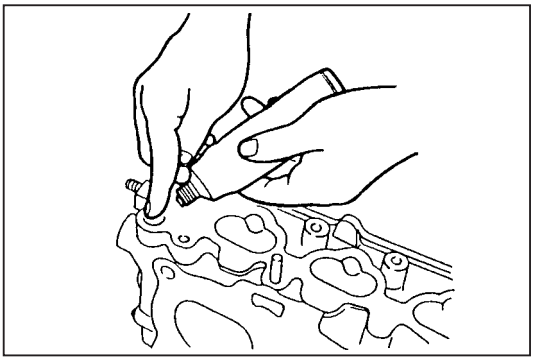
JEM00194-00178

   (4) Put a mark at a point 45.0 ± 1.0 mm from the forward end of the heater outlet tube.



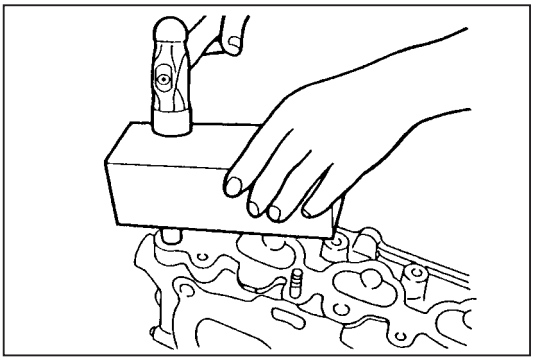
JEM00195-00179

(5) Apply a thin film of the Three Bond 1377B to the attaching section for the heater outlet tube on the cylinder head.



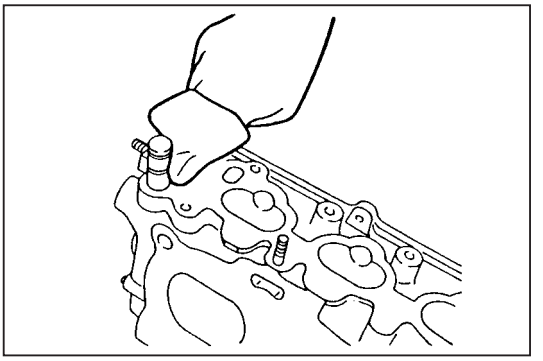
JEM00196-00180

(6) With a wooden piece interposed, drive the heater outlet tube to the point marked in Step (4).



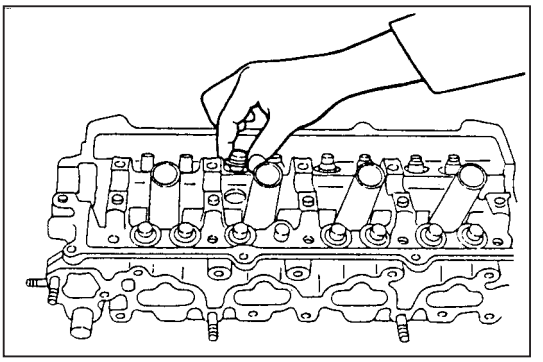
JEM00197-00181

(7) After completion of the operation, remove any oozed bond, wooden chips and so forth.



JEM00198-00182

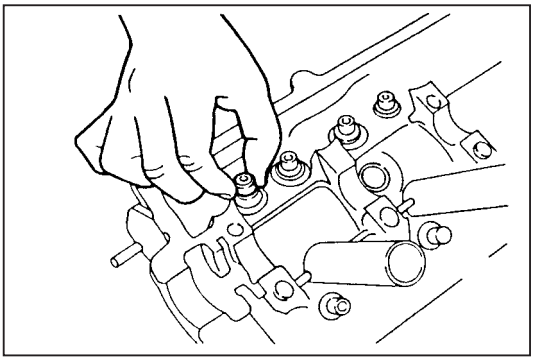
2. Install the valve spring seats to the cylinder head.



JEM00199-00183

3. Installation of valve stem oil seal
   (1) Apply engine oil to the bore of the valve stem oil seal.
   (2) Drive the valve stem oil seal into the valve stem guide bush by hand.

   NOTE:
   - When driving the oil seat, make sure that the oil seal is not tilted.
   - Do not reuse any oil seal which was tilted or driven diagonally.
   - Hold the frame of the oil seal. Do not touch the rubber section of the oil seal.

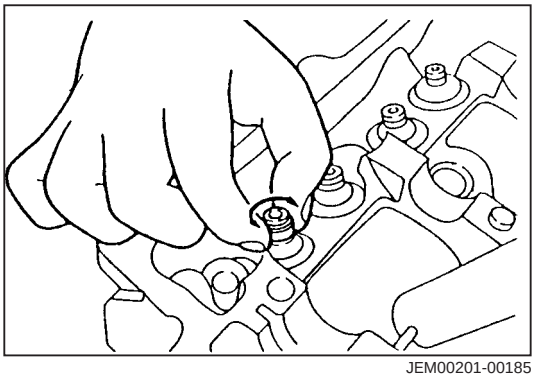


JEM00200-00184

(3) Turn the oil seal slightly by hand to see if it can be turned.

NOTE:

- Never rotate the oil seal more than one turn, because excessive turning may cause scratches on the oil seal.
- If the oil seal can not be turned by hand, it means that the oil seal has been tilted, driven diagonally or press-fitted improperly.
- Do not reuse any oil seal which was tilted or driven diagonally.



JEM00201-00185

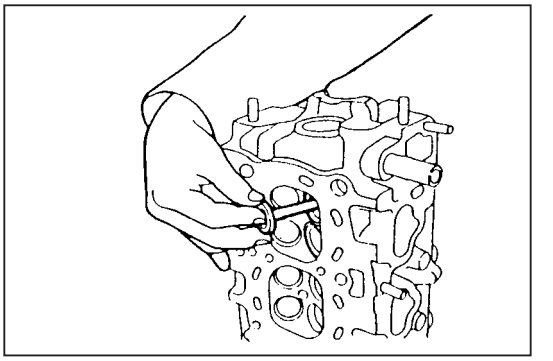
4. Apply oil to the valve stem. Install the valve to the cylinder head.

NOTE:

- Care must be exercised as to the installing position. Do not pull out the valve once it has been inserted.
- If the inserted valve should be pulled out, replace the valve stem oil seal with a new one.

Reference:
Identification of Valves

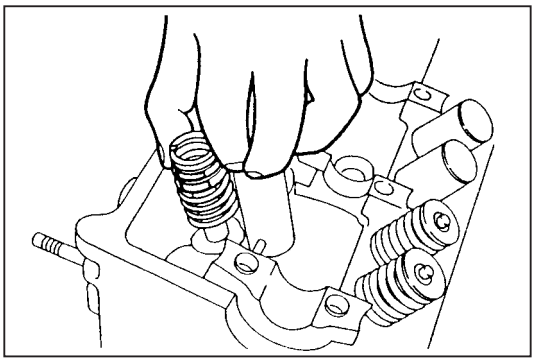
Engine	Identification No.
HC-EJ	④



JEM00202-00186

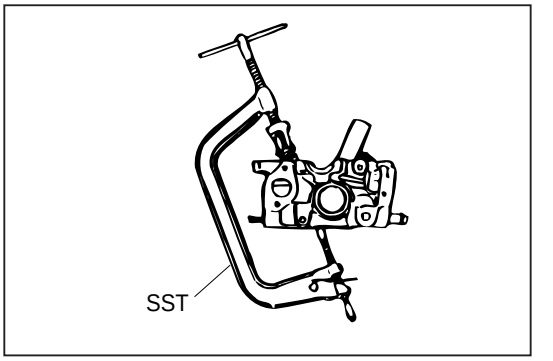
5. Assembly of valve springs, valve spring retainers and valve spring retainer locks

(1) Assemble the valve spring in such a way that the painted side (the side having a larger pitch) comes at the valve spring retainer.



JEM00203-00187

(2) Install the valve spring retainer to the valve spring. Install the valve spring retainer locks while compressing the valve spring retainer, using the following SST.
SST: 09202-87002-000

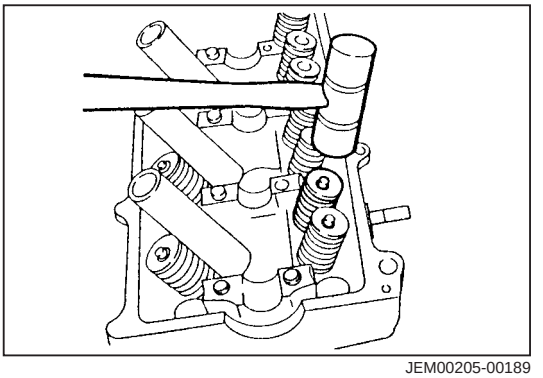


JEM00204-00188

(3) After installing the valve spring retainer lock, lightly tap the valve spring retainer with a hammer or the like so as to ensure that the valve spring retainer locks are installed securely.

WARNING:

- During this operation, care must be exercised to ensure that the valve spring retainer or retainer locks may not be jumped out.
- Protect your eyes with safety goggles during this operation.

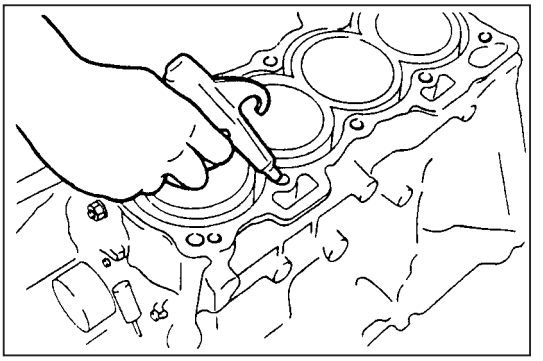


JEM00205-00189

6. Clean and dry the cylinder block head bolt holes.

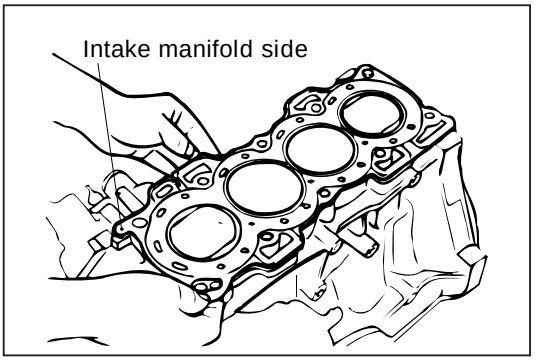
WARNING:

- Protect your eyes with goggles when using compressed air.



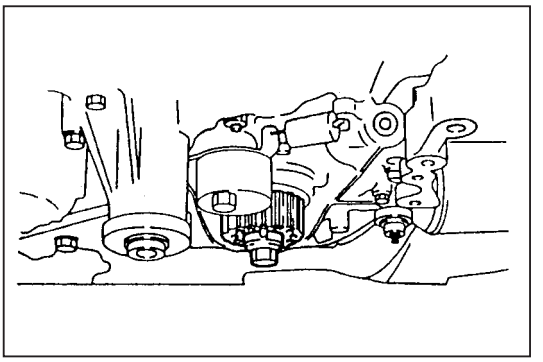
JEM00206-00190

7. Clean the cylinder block upper gasket surface. Install the cylinder head gasket, while aligning it with the pin ring for locating use.



JEM00207-00191

8. Turn the crankshaft so that the crankshaft key groove may come at the top position.



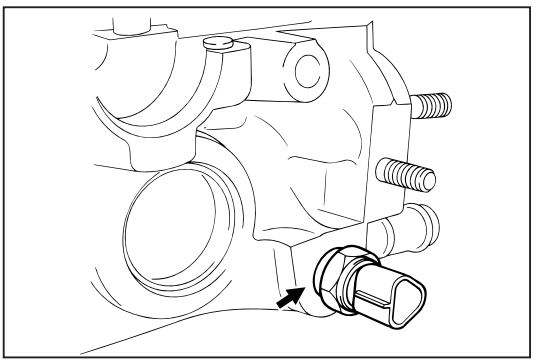
JEM00208-00192

9. Clean the threaded portion of the water temperature sensor. Wind seal tape around the threaded portion and install the sensor to the cylinder head.

Tightening Torque: 24.5 - 34.3 N·m

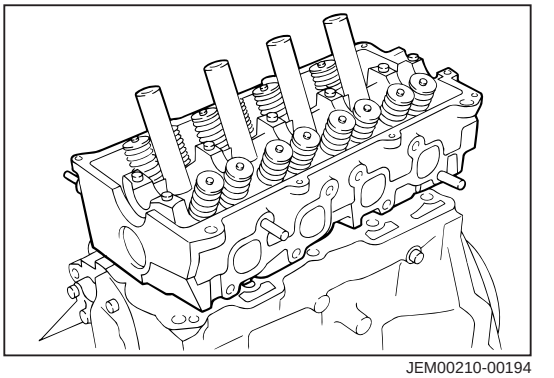
NOTE:

- The new water temperature sensor is coated with sealer. Therefore, if the sensor is replaced with a new one, remove the sealer thoroughly before winding seal tape. Moreover, be sure to clean the cylinder head side threaded holes.



JEM00209-00193

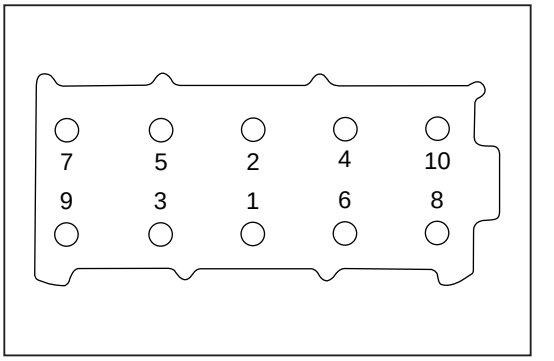
10. Install the cylinder head on the cylinder block.



JEM00210-00194

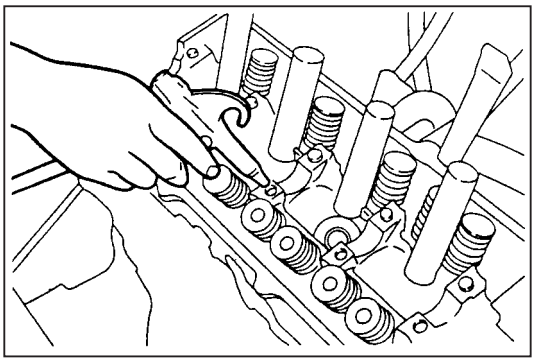
11. Coat each cylinder head bolt with a thin film of engine oil. Using these bolts, install the cylinder head to the cylinder block. Tighten the bolts evenly over two or three stages, following the sequence shown in the right figure.
    Tightening Torque: 58.8 - 66.7 N·m

    NOTE:
    - Failure to tighten the bolts evenly may cause cracks and distortion of the cylinder head, even leading to engine seizure.
    - Make sure that all the bolts are torqued uniformly to a constant value, also within the specified range.



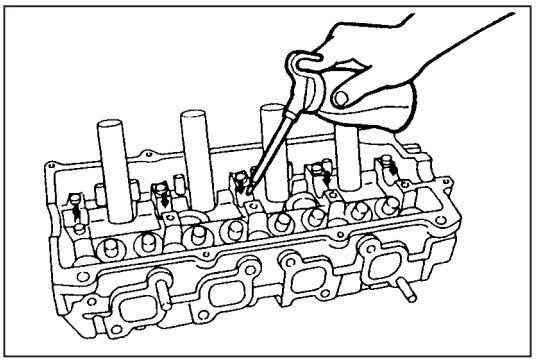
JEM00211-00195

12. Installation of camshaft and rocker shafts
    (1) Wash and dry the holes for the camshaft cap attaching bolts.
    WARNING:
    - Protect your eyes with goggles when using compressed air.



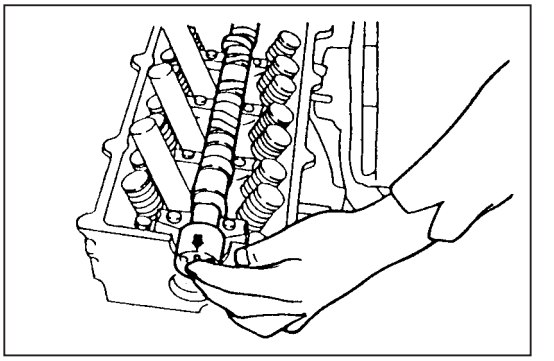
JEM00212-00196

    (2) Liberally apply engine oil to the journal sections and thrust bearing sections.
    NOTE:
    - Be very careful not to allow any oil to flow into the bearing cap attaching holes.



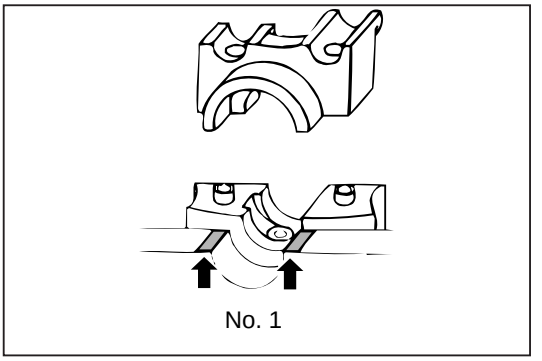
JEM00213-00197

    (3) Assemble the camshaft on the cylinder head in such a way that the locating pin for the camshaft timing belt pulley comes exactly at the top position.



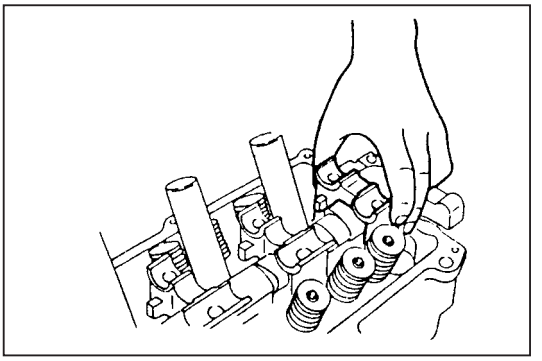
JEM00214-00198

(4) Apply the Three Bond 1104 to the camshaft cap No. 1 attaching section of the cylinder head at those points shown in the right figure.
(5) Apply engine oil to the camshaft journal section.
NOTE:
- Be very careful not to allow any oil to flow into the bearing cap attaching holes.

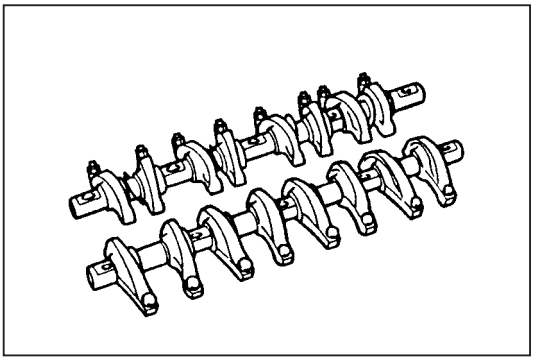


JEM00215-00199

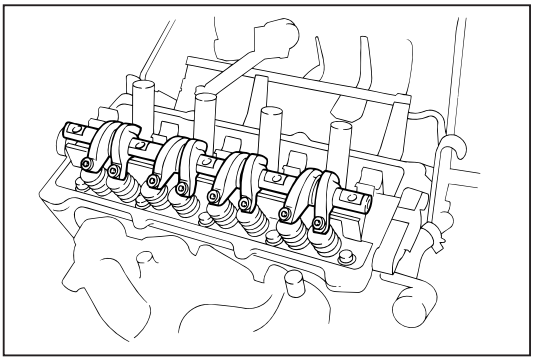
(6) Install the camshaft bearing caps in the sequence of embossed figures on the caps.
NOTE:
- Before the camshaft bearing caps are installed, wipe off any bond oozed from the camshaft cap No. 1.


JEM00216-00200

(7) Assemble the valve rocker arms and wave washers onto the valve rocker shaft, while applying engine oil liberally as shown in the right figure.
NOTE:
- The intake valve rocker shaft can be identified by the recessed sections on it.
- The larger chamber end section of valve rocker shaft faces toward the timing belt side.


JEM00217-00201

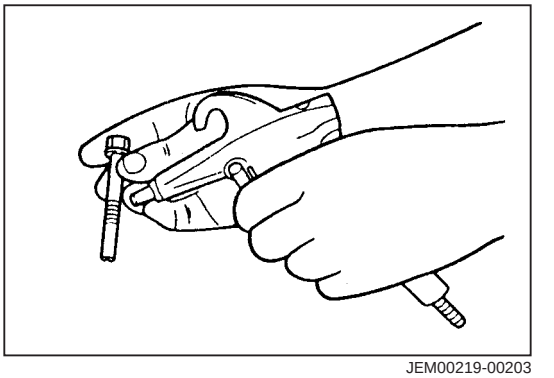
(8) Install the valve rocker shaft on the camshaft caps.
NOTE:
- For easier installation, it is advisable to insert the camshaft cap side of rocker arm first.


JEM00218-00202

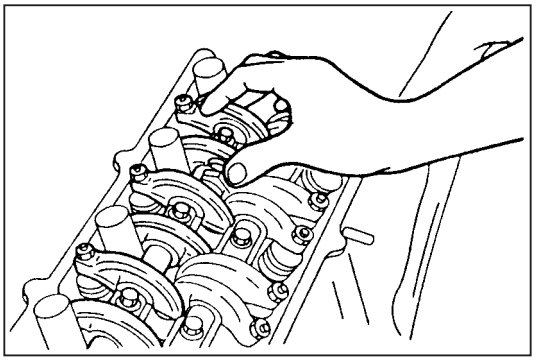
(9) Clean the attaching bolts and dry them with compressed air. Install them to the cylinder head through the rocker shafts and camshaft caps. Tighten the bolts evenly over two or three stages to the specified torque.
Tightening Torque
M10 Bolt: 28.4 - 36.3 N·m/Dry
M8 Bolt: 12.7 - 16.7 N·m/Dry

CAUTION:
- Never exceed the specified tightening torque.
- The bolts and bolt holes should be dry when tightening the bolts.

WARNING:
- Protect your eyes with safety goggles, when using compressed air.

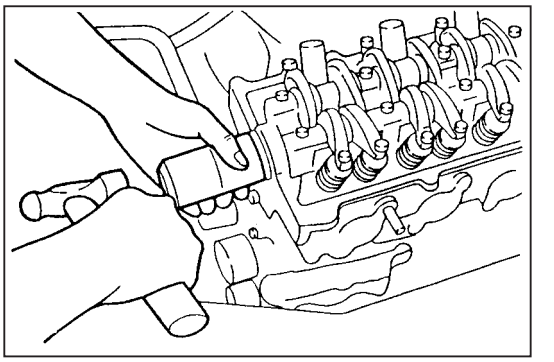

JEM00219-00203

13. Install the spacers into between the intake valve rocker arms on the rocker shaft.


JEM00220-00204

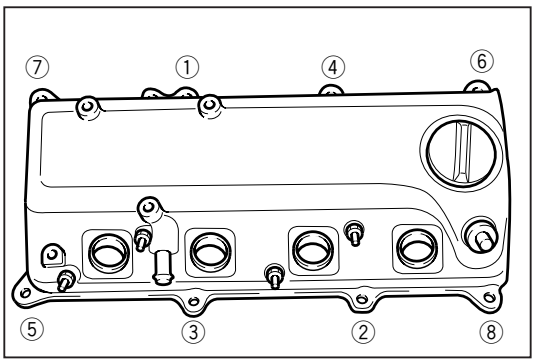
14. Apply engine oil to the lip section of the type T oil seal of the camshaft.
15. Drive the oil seal into position, using the following SST.
SST: 09636-20010-000

CAUTION:
- Be very careful not to tilt the oil seal against the attaching hole of the camshaft oil seal.


JEM00221-00205

16. Installation of the camshaft timing belt pulley.
(Refer to the Timing Belt section of the service manual.)

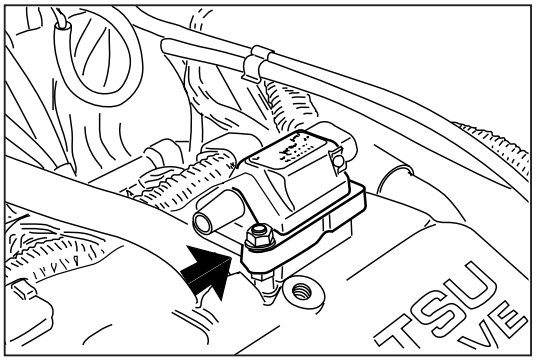
17. Install the cylinder head cover and tighten the attaching bolts evenly two or three stages, following the sequence shown in the right figure.
Tightening Torque: 2.9 - 4.9 N·m



JEM00222-00206

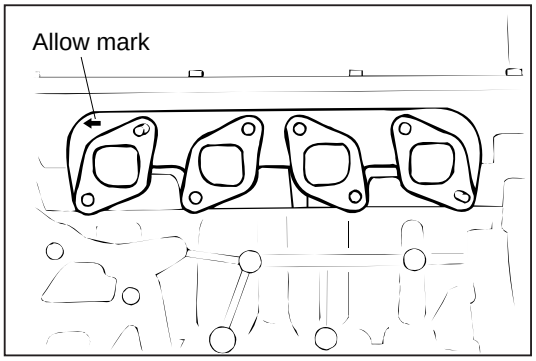
18. Connect the connector to the water temperature sensor.
19. Install the ignition coil to the cylinder head cover and tighten it.
    Tightening Torque: 2.9 - 4.9 N·m

20. Connect the resistive cords between the ignition coil and the spark plug.
    IG coil for No. 2 cylinder – No. 3 cylinder
    IG coil for No. 4 cylinder – No. 1 cylinder



JEM00223-00207

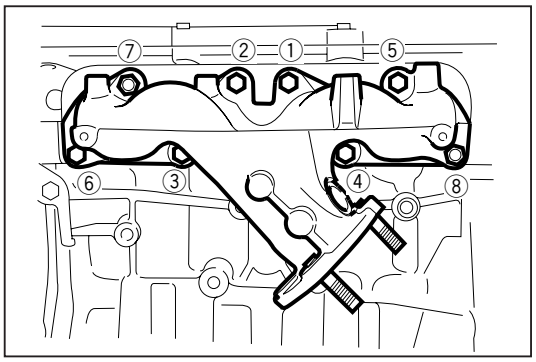
21. Installation of exhaust manifold
    (1) Install the new exhaust manifold gasket in such a way that the arrow mark can be visible and it faces toward the timing belt.



JEM00224-00208

    (2) Install the exhaust manifold to the cylinder head.
    NOTE:
    - Be very careful not to interfere with other parts.

    (3) Install and tighten the attaching bolts and nuts evenly over two to three stages, following the sequence in the right figure.
    Tightening Torque: 29.4 - 44.1 N·m



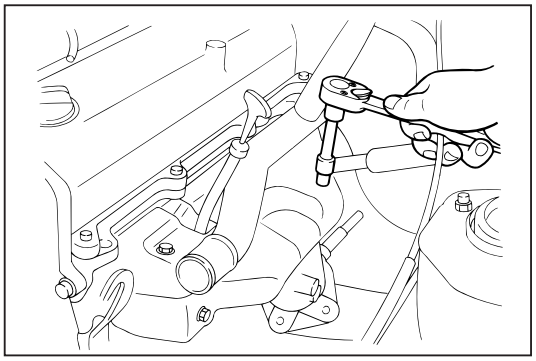
JEM00225-00209

    (4) Install a new O-ring to the oil level gauge guide.
    CAUTION:
    - Do not reuse the O-ring.

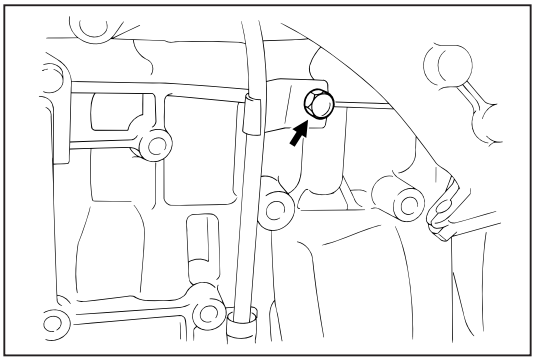
    (5) Insert the oil level gauge guide to the cylinder block.
    CAUTION:
    - Be very careful not to damage the O-ring.

JEM00226-00000

    (6) Install the exhaust manifold heat insulator to the exhaust manifold with the attaching bolts and nut.

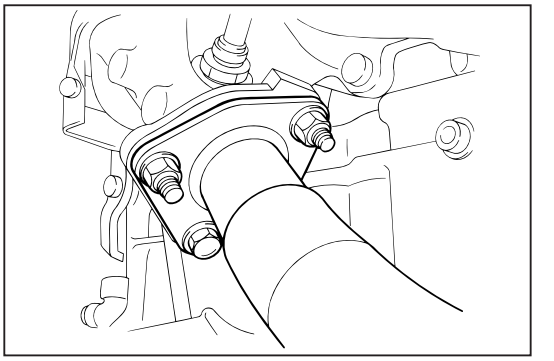

JEM00227-00210

(7) Install and tighten the attaching bolt of the oil level gauge guide.
(8) Insert the oil level gauge to the oil level gauge guide.


JEM00228-00211

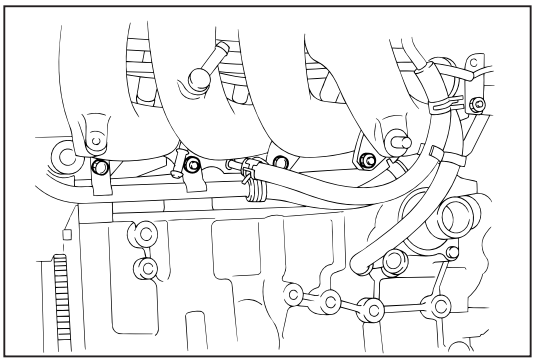
(9) Connect the exhaust front pipe to the exhaust manifold with a new gasket interposed.
CAUTION:
- Do not reuse the used gaskets.

(10) Tighten the attaching bolts of the exhaust front pipe to the specified torque.
Tightening Torque: 41.6 - 62.4 N·m

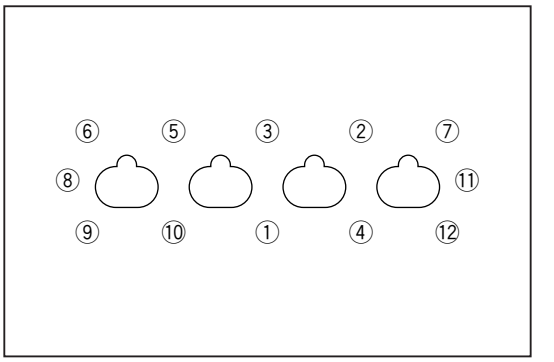

JEM00229-00212

22. Installation of intake manifold
(1) Install a new intake manifold gasket to the cylinder head.
(2) Install the intake manifold to the cylinder head.
CAUTION:
- Do not interfere with other parts.

(3) Install the attaching bolts and nuts of the intake manifold.
NOTE:
- Be sure to install the following parts interposed with the attaching bolts and nuts of the intake manifold.
  1. By-pass pipe
  2. Oil pressure switch wire clamp
  3. Power steering vane pump bracket.

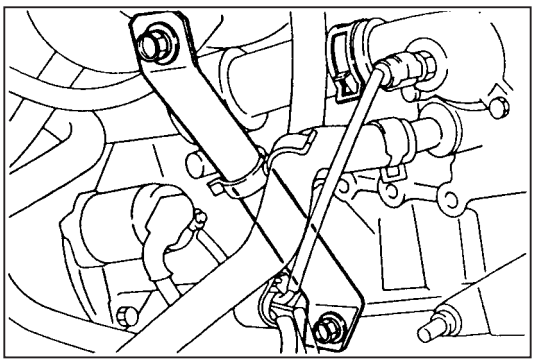

JEM00230-00213

(4) Tighten the intake manifold attaching bolts and nuts evenly to the specified torque over two or three stages in the sequence as indicated in the right figure.
Tightening Torque: 14.7 - 21.6 N·m

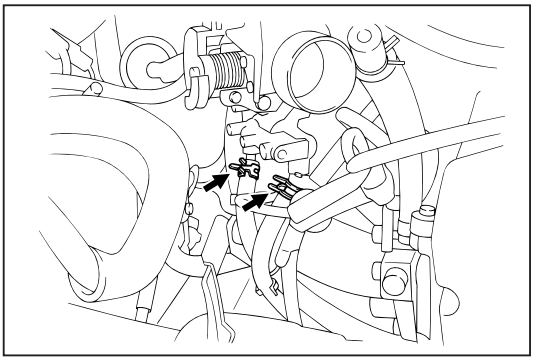


JEM00231-00214

(5) Install the intake manifold stays and tighten the attaching bolts.
(6) Install the engine wire ground terminal to the intake manifold.

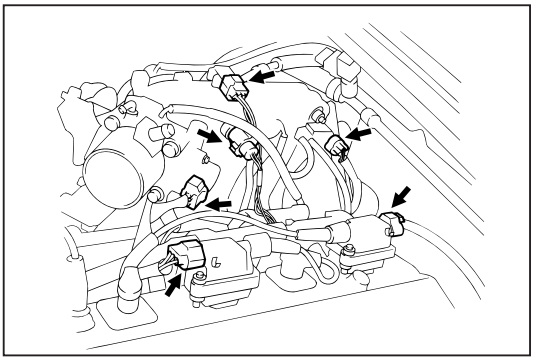

JEM00232-00215

(7) Connect the rubber hoses for brake booster and VSV.
(8) Connect the fuel inlet hose and return hose.
(9) Connect the water hose.



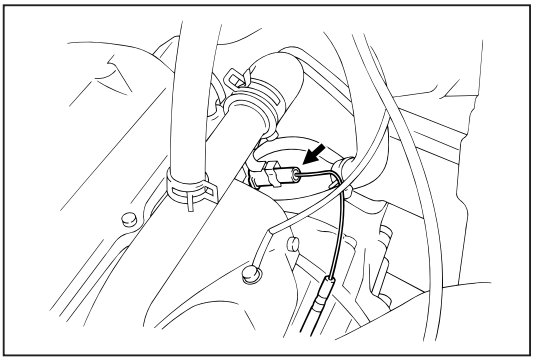
JEM00233-00216

(10) Installation of engine wire
① Connect the connector of the engine wire to the following parts.
a. Ignition coils
b. Injectors
c. Pressure sensor
d. Throttle position sensor
e. Intake air temperature sensor
f. Idle-up VSV
g. Oxygen sensor
h. Cam angle sensor



JEM00234-00217

② Install the harness clamps to each bracket.

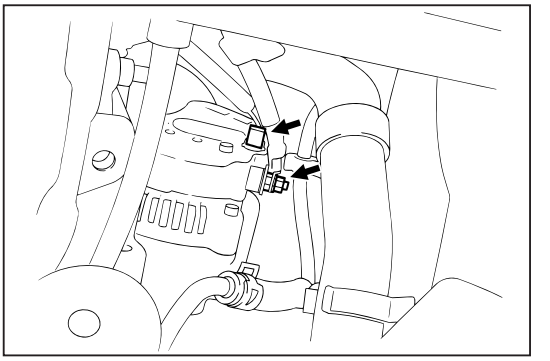


JEM00235-00218

(11) Install the timing belt.
(Refer to installation of timing belt section)

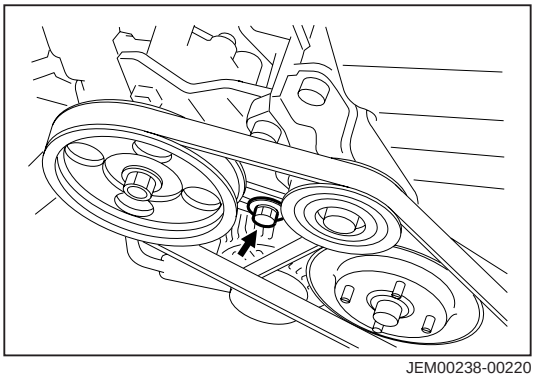
JEM00236-00000

(12) Install the alternator



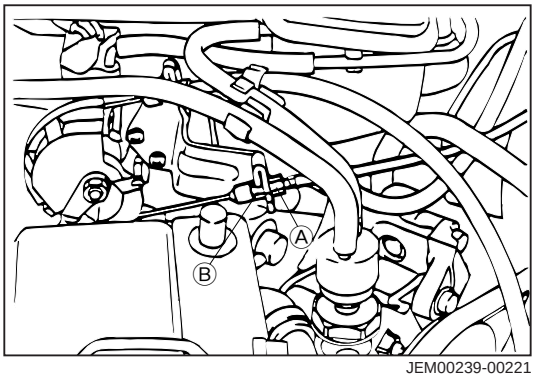
JEM00237-00219

(13) Install the power steering vane pump



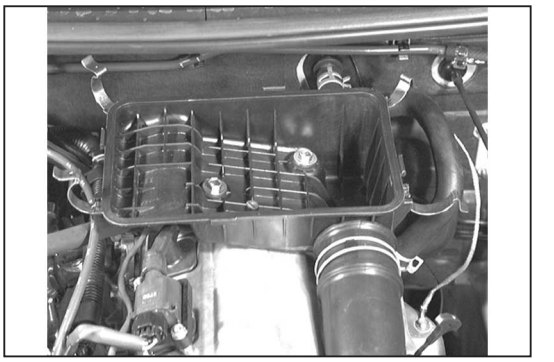
JEM00238-00220

(14) Install the acceleration cable to the throttle body and adjust it.



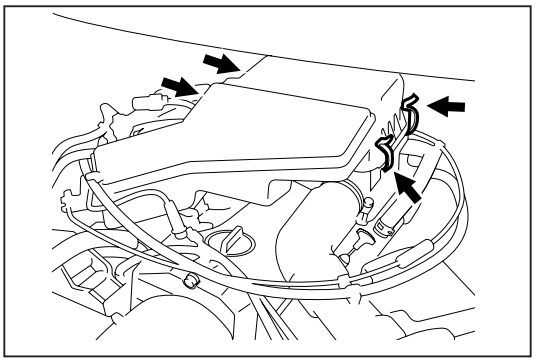
JEM00239-00221

(15) Installation of air cleaner.
① Install the air cleaner lower case to the engine and tighten the attaching bolts.



JEM00240-00222

② Install the air filter element to the air cleaner lower case.
③ Install the air cleaner upper case with the air duct and fasten the clamp.

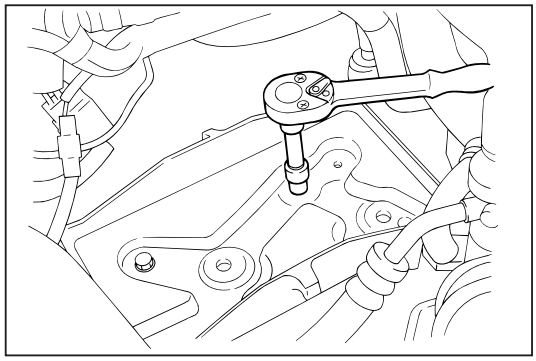


JEM00241-00223

④ Tighten the air intake hose attaching bolt.
⑤ Connect the rubber hoses to the air cleaner.

JEM00242-00000

(16) Install the battery carrier and the battery.
(17) Connect the battery cable to each terminals of the battery.



JEM00243-00224

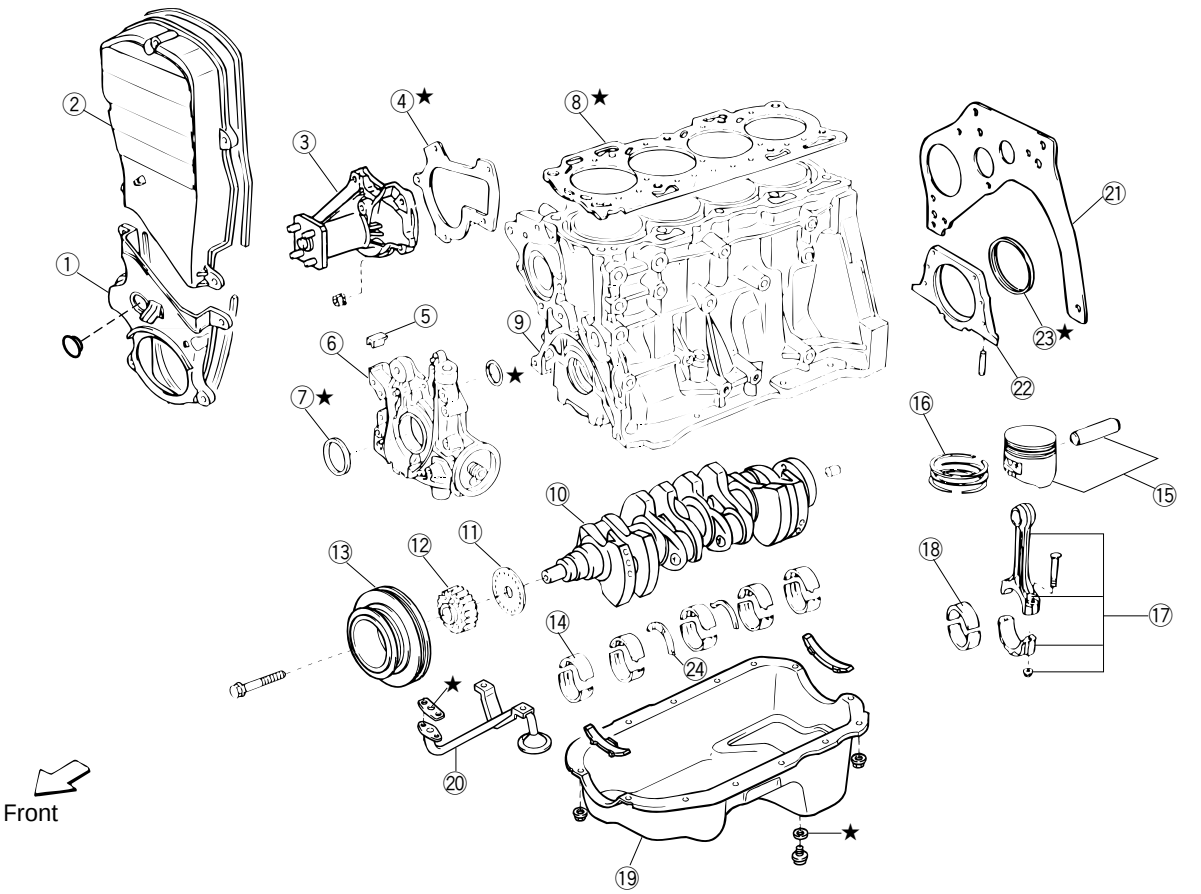
(18) Fill the coolant
(Refer to CO section of this manual)

JEM00244-00000

CYLINDER BLOCK

COMPONENTS

★ : **Non-reusable parts**



① Timing belt cover No. 1
② Timing belt cover No. 2
③ Water pump assembly
④ Water pump gasket
⑤ Dust seal
⑥ Oil pump assembly
⑦ Oil seal
⑧ Cylinder head gasket
⑨ Cylinder block
⑩ Crankshaft
⑪ Crankshaft timing belt pulley flange
⑫ Crankshaft timing belt pulley
⑬ Crankshaft pulley
⑭ Crankshaft bearing
⑮ Piston with pin
⑯ Piston ring
⑰ Connecting rod
⑱ Connecting rod bearing
⑲ Oil pan
⑳ Oil pump strainer
㉑ Rear end plate
㉒ Oil seal retainer
㉓ Oil seal
㉔ Crankshaft thrust bearing

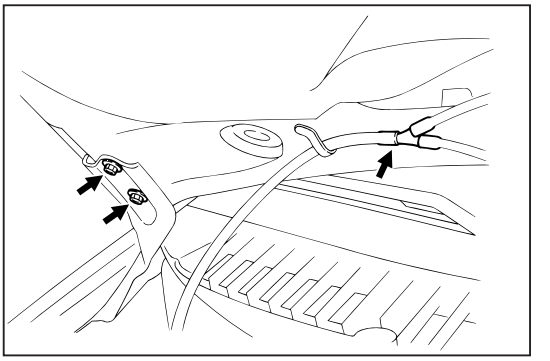
INSTRUCTION PRIOR TO OPERATION

- Install the fender cover to the fenders so that no scratch may be made to the fenders.
- Be sure to read the general information section of the service manual.

JEM00246-00000

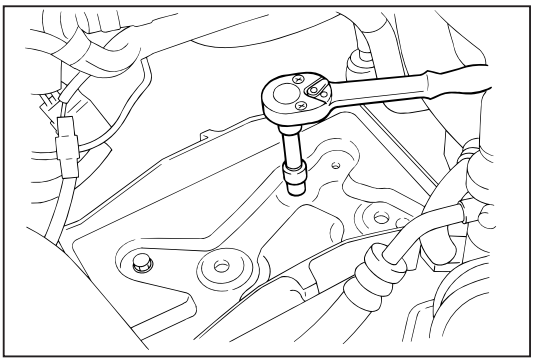
ENGINE REMOVAL

1. Disconnect the battery ground cable from the negative (–) terminal of the battery.
2. Removal of engine hood
   (1) Disconnect the windshield washer hose from the joint section.
   (2) Remove the hose from the clamp of the engine hood.
   (3) Remove the hood, being very careful not to scratch the body and hood.
3. Disconnect the wires of the positive (+) terminal from the battery positive terminal.
4. Drain the coolant.
   (Refer to the CO section of the service manual.)
5. Drain the engine oil.
   (Refer to the MA section of the service manual.)



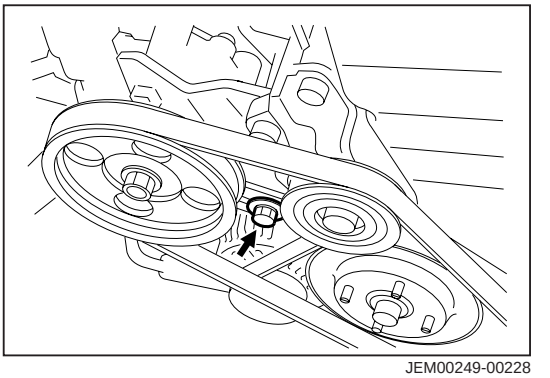
JEM00247-00226

6. Removal of battery
   (1) Remove the battery hold down clamp by removing the two attaching nuts.
   (2) Remove the battery from the battery carrier.
   (3) Remove the wiring harness from the clamp section of the battery carrier.
   (4) Disconnect the engine wire harness clamp from the battery carrier.
   (5) Remove the battery carrier by removing the four attaching bolts.



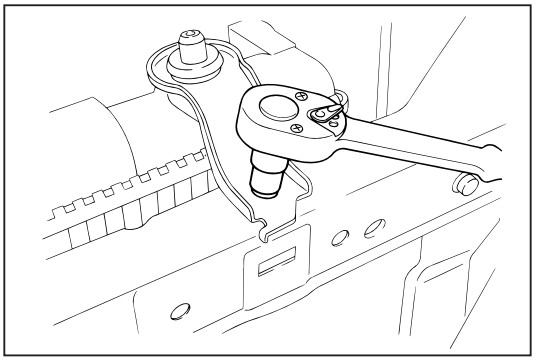
JEM00248-00227

7. Remove the power steering vane pump from the engine.
   Suspend the removed vane pump at the body side, using an adequate rope.



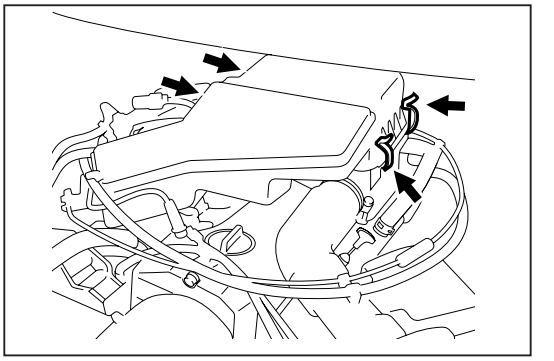
JEM00249-00228

8. Remove the fan and fan shroud.
9. Remove the radiator.



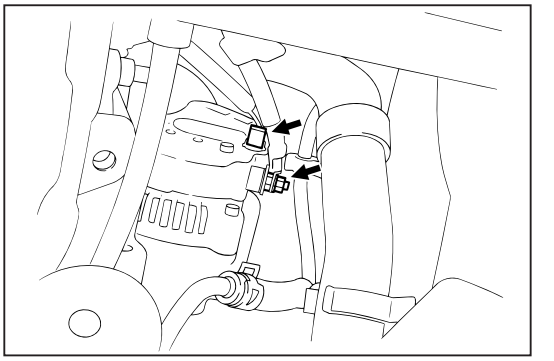
JEM00250-00229

10. Remove the air cleaner.



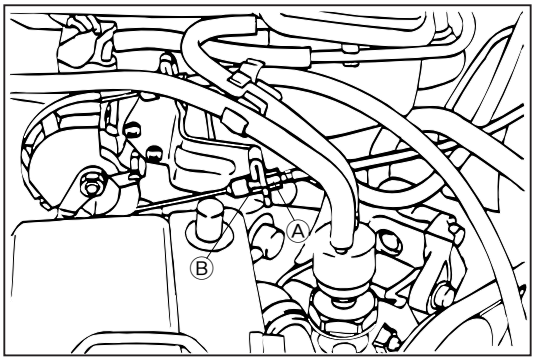
JEM00251-00230

11. Remove the alternator.



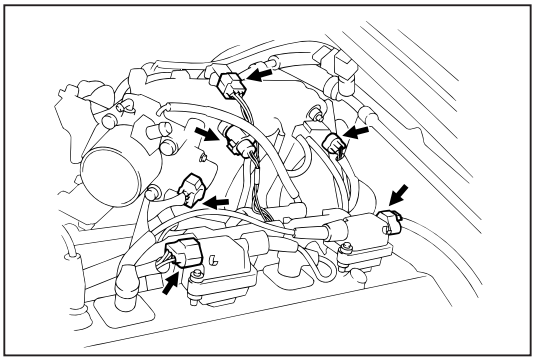
JEM00252-00231

12. Remove the accelerator cable and rubber hoses.

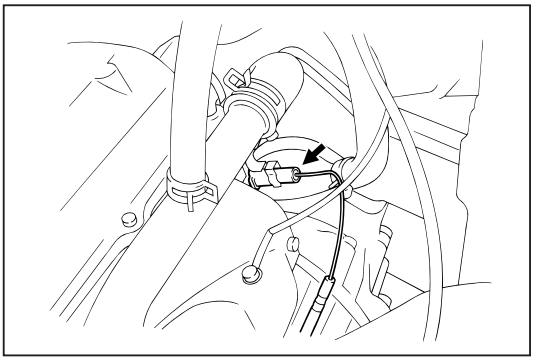


JEM00253-00232

13. Disconnect the following connectors and remove the engine wire
    (1) Ignition coils
    (2) Injectors
    (3) Pressure sensor
    (4) Throttle position sensor
    (5) Intake air temperature sensor
    (6) Idle-up VSV
    (7) Water temperature sensor
    (8) Oxygen sensor
    (9) Cam angle sensor

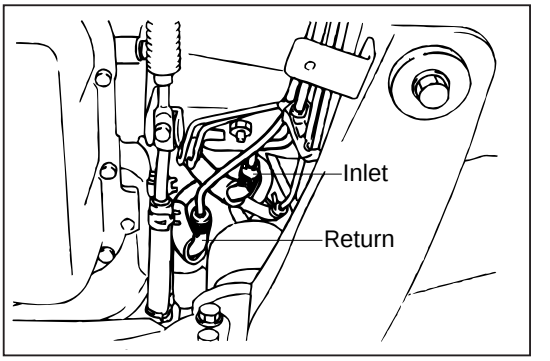


JEM00254-00233



JEM00000-00234

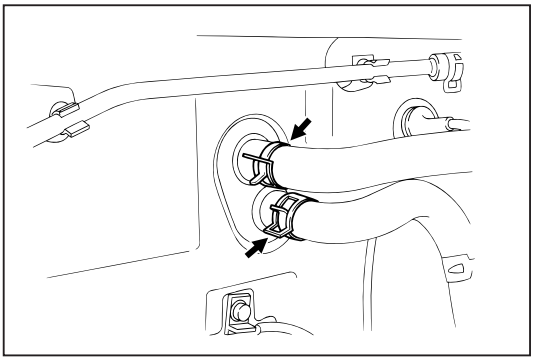
14. Disconnect the fuel inlet hose and return hose.
    CAUTION:
    - The fuel pressure at inside of the fuel line is approximately 284 kPa higher than the atmospheric pressure.
    - Therefore, be sure to gradually pull out the rubber hoses so as to prevent fuel from splashing.



JEM00255-00235

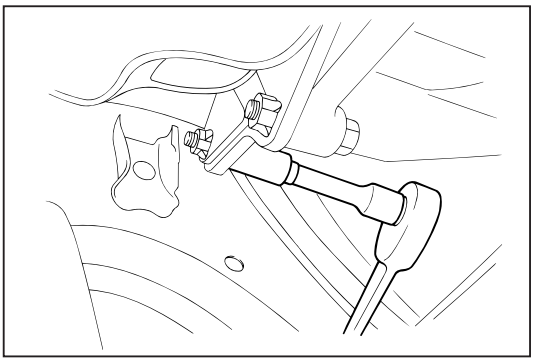
15. Disconnect the heater hoses.
    CAUTION:
    - Be careful not to deform the heater inlet and outlet pipes during disconnection. The heater core and pipe are made copper.

    NOTE:
    - Place a suitable container under the heater hose connecting section, for the coolant may flow out.



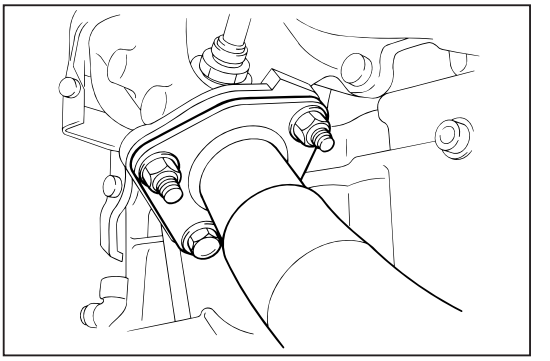
JEM00256-00236

16. Remove the charcoal canister from the engine compartment.
17. Remove the clutch cable with bracket from the transmission.



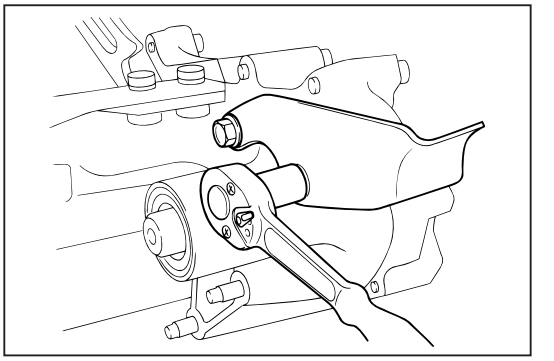
JEM00257-00237

18. Removal of front exhaust pipe.
    (1) Disconnect the attaching bolt and nuts of the exhaust manifold.
    (2) Disconnect the clamp of the front exhaust pipe.



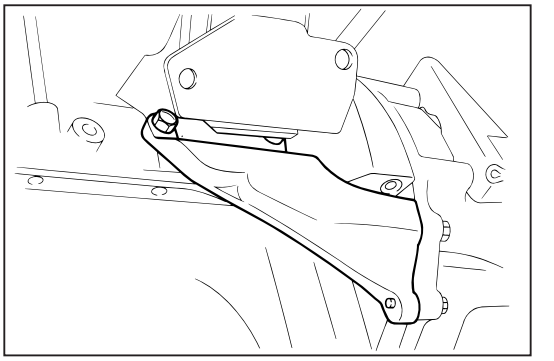
JEM00258-00238

(3) Remove the bracket of the front exhaust pipe clamp from the transmission.
(4) Remove the front exhaust pipe from the engine by disconnecting the attaching nuts of the main muffler.



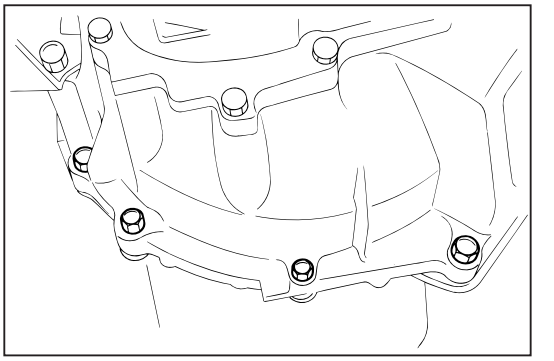
JEM00259-00239

19. Remove the following stiffener from the engine and the transmission.
    (1) Engine stiffener RH
    (2) Engine stiffener LH
    (3) Power train stiffener



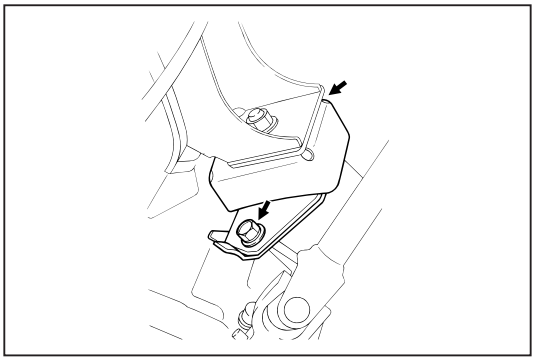
JEM00260-00240

20. Remove the starter from the engine by disconnecting the attaching bolts.
21. Disconnect the attaching bolts of the engine with the transmission.



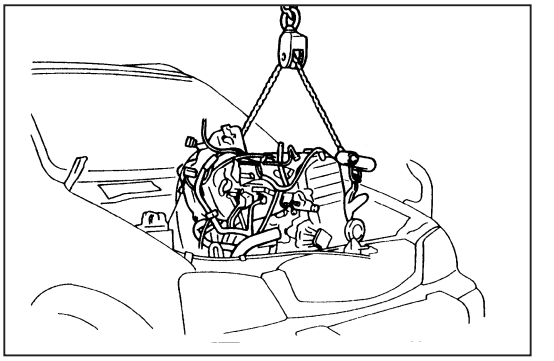
JEM00261-00241

22. Disconnect the attaching bolts of the engine mounting bracket.



JEM00262-00242

23. Take out the engine from the engine compartment.
    CAUTION:
    - Be very careful not to allow the engine to hit to the vehicle body and other parts.

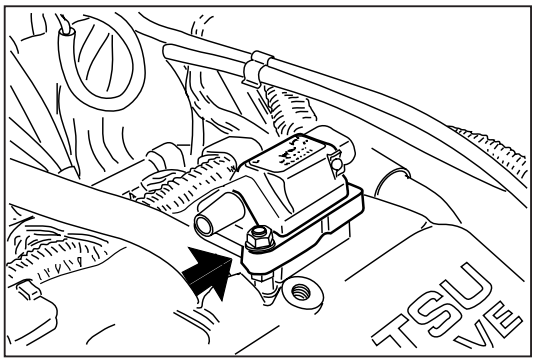


JEM00263-00243

24. Place the engine on the suitable engine stand.

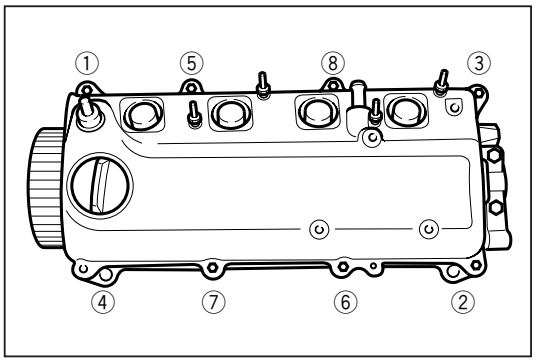
JEM00264-00000

25. Remove the timing belt.
26. Removal of cylinder head cover.
    (1) Remove the ignition coils and resistive cords.



JEM00265-00244

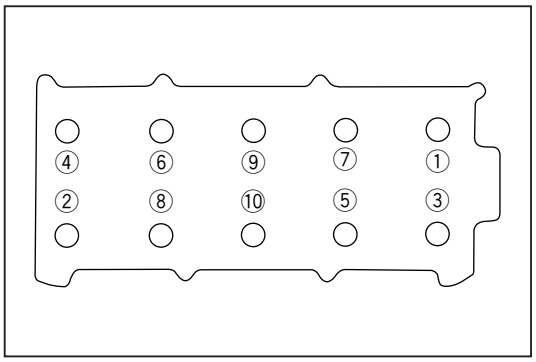
    (2) Remove the cylinder head cover attaching bolts.
    (3) Remove the cylinder head cover.



JEM00266-00245

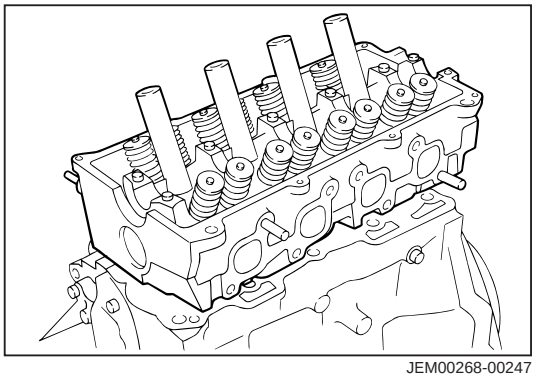
27. Removal of cylinder head.
    (1) Loosen the cylinder head attaching bolts evenly over two or three stages in the sequence indicated in the right figure.

    NOTE:
    - Be certain to loosen the cylinder head bolts evenly. Failure to observe this caution will cause cracks or distortion of the cylinder head, even leading to engine seizure.



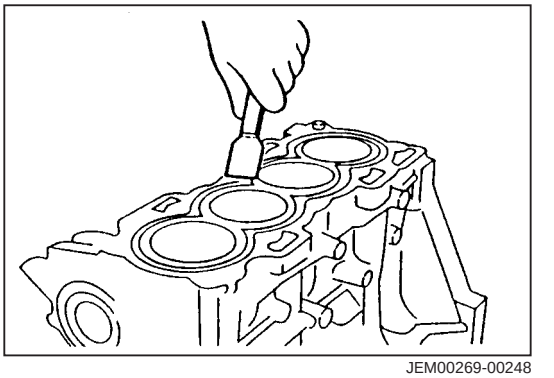
JEM00267-00246

    (2) Remove the cylinder head bolts.
    (3) Remove the cylinder head from the cylinder block.



JEM00268-00247

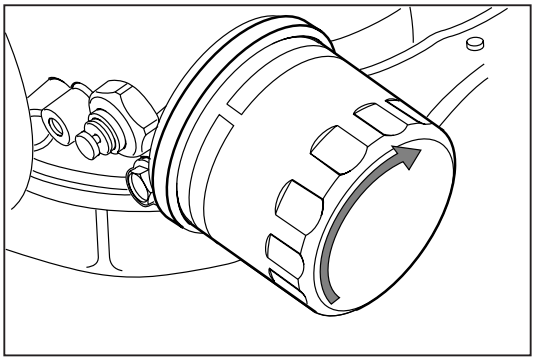
(4) Remove the cylinder head gasket.
(5) Remove any remaining gasket material from the gasket surfaces of the cylinder head and cylinder block, using the gasket scraper.



JEM00269-00248

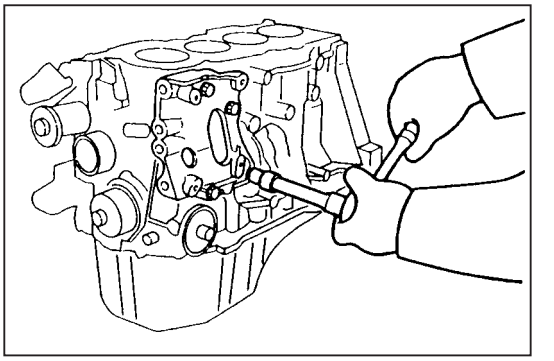
DISASSEMBLY OF CYLINDER BLOCK

1. Remove the oil pressure switch and oil filter.



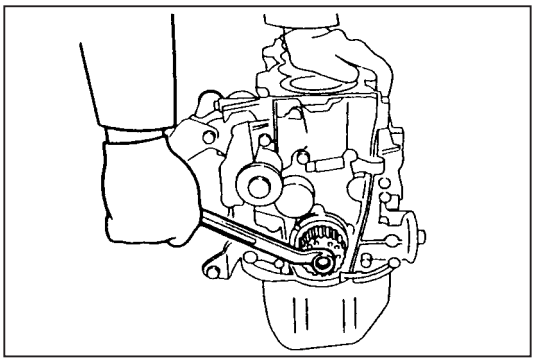
JEM00270-00249

2. Remove the air conditioner compressor bracket. (Air conditioner equipped vehicle only)



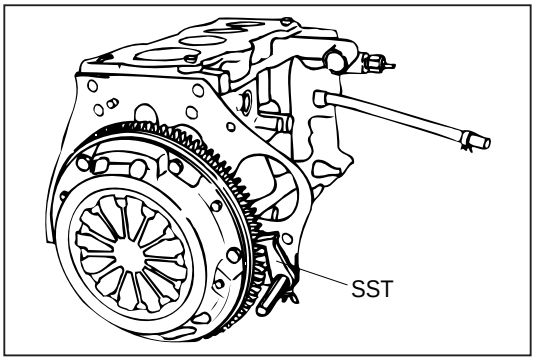
JEM00271-00250

3. Remove the crankshaft timing belt pulley bolt.



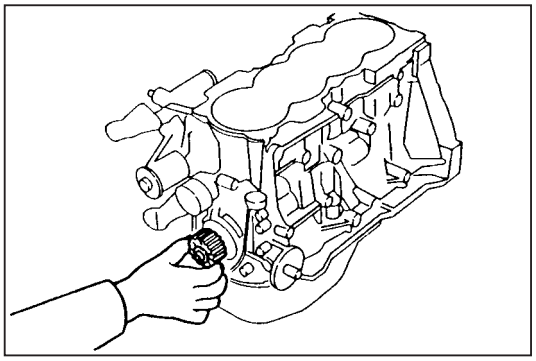
JEM00272-00251

NOTE:
- Prevent the ring gear from turning, using the following SST.
  SST: 09210-87701-000



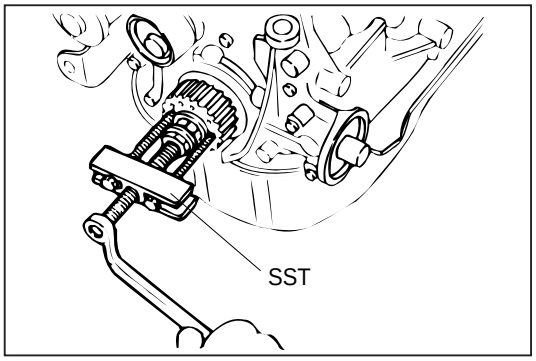
JEM00273-00252

4. Remove the crankshaft timing belt pulley.



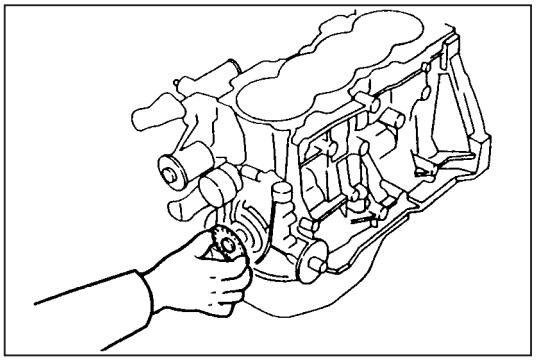
JEM00274-00253

NOTE:
- If the crankshaft timing belt pulley can not be removed by hand, install the following SST with the crankshaft timing belt pulley bolt interposed.
  SST: 09609-20011-000



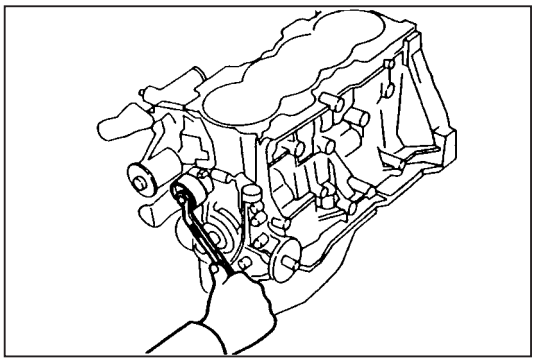
JEM00275-00254

5. Remove the crankshaft timing belt pulley flange.



JEM00276-00255

6. Remove the tensioner and tension spring.

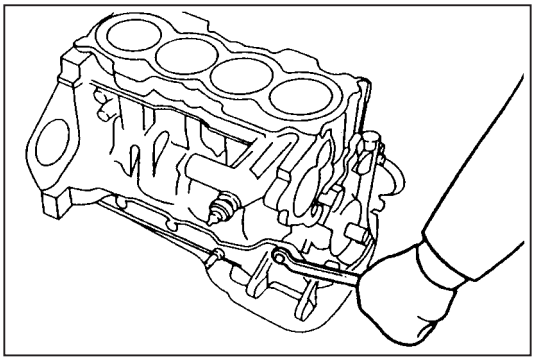


JEM00277-00256

7. Remove the water pump.
8. Remove the water pump gasket.

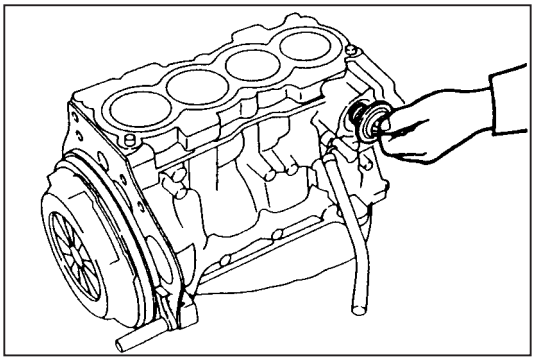
JEM00278-00000

9. Remove the alternator bracket.



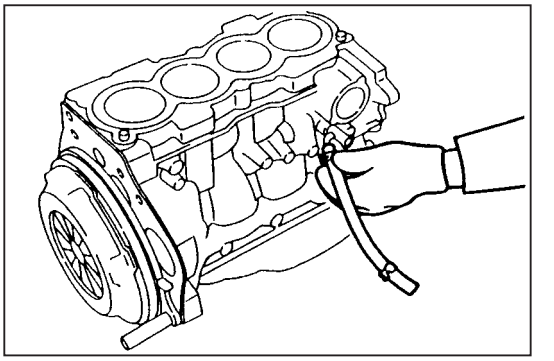
JEM00279-00257

10. Remove the water inlet and thermostat.



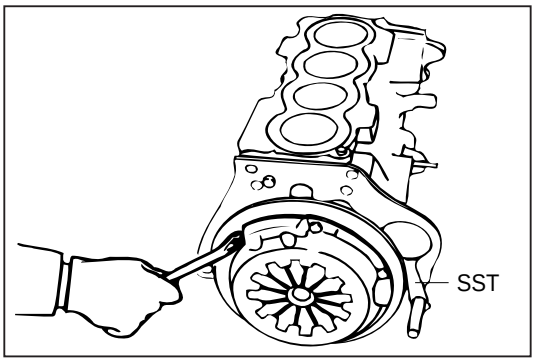
JEM00280-00258

11. Remove the water hose for the throttle body.



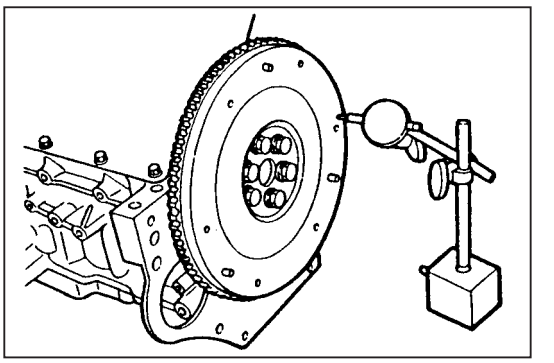
JEM00281-00259

12. Remove the pressure plate and clutch disc. (M/T vehicle only)
    NOTE:
    - Prevent the pressure plate from turning, using the following SST.
      SST: 09210-87701-000



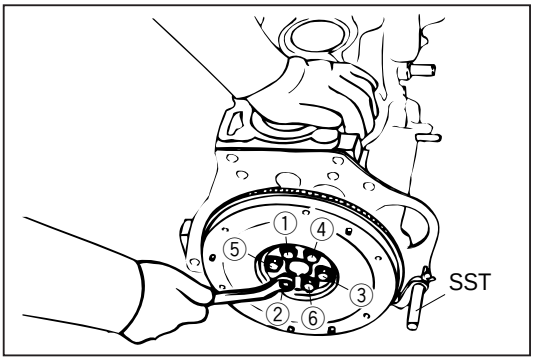
JEM00282-00260

13. Check of flywheel for runout (M/T vehicle only)
    NOTE:
    - If the runout does not conform to the specification, confirm the tightening torque of the flywheel. Only case where the tightening torque conforms to the specified value, replace the flywheel.



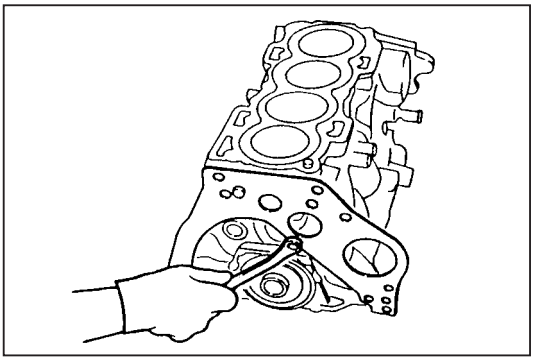
JEM00283-00261

14. Loosen the attaching bolts of the flywheel or drive plate in the sequence as indicated in the right figure. Remove the flywheel or drive plate.
    NOTE:
    - Prevent the flywheel from turning, using the following SST.
      SST: 09210-87701-000



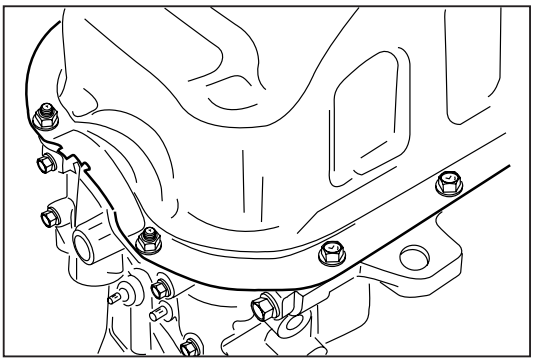
JEM00284-00262

15. Remove the rear end plate.

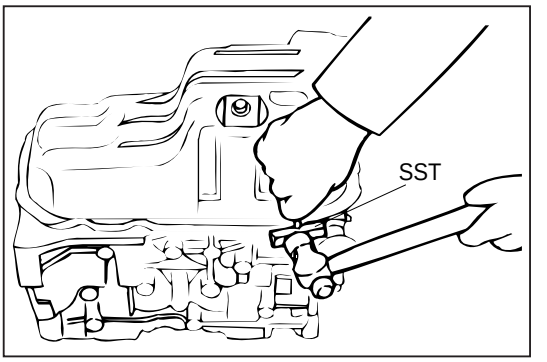

JEM00285-00263

16. Removal of oil pan
    (1) Prepare two suitable wooden blocks. Place the cylinder block on those blocks.
    NOTE:
    - Be very careful not to damage the piston head.

    (2) Loosen the attaching bolts and nuts of the oil pan over two or three stages. Pull out the bolts and nuts.

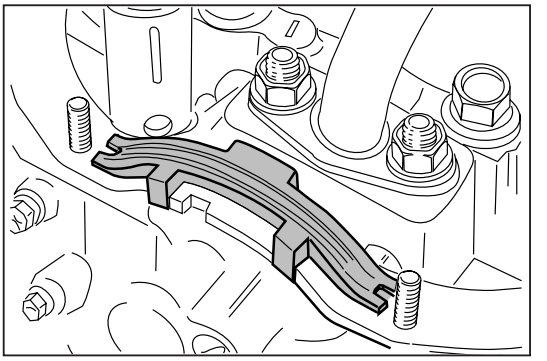

JEM00286-00264

    (3) Separate the oil pan from the cylinder block by driving the following SST into between the cylinder block and the oil pan.
      SST: 09032-00100-000

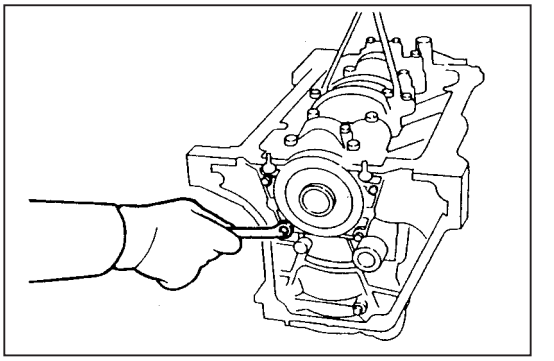


JEM00287-00265

17. Remove the oil pan gasket.

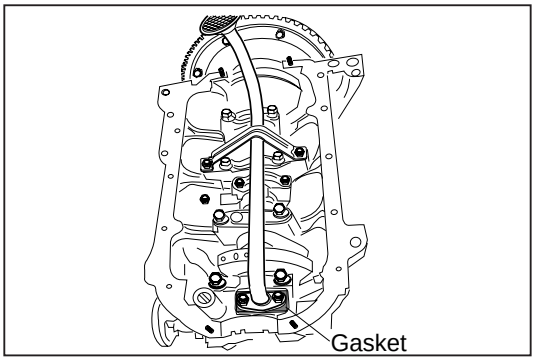

JEM00288-00266

18. Remove the rear oil seal retainer.



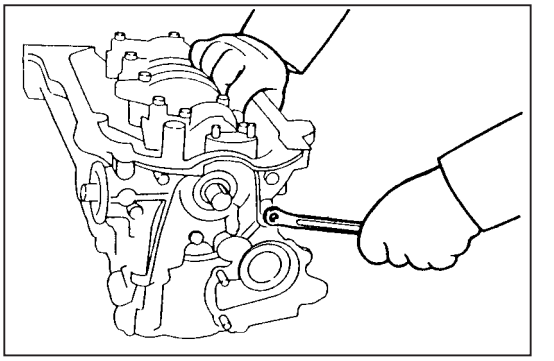
JEM00289-00267

19. Remove the oil strainer.



JEM00290-00268

20. Remove the oil pump.



JEM00291-00269

21. Measurement of connecting rod thrust clearance.
Measure the thrust clearance between the connecting rod and the crankshaft, using a thickness gauge.

Thrust Clearance

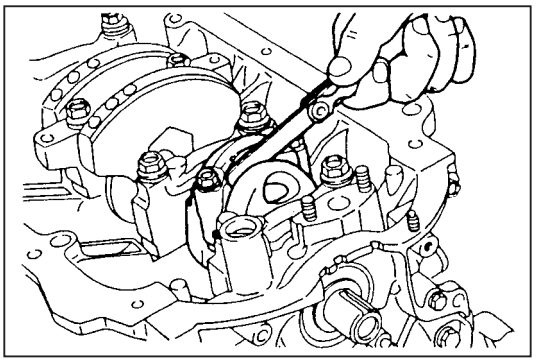
Standard: 0.15 - 0.4 mm

Maximum: 0.45 mm

NOTE:

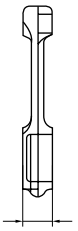
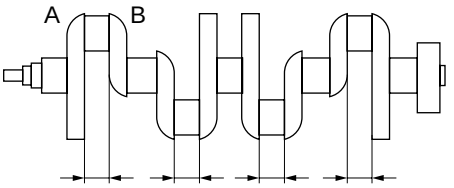
- The thrust clearance should be measured while the connecting rod is being pushed against either side of the crankshaft in the axial direction. Measure the thrust clearance at the opposite side.

If the clearance exceeds the specified value, replace the connecting rod or the crankshaft, or both of them, referring to the width of the big end of the connecting rod in the thrust direction and the side width of the crankpin journal.



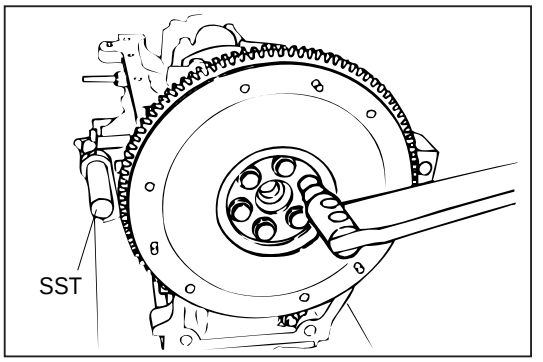
JEM00292-00270

Reference:

Width of big end of connecting rod in thrust direction	Side width of crankpin
21.80 - 21.85 mm	22.0 - 22.2 mm
	Crankshaft HC-EJ engine 

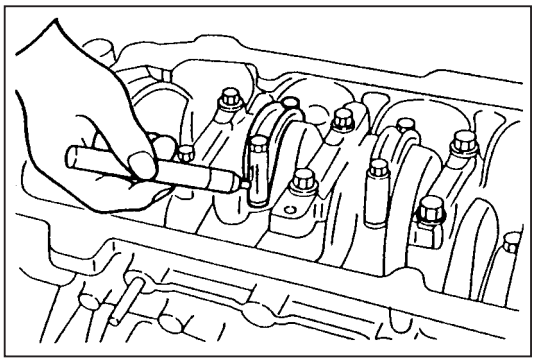
JEM00293-00271

22. Measurement of crankpin journal oil clearance
    (1) Install the flywheel temporarily.



JEM00294-00272

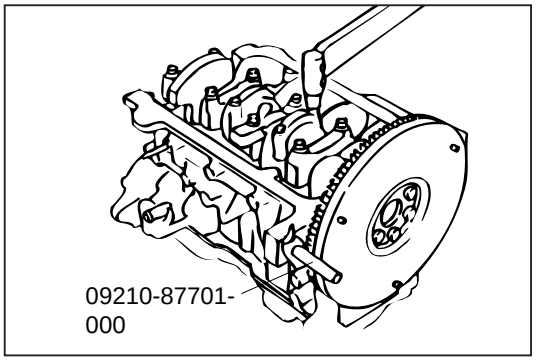
    (2) Wipe off any oil from the side of the mate surface between the connecting rod bearing cap and the connecting rod. Daub a mate mark with an oily paint on the side so that the parts can be assembled correctly in the original combination.
    (Also ensure that the cylinder number may be identified)
    (3) Turn the crankshaft, until the connecting rod bearing cap to be removed comes at the oil pan side.



JEM00295-00273

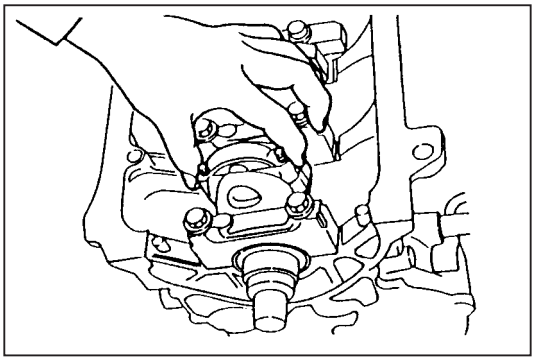
    (4) Lock the flywheel to prevent the crankshaft from turning, using the following SST.
    SST: 09210-87701-000

    (5) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap nuts.

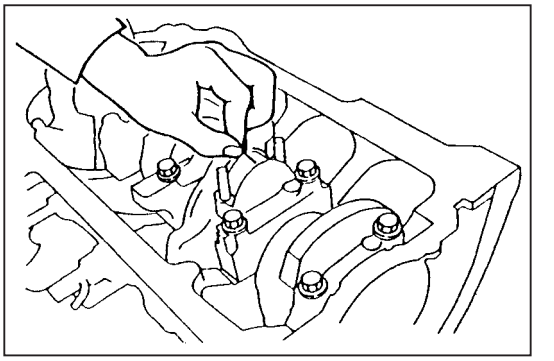


JEM00296-00274

(6) Remove the bearing cap.
NOTE:
- Replace the crankshaft if the crankpin journals exhibit damages, such as seizure.

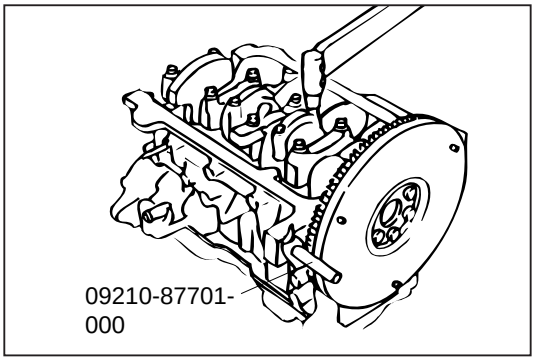

JEM00297-00275

(7) Place a plastigage on the crankpin journal.
NOTE:
- Wipe off any oil from the crankpin journal.


JEM00298-00276

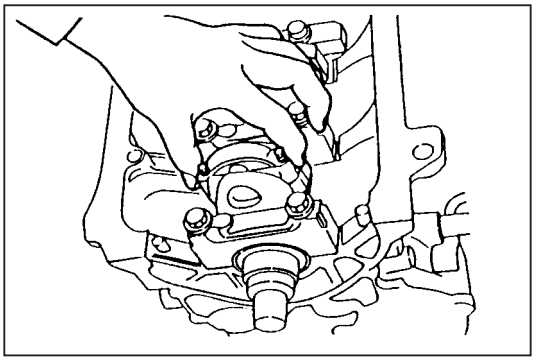
(8) Install the connecting rod cap, making sure that the mate marks are lined up. Tighten the connecting rod bearing cap nuts evenly over two or three stages to the specified torque.
Tightening Torque: 34.3 - 44.1 N·m

NOTE:
- When tightening of the bearing cap nuts, apply engine oil to the bearing cap nuts.
- Prevent the crankshaft from turning, using the SST.
SST: 09210-87701-000



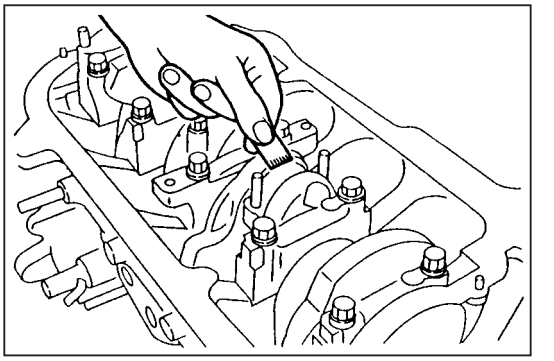
JEM00299-00277

(9) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap.
NOTE:
- Prevent the crankshaft from turning, using the SST.
SST: 09210-87701-000


JEM00300-00278

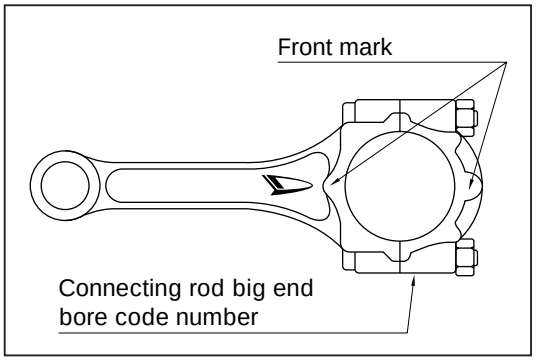
(10) Measure the plastigage width at its widest point.
Oil Clearance: 0.020 - 0.044 mm

If the oil clearance fails to conform to the specified value, measure the crankpin journal diameter and select a suitable connecting rod bearing or replace the crankshaft.
(11) Remove the plastigage from the crankpin journal.
(12) Measure the oil clearances of the remaining crankpin journals.


JEM00301-00279

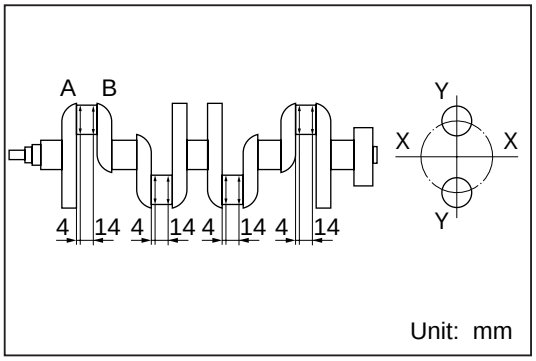
23. Selection of connecting rod bearings
NOTE:
- The replacement of the connecting rod bearings should be performed after all inspections have been finished.

(1) Read the connecting rod big end bore code number.
NOTE:
- The connecting rod big end bore code number comes in three kinds of 4, 5 and 6.



JEM00302-00280

(2) Measure the diameter of the crankpin journal.
The measurement should be performed at four points, 90 degrees spaced, for each crankpin journal at the points shown in the right figure. The maximum value is regarded as the crankpin journal diameter.
However, if the variation in the measured diameters exceeds 0.044 mm, replace the crankshaft.



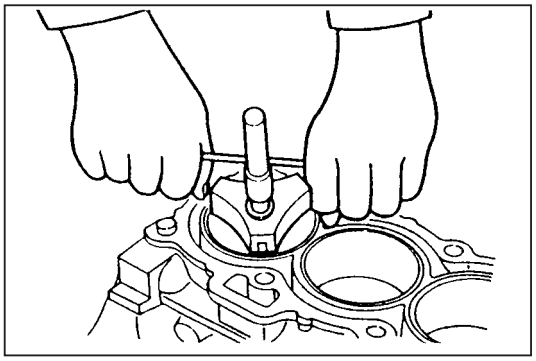
JEM00303-00281

(3) Select the connecting rod bearing or replace the crankshaft, based on the results of (1) and (2).

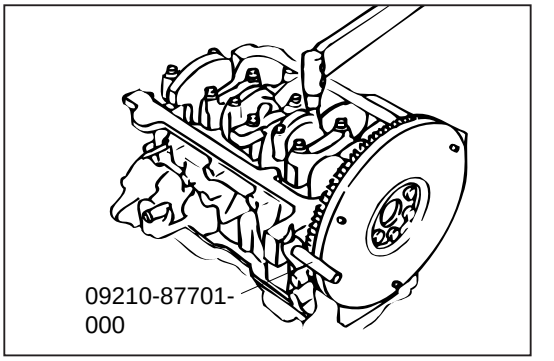
Connecting rod big end bore code number	Crankpin journal diameter	Bearing classification number	Remarks
4	44.993 - 45.000	1	—
	44.985 - 44.992	2	—
	44.976 - 44.984	3	—
	44.975 or less	—	Crankshaft replacement
5	44.993 - 45.000	2	—
	44.985 - 44.992	3	—
	44.976 - 44.984	4	—
	44.975 or less	—	Crankshaft replacement
6	44.993 - 45.000	3	—
	44.985 - 44.992	4	—
	44.976 - 44.984	5	—
	44.975 or less	—	Crankshaft replacement

JEM00304-00000

24. Removal of pistons
(1) Remove all carbon deposits from the piston ring ridges.
(2) Turn the crankshaft, until the connecting rod bearing cap to be removed comes at the oil pan side.


JEM00305-00282

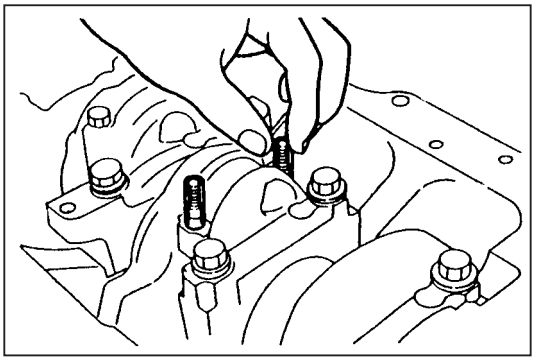
(3) Lock the flywheel to prevent the crankshaft from turning, using the following SST.
SST: 09210-87701-000



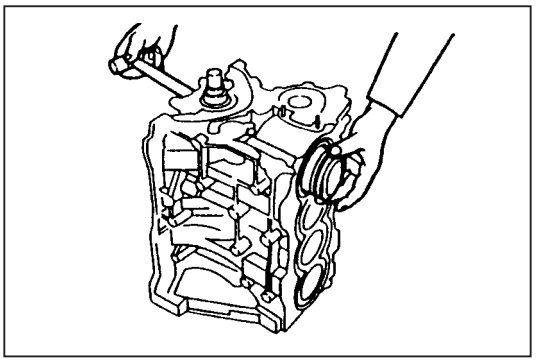
JEM00306-00283

(4) Loosen the connecting rod bearing cap nuts evenly over two or three stages. Then, remove the connecting rod bearing cap nuts.

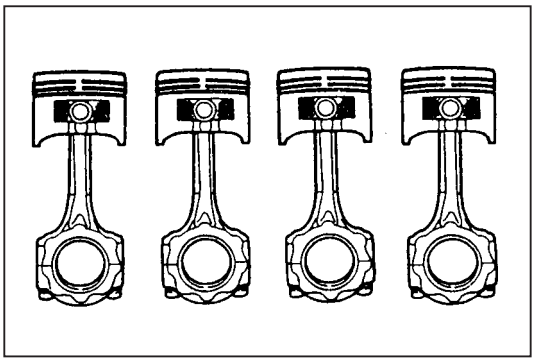
(5) Cover each connecting rod bolt with a short piece of hose to protect the crankpin journal from damage.


JEM00307-00284

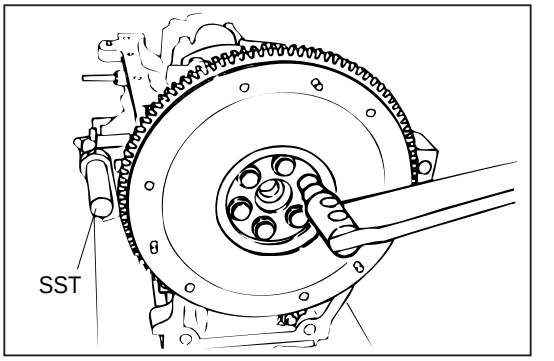
(6) Push out the piston and connecting rod assembly and the upper bearing through the top of the cylinder block.


JEM00308-00285

NOTE:
- Arrange the disassembled pistons and connecting rod in order so that their installation positions may be known readily.
- Care should be exercised so as not to damage the bearings.


JEM00309-00286

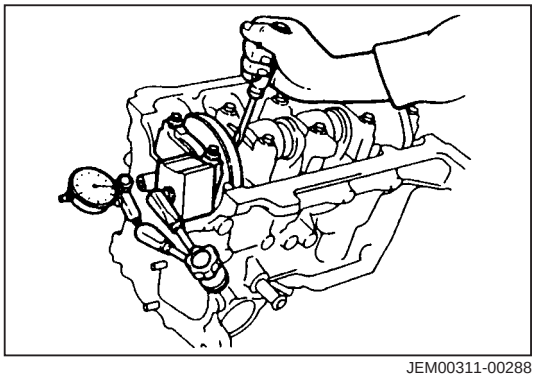
25. Remove the flywheel.
NOTE:
- Prevent the ring gear from turning with the SST.
SST: 09210-87701-000



JEM00310-00287

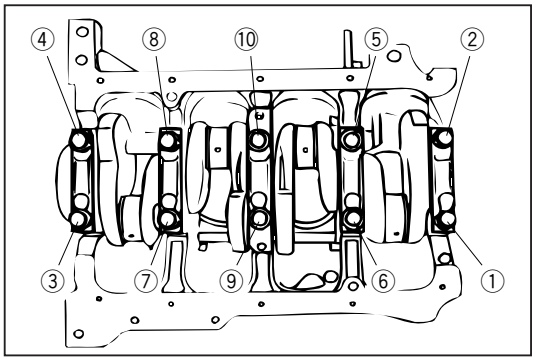
26. Check of crankshaft thrust clearance
NOTE:
- Measure the thrust clearance, using a dial gauge.
Thrust Clearance
Specified Value: 0.02 - 0.22 mm
Allowable Limit: 0.30 mm

If the thrust clearance exceeds the allowable limit, measure the width of the crankshaft thrust bearing contact surface. If the measured value is less than 23.59 mm, replace the thrust washer. If the measured value exceeds 23.59 mm, replace the crankshaft and thrust washer.



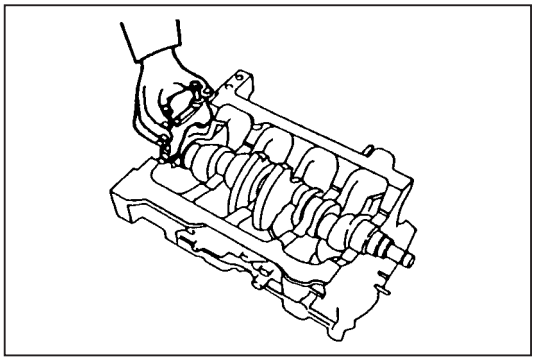
JEM00311-00288

27. Check of crankshaft main journal oil clearance
(1) Gradually loosen the main bearing cap bolts over three stages in the numerical sequence shown in the figure. Remove the bearing cap bolts.



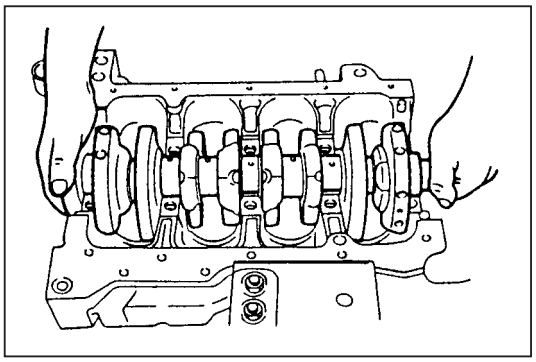
JEM00312-00289

(2) With the main bearing cap bolts inserted into the bolt holes of the main bearing cap, wiggle the bearing cap back and forth. Remove the bearing cap together with the lower bearing.
NOTE:
- Keep the lower bearing fitted to the main bearing cap. Arrange the removed main bearing caps in order.



JEM00313-00290

(3) Lift off the crankshaft.
NOTE:
- Be very careful not to allow the main bearings to be mixed with the bearings of the other cylinders.
- Remove the thrust washer.
- If the main journal or crankshaft bearing exhibit damages, replace the crankshaft or crankshaft bearing as necessary.

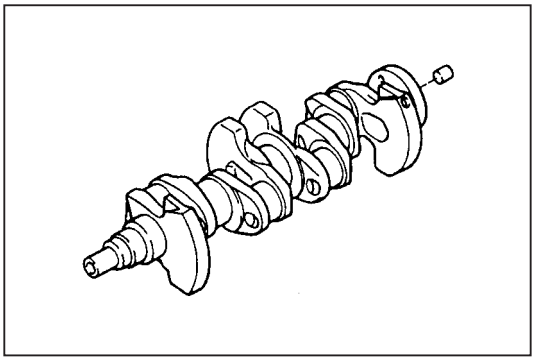


JEM00314-00291

(4) Clean the main journals and bearings, using cleaning solvent. Blow them with compressed air.
WARNING:
- Protect your eyes with safety goggles during the cleaning operation.

JEM00315-00000

(5) Check the main journals and bearings for pitting or scratches.
If the main journals are damaged, replace the crankshaft.
If the main journal bearings are damaged, replace the main journal bearings.

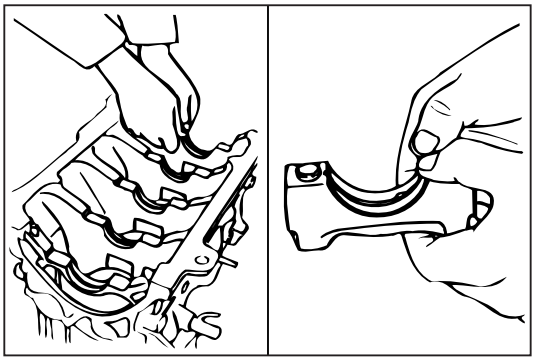


JEM00316-00292

(6) Install the main bearings to the cylinder block and crankshaft main bearing cap.

NOTE:

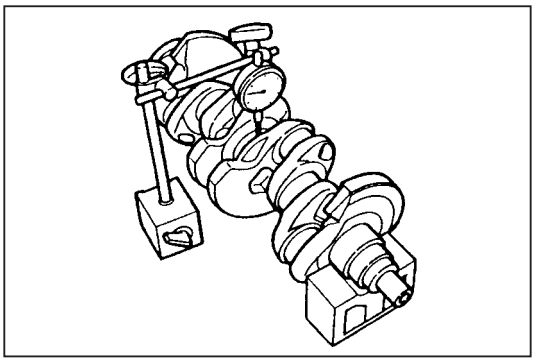
- Do not touch the metal surface of the bearing.



JEM00317-00293

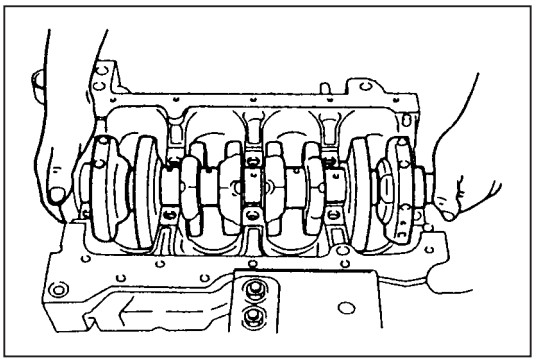
(7) Support the both ends of the crankshaft with a V-block.
Measure the crankshaft runout with a dial gauge.
Allowable Limit of Runout: 0.06 mm

If the runout exceeds the allowable limit, replace the crankshaft.



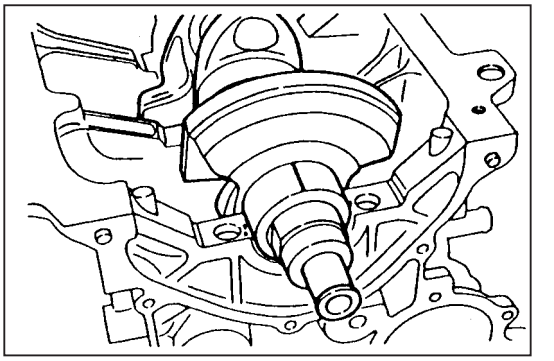
JEM00318-00294

(8) Place the crankshaft in the cylinder block.



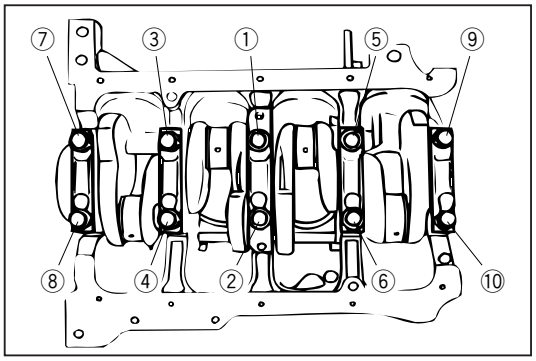
JEM00319-00295

(9) Lay a strip of plastigage across each crankshaft main journal.



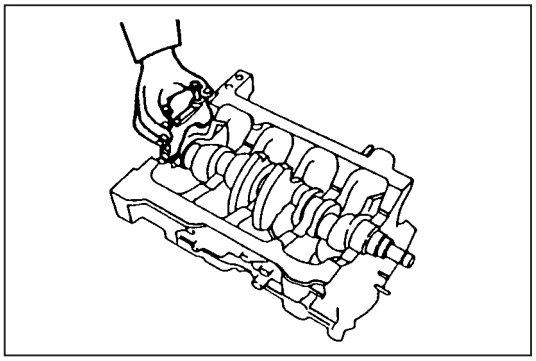
JEM00320-00296

(10) Install the crankshaft bearing caps. Tighten the crankshaft bearing cap bolts evenly in the sequence indicated in the right figure.
Tightening Torque: 44.1 - 53.9 N·m



JEM00321-00297

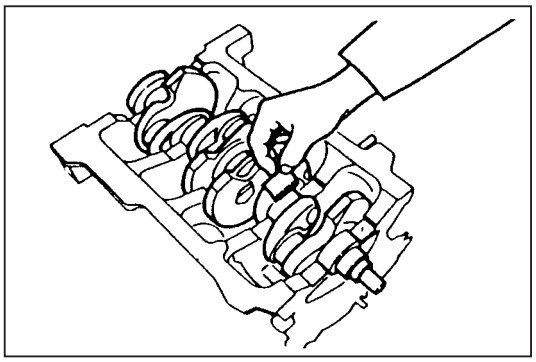
(11) Remove the main bearing caps with the lower bearings fitted on them.


JEM00322-00298

(12) Measure the plastigage width at its widest point.
Oil Clearance: 0.024 - 0.042 mm

If the oil clearance fail to conform to the specified value, measure the crankshaft main journal diameter and select suitable connecting rod bearings or replace the crankshaft.

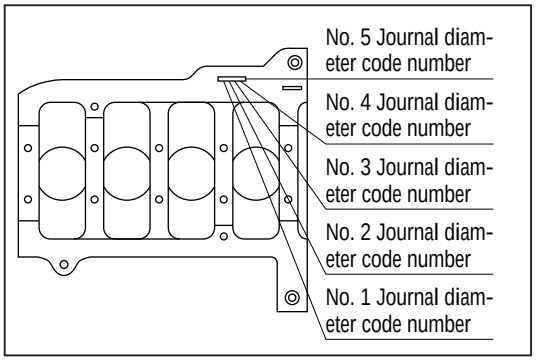
(13) Remove the plastigage from the crankshaft main journals.


JEM00323-00299

28. Selection of crankshaft bearings
NOTE:
- The replacement of the crankshaft bearings should be performed after all inspections have been finished.
- For the selection of the crankshaft bearing as a result of the replacement of the crankshaft, refer to the section under “Replacement of Crankshaft.”

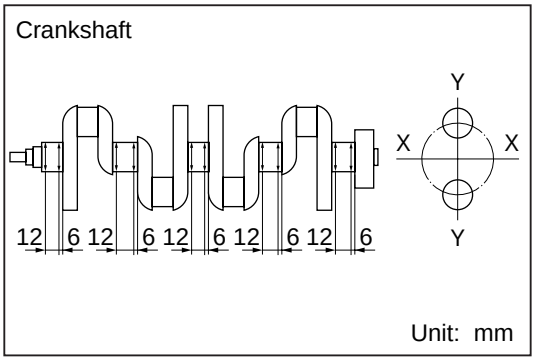
JEM00324-00000

(1) Read the cylinder block main journal diameter code number.
NOTE:
- The main journal diameter code comes in four kinds of 5, 6, 7 and 8.



JEM00325-00300

(2) Measure the diameter of the crankshaft main journals.
The measurement should be performed at four points, 90 degrees spaced, for each crankshaft main journal at the points shown in the right figure. The maximum value is regarded as the crankshaft main journal diameter.
However, if the variation in the measured diameters exceeds 0.026 mm, replace the crankshaft.



JEM00326-00301

(3) Select the crankshaft bearings or replace the crankshaft, based on the results of (1) and (2).

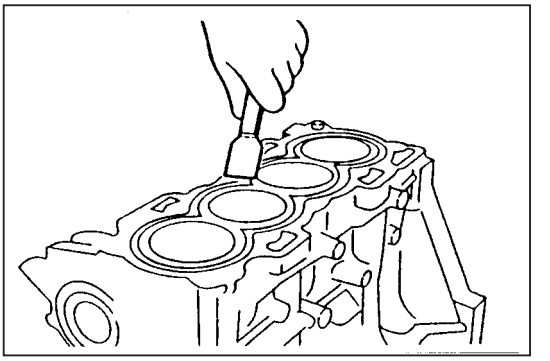
Main journal diameter code	Crank main journal diameter mm	Bearing classification number	Remarks
5	49.995 - 50.000	1	—
	49.989 - 49.994	2	—
	49.983 - 49.988	3	—
	49.976 - 49.982	4	—
	49.975 or less	—	Crankshaft replacement
6	49.995 - 50.000	2	—
	49.989 - 49.994	3	—
	49.983 - 49.988	4	—
	49.976 - 49.982	5	—
	49.975 or less	—	Crankshaft replacement
7	49.995 - 50.000	3	—
	49.989 - 49.994	4	—
	49.983 - 49.988	5	—
	49.976 - 49.982	6	—
	49.975 or less	—	Crankshaft replacement
8	49.995 - 50.000	4	—
	49.989 - 49.994	5	—
	49.983 - 49.988	6	—
	49.976 - 49.982	7	—
	49.975 or less	—	Crankshaft replacement

JEM00327-00000

INSPECTION OF EACH PART

INSPECTION OF CYLINDER BLOCK

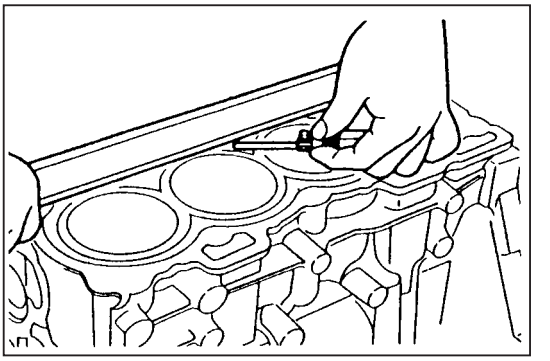
1. Removal of gasket material
   Remove all gasket materials from the cylinder block.
2. Cleaning of cylinder block
   Clean the cylinder block, using a soft brush and cleaning solvent.



JEM00328-00303

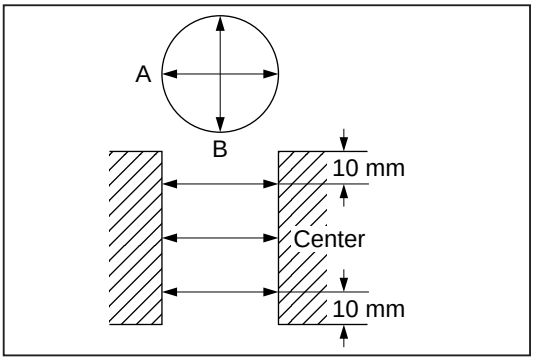
3. Inspection of top surface of cylinder block
   Using a precision straightedge and a thickness gauge, check the surface contacting the cylinder head gasket for warpage.
   Maximum Warpage: 0.10 mm

   If the warpage exceeds the allowable limit, replace the cylinder block.



JEM00329-00304

4. Inspection of cylinder bores
   (1) Measure the bore diameter of each cylinder at the six points shown in the right figure. Ensure that the difference between the maximum and minimum bore diameters of each cylinder is within 0.1 mm.
   If the difference between the maximum and minimum values exceeds 0.1 mm, perform boring and/or honing for the cylinder bore in accordance with the oversized piston.
   The honing angle is 35° ± 5°. The surface coarse degree is 1 - 4Z.

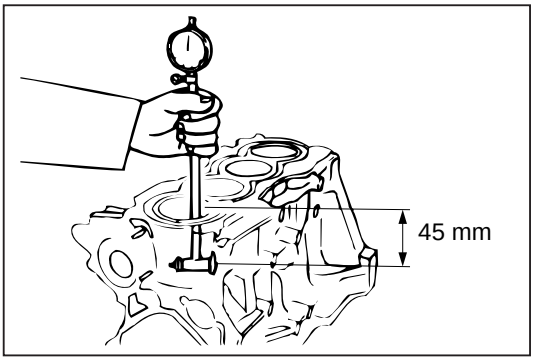


JEM00330-00305

Reference:
The table below shows the cylinder bore diameter when oversized pistons are used.
However, after the diameter of the replacement piston has been measured, perform the finishing in accordance with the piston diameter.

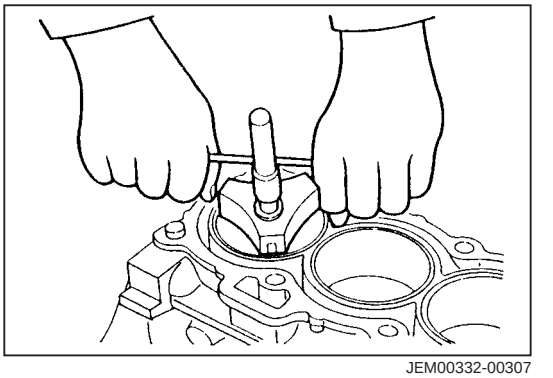
Standard	O/S 0.25
76.000 - 76.030 mm	76.250 - 76.280 mm

(2) Measure the bore diameter of each cylinder at a position shown in the right figure. The measured value is regarded as the cylinder bore diameter.



JEM00331-00306

5. Removal of cylinder ridges
   If ridges are formed at the upper parts of the cylinder bores, use a ridge reamer to remove the ridges.



JEM00332-00307

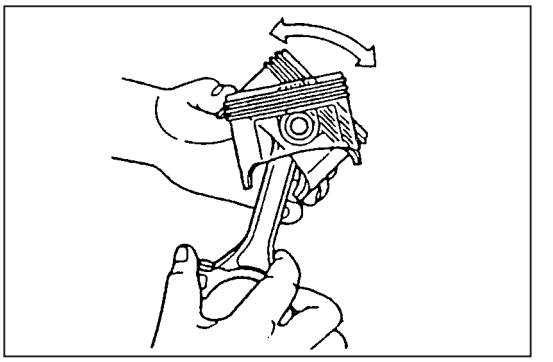
INSPECTION OF PISTONS AND CONNECTING RODS

CAUTION:

- The piston and piston pin are available only as a set so that the oil clearance may become the specified value. Therefore, if you replace a piston or a piston pin, be sure to replace them as a set. Moreover, the piston and piston pin should be handled at all times as a set. Care must be exercised so that the piston or piston pin may be mixed with other ones.

JEM00333-00000

1. Inspection of fit between piston and piston pin
   Try to move the piston back and forth on the piston pin. If any movement is felt replace the piston and piston pin as a set.
   NOTE:
   - When the piston is moved back and forth on the piston pin, you may encounter hard movement. However, if the piston moves smoothly without any binding, this fitting of the piston is normal.



JEM00334-00308

Reference:

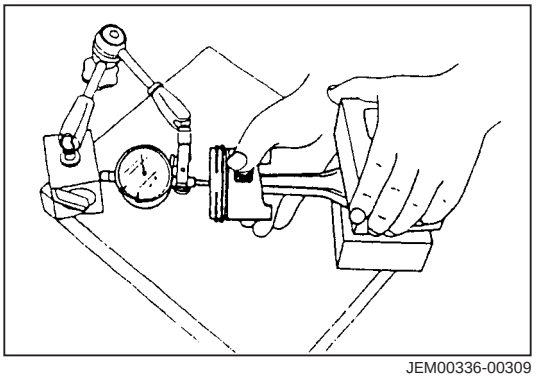
1. The oil clearance between the piston and piston pin is as follows.
   Specified Oil Clearance: 0.005 - 0.011 mm

   NOTE:
   - In the case of a piston and piston pin assembly having this degree of oil clearance, you will hardly feel excessive play when you move the piston by your hands.

JEM00335-00000

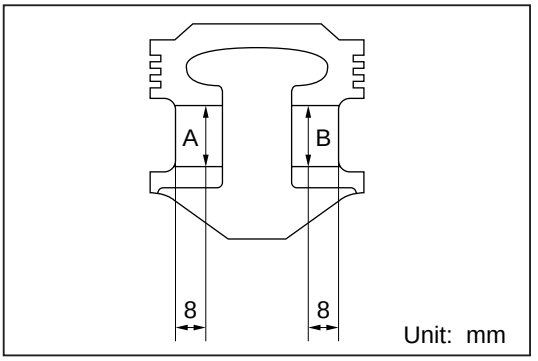
2. Measurement of oil clearance
   NOTE:
   - The oil clearance can be measured, following the procedure given below.

   (1) When measuring oil clearance without disassembling:
   Interpose the big end of the connecting rod between V-blocks on a surface plate. Measure the play while moving the piston, as indicated in the right figure.



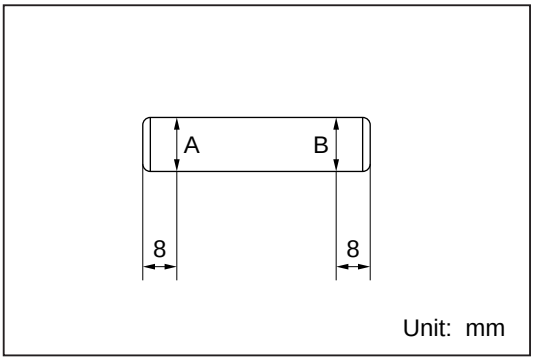
JEM00336-00309

(2) When measuring oil clearance after disassembling:
① Measure the diameter of the whole circumference at the positions A and B indicated in the right figure. The minimum dimension should be the piston pin hole diameter.
Specified Value: 19.002 - 19.005 mm



JEM00337-00310

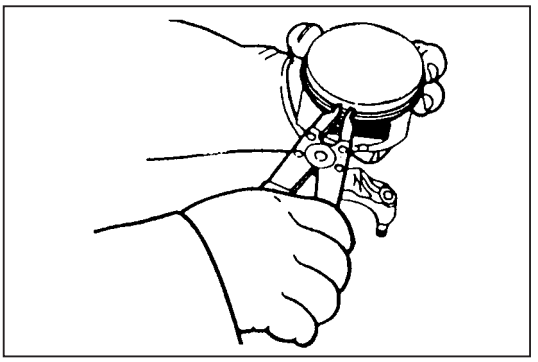
② Measure the diameter of the whole circumference at the positions A and B indicated in the right figure. The maximum dimension should be the piston pin outer diameter.
Specified Value: 18.994 - 18.997 mm



JEM00338-00311

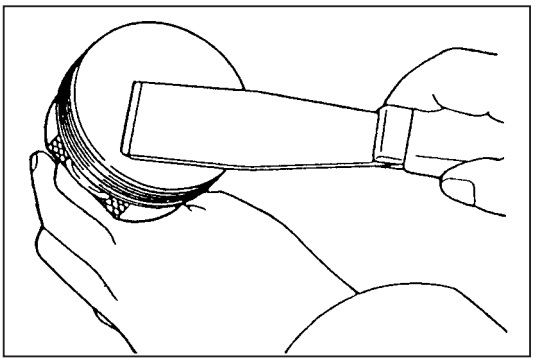
2. Removal of piston rings
NOTE:
- Arrange the removed piston rings in order so that their installation positions may be known readily.
- Do not expand the piston ring unnecessarily beyond the required extent.

(1) Remove the piston rings No. 1 and No. 2, using a piston ring expander.
(2) Remove the oil ring side rails by hand.
(3) Remove the oil ring expander by hand.


JEM00339-00312

INSPECTION OF PISTONS

1. Cleaning of pistons
(1) Remove the carbon deposits from the piston top, using a gasket scraper or the like.
(2) Clean the piston grooves with a broken piston ring or a groove cleaning tool.
NOTE:
- Be very careful not to scratch the piston.


JEM00340-00313

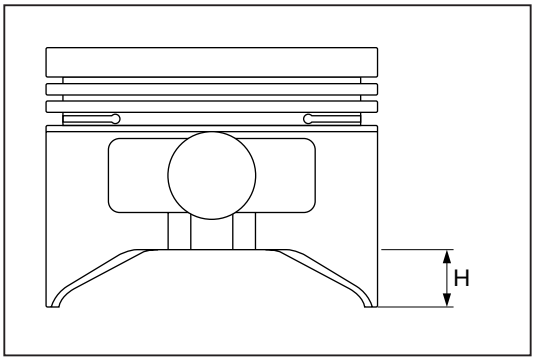
2. Inspection of pistons
Visually inspect the piston for cracks, damage or seizure. Replace the piston, if necessary.

JEM00341-00000

3. Measurement of piston diameter
   (1) Measure the piston outer diameter horizontally at a specified point shown bellow from the lower end of the piston at right angles to the piston pin.
   Specified Measuring Point H: 15 mm

   (2) Calculation of piston-to-cylinder bore clearance
   Subtract the measured piston outer diameter from the measured cylinder bore diameter. Ensure that this piston-to-cylinder bore clearance is less than 0.045 mm.
   Piston-to-Cylinder Bore Clearance
   Specified Value: 0.025 - 0.045 mm
   Allowable Limit: 0.11 mm

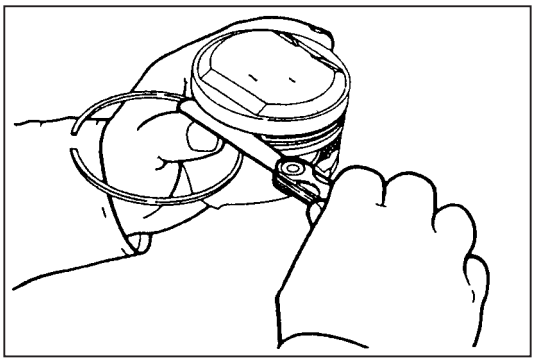
   If the piston-to-cylinder bore clearance exceeds the allowable limit, perform boring and honing the cylinder bores so that the cylinder bore diameter may match with the oversized piston.



JEM00342-00314

JEM00343-00000

4. Inspection of piston ring groove side clearance
   Measure the side clearances of the piston rings No. 1 and No. 2 over the entire periphery of each groove, using a thickness gauge.
   The maximum measured value is regarded as the piston ring side clearance.



JEM00344-00315

Piston ring side clearance

	Specified value mm	Allowable limit mm
Compression ring No. 1	0.03 - 0.07	0.12
Compression ring No. 2	0.02 - 0.06	

If the piston side clearance exceeds the allowable limit, measure the piston ring thickness. Referring to the piston ring standard thicknesses given below, replace the piston ring and/or piston so that the piston ring side clearance may become less than the allowable limit.

JEM00345-00000

Piston ring specified thickness

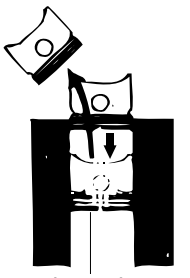
Unit: mm

Compression ring No. 1	1.17 - 1.19
Compression ring No. 2	1.47 - 1.49

NOTE:
- When replacing the piston rings, a set of piston rings for the engine should be replaced.

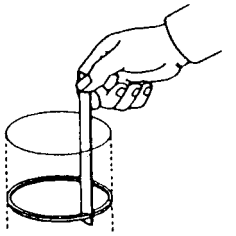
JEM00346-00000

5. Inspection of piston ring end gap
   (1) Apply engine oil to the cylinder walls.
   (2) Insert the piston rings into the cylinder bore.
   (3) Using a piston, push down the piston ring to a point 110 mm from the cylinder block upper surface.



JEM00347-00316

   (4) Measure the piston ring end gap, using a thickness gauge or a feeler gauge.



JEM00348-00317

Piston ring end gap

		Specified value mm	Allowable limit mm
Compression ring No. 1	With “T” mark	0.27 - 0.37	0.7
	With “N” mark	0.27 - 0.40	
Compression ring No. 2		0.4 - 0.55	0.8
Oil ring	Shape of spacer A	0.2 - 0.6	1.0
	Shape of spacer B	0.15 - 0.6	

Oil ring spacer shape

Shape A

Shape B

If the piston ring end gap exceeds the allowable limit, a set of piston rings for that engine should be replaced.

JEM00349-00318

ASSEMBLY/DISASSEMBLY OF PISTON & CONNECTING ROD

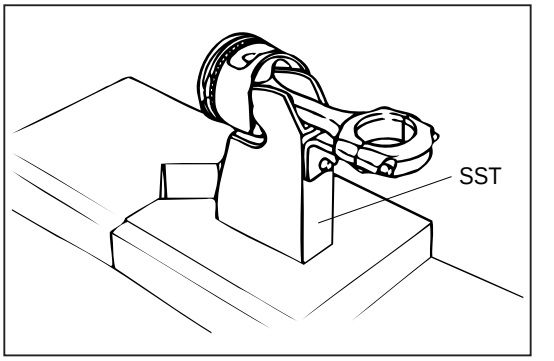
NOTE:

- The piston and piston pin are handled as a set, for their oil clearance is controlled. Therefore, when disassembling the pistons, care must be exercised so that the piston and piston pin may not be mixed with other pistons or piston pins.
- The piston disassembling should be performed only when any malfunction takes place and disassembling is required. Failure to observe this caution may loosen the interference fit between the connecting rod and the piston pin, leading to an engine damage.

1. Disassembly of piston and connecting rod
   Use the following SSTs for the disassembling operation.
   SST: 09221-87704-000
   09221-87705-000

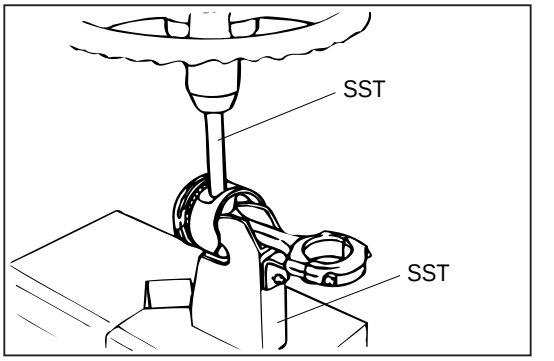
JEM00350-00000

(1) Install the connecting rod in the following SST as shown in the right figure.
SST: 09221-87704-000



JEM00351-00319

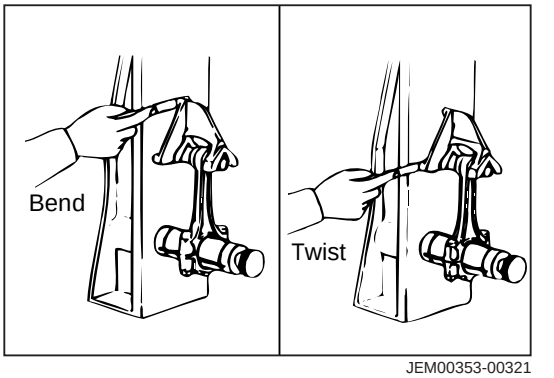
(2) Insert the longer SST into the piston pin hole. Press off the piston, using a hydraulic press.



JEM00352-00320

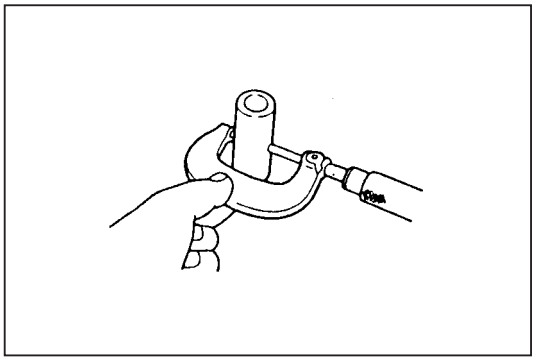
2. Inspection of connecting rods
   (1) Visually inspect the connecting rods for damage or cracks.
   (2) Check the connecting rod for bend and twist, using a connecting rod aligner.
   Maximum Bend: 0.05 mm
   Maximum Twist: 0.05 mm

   If the bend and/or twist is greater than the maximum limit, replace the connecting rod assembly.



JEM00353-00321

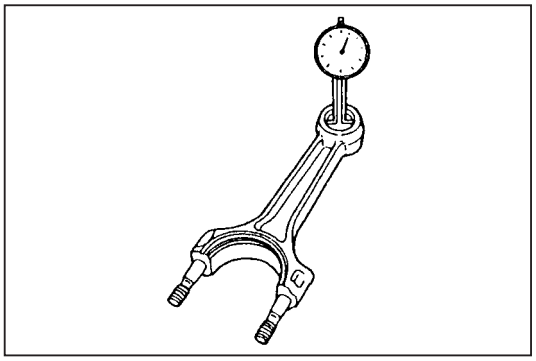
3. Inspection of piston pin-to-connecting rod interference fit
   (1) Measure the outer diameter of the piston pin contacting with the connecting rod, using a micrometer.



JEM00354-00322

   (2) Measure the inner diameter of the connecting rod, using a bore dial gauge.
   (3) Determine the interference fit by subtracting the inner diameter of the connecting rod from the outer diameter of the piston pin.
   Interference Fit: 0.015 - 0.044 mm

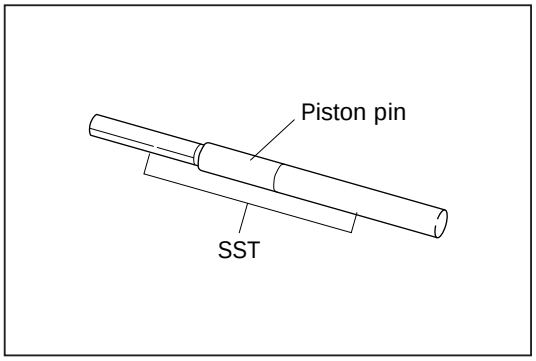
   If the interference fit does not conform to the specification, replace the connecting rod.



JEM00355-00323

4. Assembly of piston and connecting rod
   Use the following SSTs for the assembling operation.
   SST: 09221-87704-000
   09221-87705-000

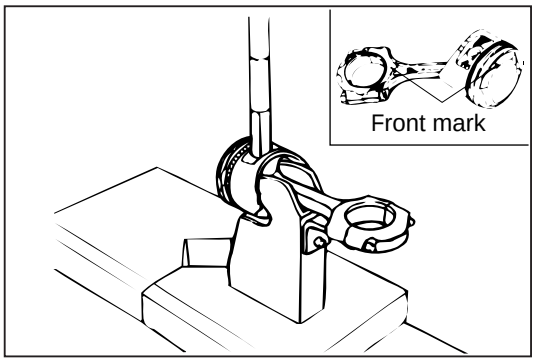
   (1) Install the piston pin to the following SST in a way shown in the right figure.
   SST: 09221-87705-000



JEM00356-00324

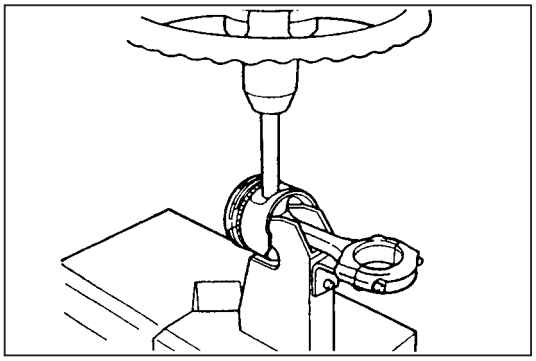
   (2) Install the piston and connecting rod in the SST in a way shown in the right figure. Insert the SST installed with the piston pin into the piston pin hole.
   SST: 09221-87704-000
   09221-87705-000

   NOTE:
   - The piston and connecting rod should be assembled in such a way that the piston front mark and connecting rod front mark come in the same direction.



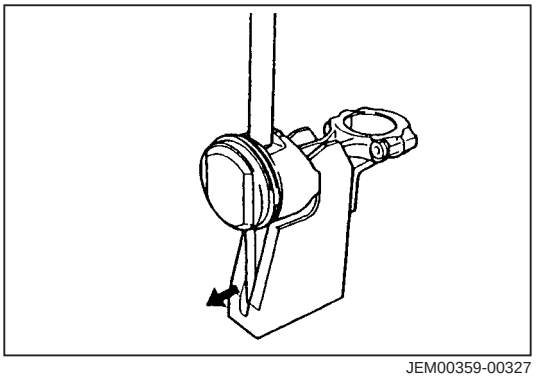
JEM00357-00325

   (3) Press the piston pin into the piston and connecting rod, using a hydraulic press.



JEM00358-00326

(4) Remove the piston and connecting rod assembly from the SST. Remove the SST from the piston pin.



JEM00359-00327

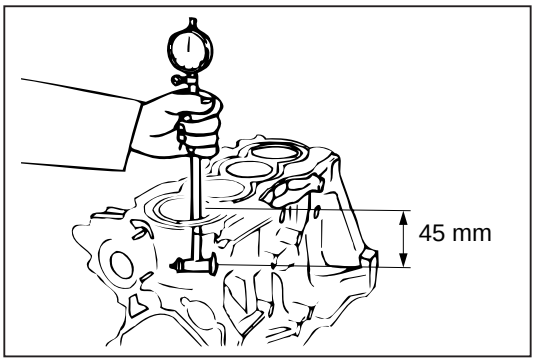
CYLINDER BORING

NOTE:

- When the cylinder is bored, all cylinders should be bored at the same time.
- As for piston rings, use oversized piston rings.

JEM00360-00000

1. Measurement of cylinder bore diameter
   Measure the diameter at a point 45 mm from the cylinder upper surface in the direction shown in the right figure.
   If the measured value exceeds 76.28 mm, replace the cylinder block.



JEM00361-00328

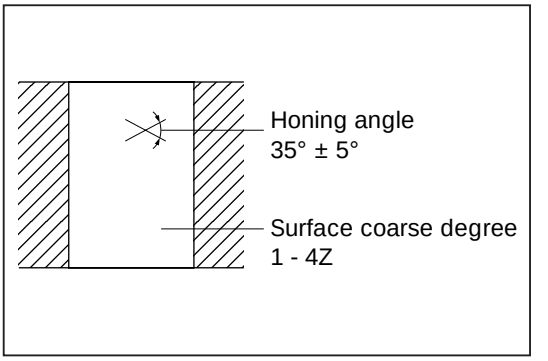
2. Determining cylinder finishing diameter
   (1) Measure the diameter of the oversized piston to be used, using a micrometer.
   NOTE:
   - The measurement should be conducted at the specified skirt section from the piston lower end.
   - Perform the measurement horizontally, not in a tilted state.

JEM00362-00000

   (2) Calculate the finishing dimension, as follows.
   A: Piston diameter
   B: Piston-to-cylinder bore clearance
   0.025 - 0.045 mm
   C: Honing allowance
   0.02 mm
   D: Finishing diameter
   D = A + B – C

JEM00363-00000

3. Hone the cylinder after the boring.
   (1) Bore the cylinder, leaving a honing allowance of 0.02 mm.
   (2) Hone the cylinder.
   Honing Angle: 35° ± 5°
   Surface Coarse Degree: 1 - 4Z

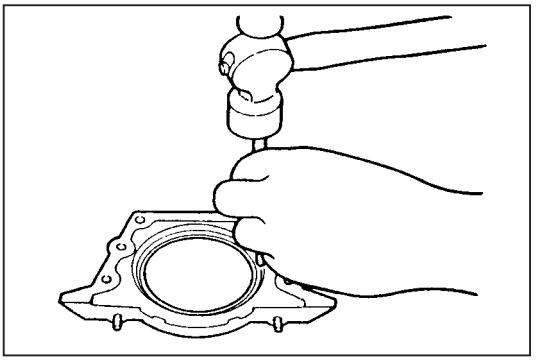


JEM00364-00329

REPLACEMENT OF REAR OIL SEAL

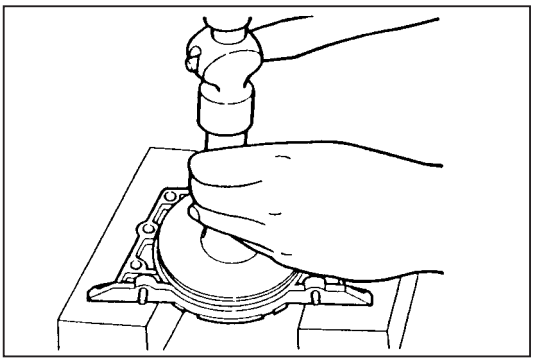
(1) Removal of rear oil seal
Remove the rear oil seal from the rear oil seal retainer, using a pin punch.

NOTE:
- Be very careful not to damage the oil seal retainer.


JEM00365-00330

(2) Installation of rear oil seal
Drive a new rear oil seal into position, using the following SST.
SST: 09223-41020-000

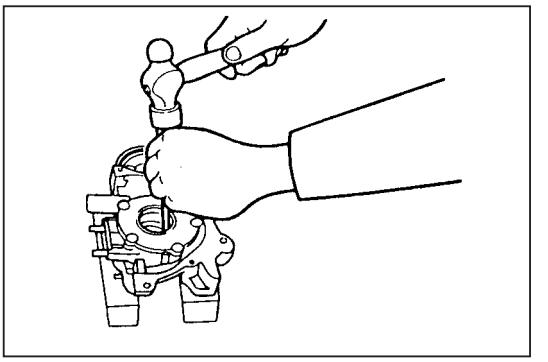
NOTE:
- Care must be exercised to ensure that the oil seal is not driven in a tilted state.


JEM00366-00331

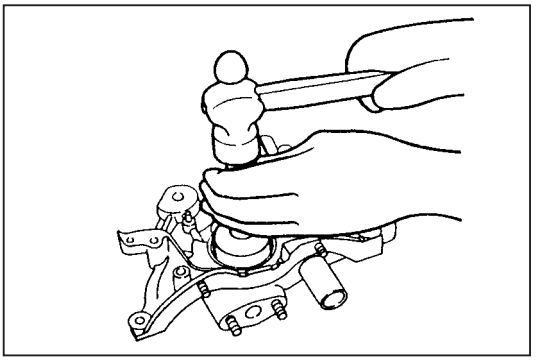
REPLACEMENT OF FRONT OIL SEAL

(1) Removal of front oil seal
Remove the front oil seal from the oil pump, using a pin punch.

NOTE:
- Be very careful not to damage the oil pump during the removal.


JEM00367-00332

(2) Installation of front oil seal
Drive a new front oil seal into position, using the following SST.
SST: 09310-87102-000

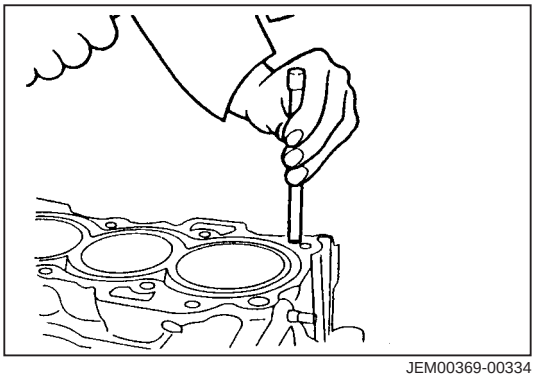

JEM00368-00333

REPLACEMENT OF CYLINDER BLOCK

NOTE:

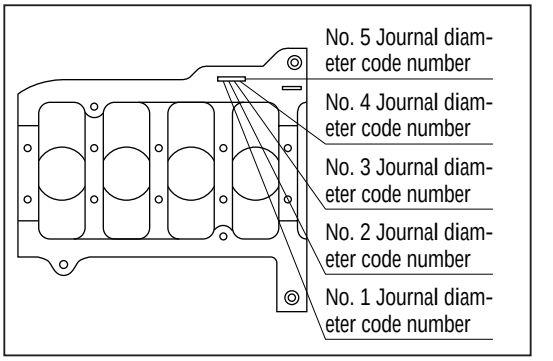
- The cylinder block is furnished along with the pistons as a set. Hence, make sure that each piston is installed in the mated cylinder bore.

1. Wash the cylinder block using cleaning solvent.
2. Drive the oil orifice until it is recessed 3.0 ± 1.0 mm from the cylinder upper surface.
   NOTE:
   - For driving this oil orifice, use an iron rod having an outer diameter of 10 mm.



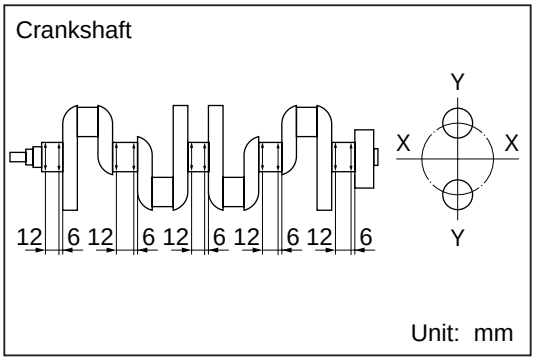
JEM00369-00334

3. Selection of crankshaft bearings
   (1) Read the crankshaft journal diameter code number of the cylinder block.



JEM00370-00335

   (2) Measure the main journal diameter of the crankshaft at those points indicated in the right figure.
      - The measurement should be conducted in four directions for each main journal, 90 degrees spaced, at those points indicated in the right figure.
   (3) Select the crankshaft bearings in accordance with the table next page.

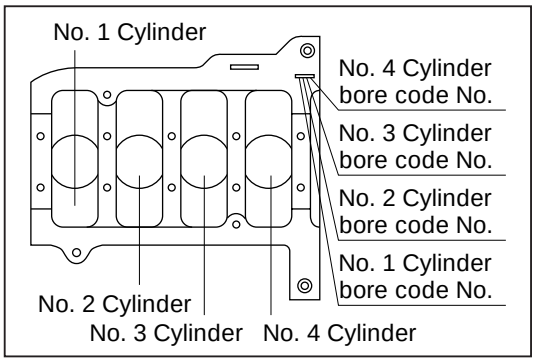


JEM00371-00336

Crankshaft jurnal hole code	Crankshaft journal diameter mm	Crankshaft bearing classification No.	Remarks
5	50.000 - 49.995	1	—
	49.994 - 49.989	2	—
	49.988 - 49.983	3	—
	49.982 - 49.976	4	—
	49.975 or less	—	Crankshaft replacement
6	50.000 - 49.995	2	—
	49.994 - 49.989	3	—
	49.988 - 49.983	4	—
	49.982 - 49.976	5	—
	49.975 or less	—	Crankshaft replacement
7	50.000 - 49.995	3	—
	49.994 - 49.989	4	—
	49.988 - 49.983	5	—
	49.982 - 49.976	6	—
	49.975 or less	—	Crankshaft replacement
8	50.000 - 49.995	4	—
	49.994 - 49.989	5	—
	49.988 - 49.983	6	—
	49.982 - 49.976	7	—
	49.975 or less	—	Crankshaft replacement

JEM00372-00000

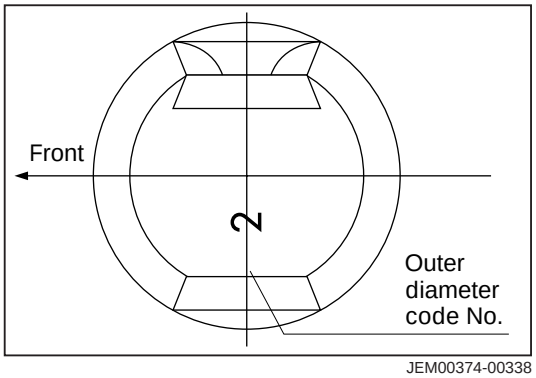
4. Selection of pistons
   (1) Read the cylinder block bore code number.



JEM00373-00337

   (2) Select a piston having the same classification number as the cylinder block bore code number.

NOTE:
- The piston code number is stamped on the top of each piston.



JEM00374-00338

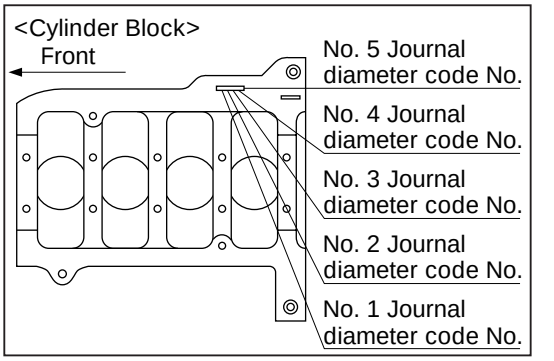
REPLACEMENT OF CRANKSHAFT

(Replacement of the crankshaft only)

1. Wash the crankshaft using cleaning solvent. Dry it with compressed air.
   NOTE:
   - Make sure that the oil gallery exhibits no restriction due to rust-proof oil.
   - As for the crankshaft for automatic transmission, drive the rear end bush into the rear end of the crankshaft with a brass rod so as to prevent damage to the bush.

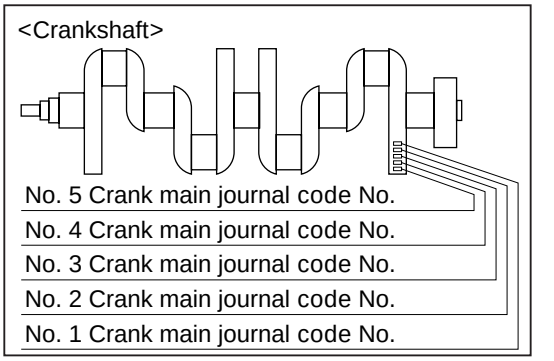
JEM00375-00000

2. Selection of crankshaft bearings
   (1) Read the crankshaft journal diameter code number of the cylinder block.



JEM00376-00339

   (2) Read the crankshaft main journal diameter code number.



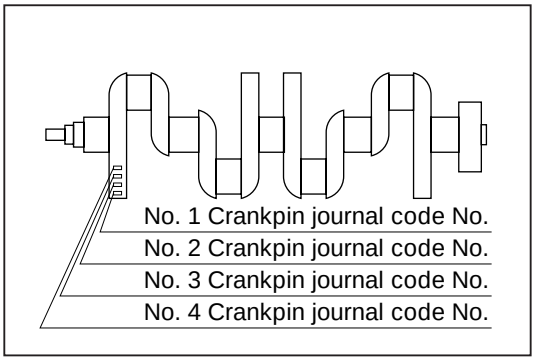
JEM00377-00340

   (3) Establish the crankshaft bearing classification number, using the table below.

Cylinder block \ Crankshaft		Crankshaft journal 1	2	3	4
Crankshaft journal diameter code No.	5	4	3	2	1
	6	5	4	3	2
	7	6	5	4	3
	8	7	6	5	4

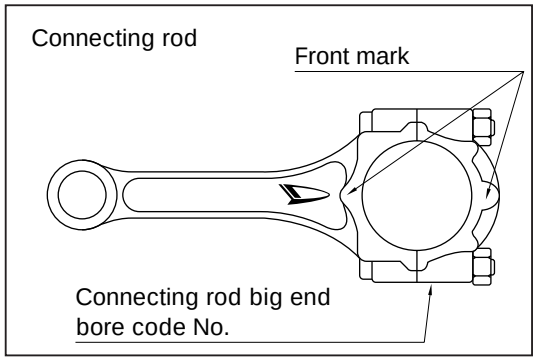
JEM00378-00000

3. Selection of connecting rod bearings
   (1) Read the crankpin journal diameter code number.



JEM00379-00341

(2) Read the connecting rod big end bore code number.



JEM00380-00342

(3) Establish the classification number of the connecting rod bearing, using the table below.

Connecting rod \ Crankshaft		Crankpin journal diameter code No.		
		1	2	3
Connecting rod big end bore code No.	4	3	2	1
	5	4	3	2
	6	5	4	3

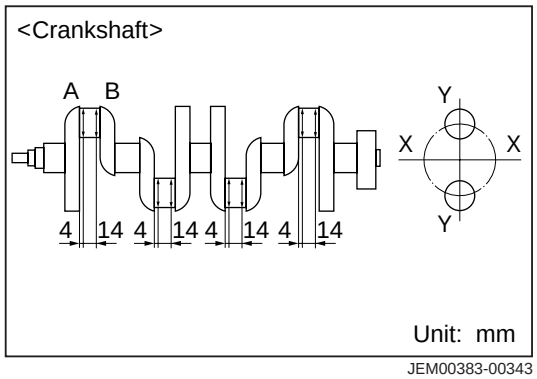
JEM00381-00000

REPLACEMENT OF CONNECTING RODS

1. Wash the connecting rods using cleaning solvent.
   WARNING:
   - Be sure to protect your eyes, wearing goggles.

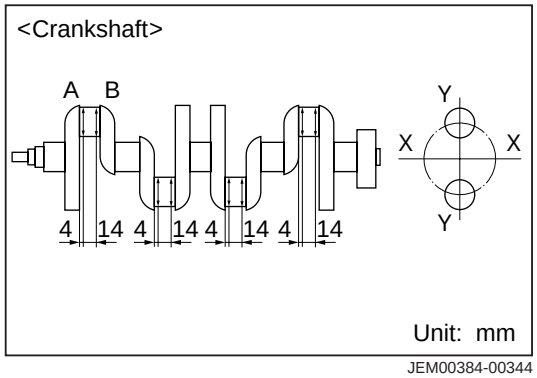
JEM00382-00000

2. Selection of connecting rod bearings
   (1) Read the connecting rod big end bore code number.



JEM00383-00343

   (2) Measure the crankshaft pin diameter of the crankshaft in four directions for each crankshaft pin, 90 degrees spaced, at those points indicated in the right figure.
   NOTE:
   - The greatest value among the measured diameters is regarded as the crankpin journal diameter.
     However, if the difference among the measured values exceeds 0.044 mm, replace the crankshaft.



JEM00384-00344

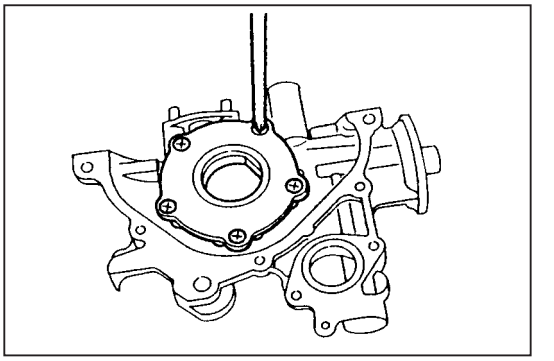
   (3) Select the connecting rod bearing in accordance with the table posted in next page.

Connecting rod big end bore code No.	Crankpin journal diameter mm	Connecting rod bearing classification No.	Remarks
4	45.000 - 44.993	1	—
	44.992 - 44.985	2	—
	44.984 - 44.976	3	—
	44.975 or less	—	Crankshaft replacement
5	45.000 - 44.993	2	—
	44.992 - 44.985	3	—
	44.984 - 44.976	4	—
	44.975 or less	—	Crankshaft replacement
6	45.000 - 44.993	3	—
	44.992 - 44.985	4	—
	44.984 - 44.976	5	—
	44.975 or less	—	Crankshaft replacement

JEM00385-00000

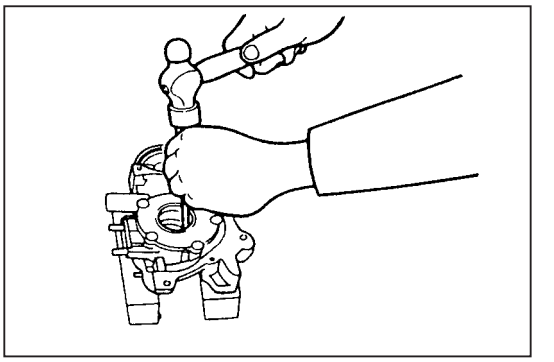
DISASSEMBLY OF OIL PUMP

1. Detach the oil pump cover.



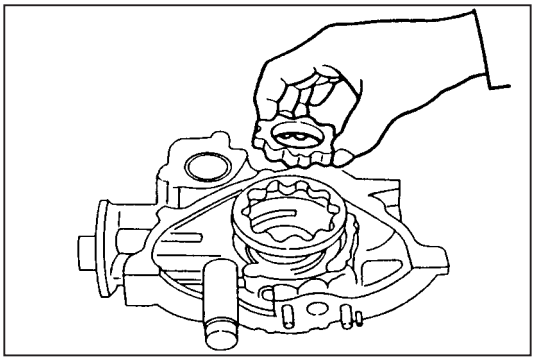
JEM00386-00345

2. Remove the front oil seal.



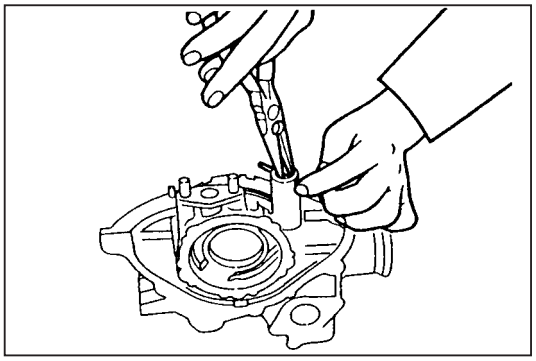
JEM00387-00346

3. Remove the oil pump rotor set.



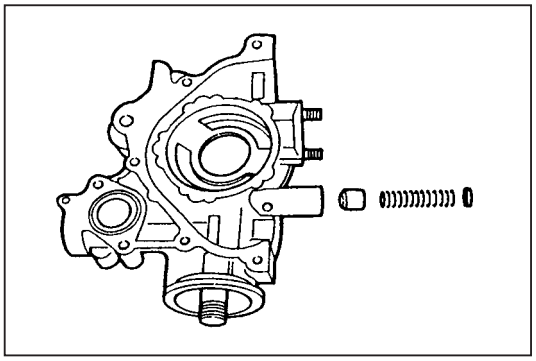
JEM00388-00347

4. Pull out the cotter pin, while pushing the spring retainer with nose pliers or the like.
   NOTE:
   - Put an appropriate cloth, etc. on the retainer spring so that it may not jump out.



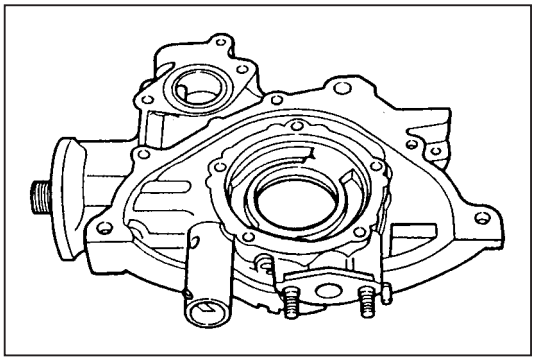
JEM00389-00348

5. Remove the oil pump relief valve spring retainer, compression spring and oil pump relief valve.
   NOTE:
   - Wash the disassembled parts in cleaning solvent.



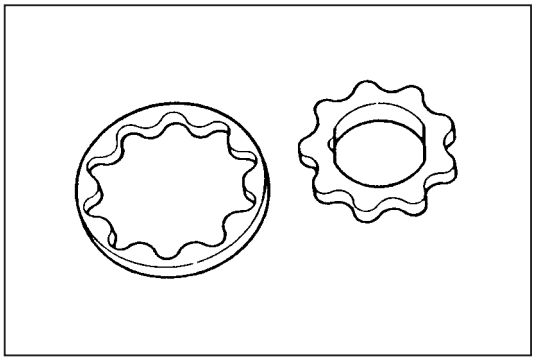
JEM00390-00349

6. Inspection of each part
   (1) Check the pump body for damage.
   Replace the pump body if it exhibits damage.



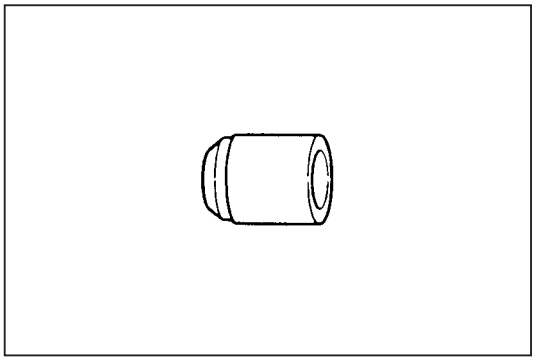
JEM00391-00350

   (2) Check the rotor set for damage.
   Replace the rotor set if it exhibits damage.



JEM00392-00351

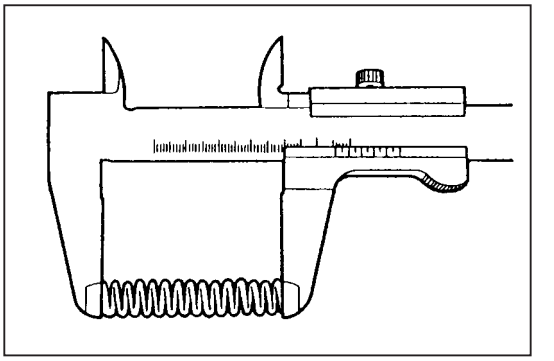
   (3) Check the oil pump relief valve for damage.
   Replace the relief valve if it exhibits damage. Also, check to see if any damage is present at the relief valve installation hole of the oil pump body.



JEM00393-00352

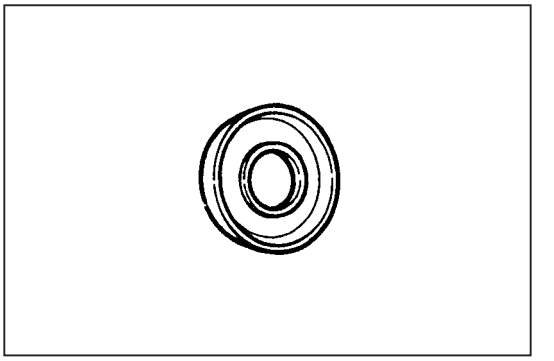
(4) Check the compression spring for damage. Also, measure its free length.
Specified Free Length: 57 mm

Replace the compression spring if it exhibits damage or the free length is less than the specified valve.



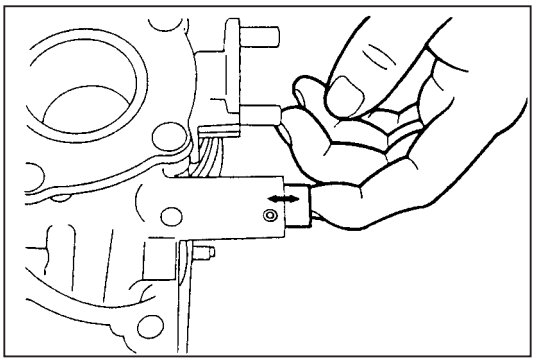
JEM00394-00353

(5) Check the oil pump relief valve spring retainer for damage.
Replace the retainer if it exhibits damage.



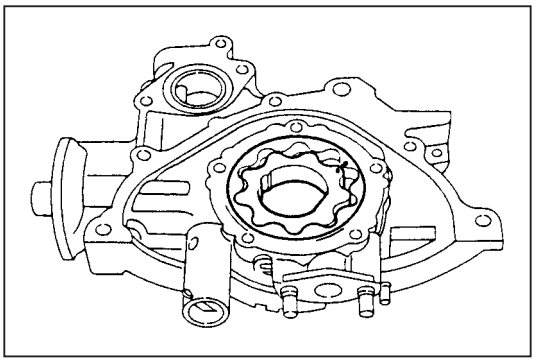
JEM00395-00354

(6) Apply engine oil to the oil pump relief valve. Insert the oil pump relief valve into the oil pump body. Check to see if the valve slides smoothly.
Replace the oil pump body if the valve fails to slide smoothly.



JEM00396-00355

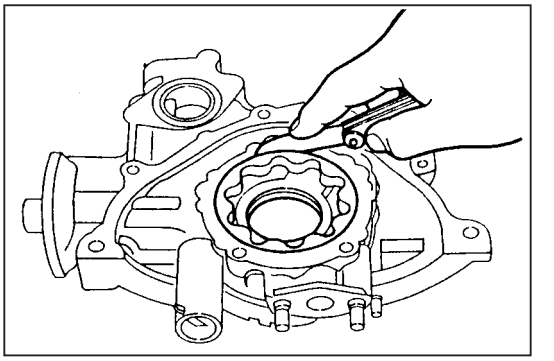
7. Measurement of body clearance, tip clearance and side clearance
(1) Apply a thin film of engine to the rotor mate surface of the oil pump body as well as to the rotor set. Assemble the rotor set in the oil pump body in such a way that the drilled mark may be seen from the outside.



JEM00397-00356

(2) Measure the body clearance between the oil pump body and the outer rotor, using a thickness gauge.
Body Clearance: 0.20 - 0.28 mm

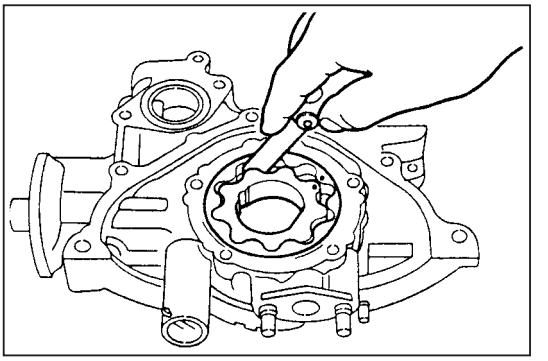
Replace the oil pump if the body clearance exceeds the specified value.



JEM00398-00357

(3) Measure the tip clearance of the rotor set, using a thickness gauge.
Tip Clearance: 0.16 - 0.24 mm

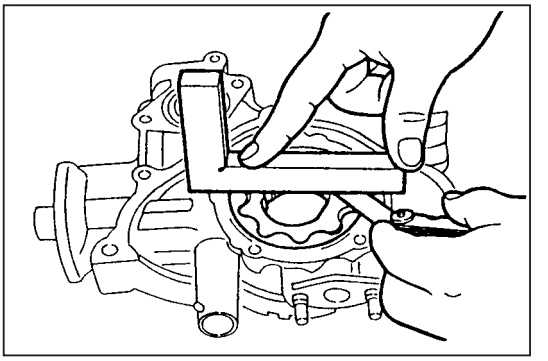
Replace the rotor set if the tip clearance exceeds the specified value.



JEM00399-00358

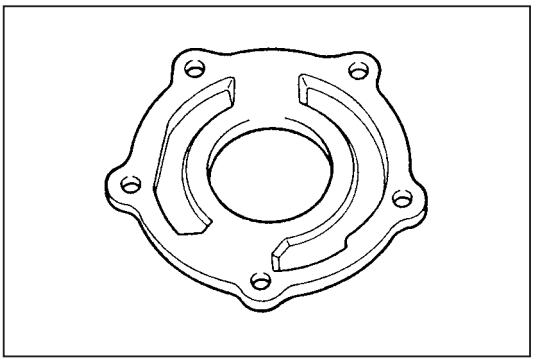
(4) Measure the side clearance between the oil pump body and the rotor set, using and a straightedge and a thickness gauge.
Side Clearance: 0.035 - 0.085 mm

Replace the oil pump if the side clearance exceeds the specified value.



JEM00400-00359

8. Check to see if any wear is present at the rotor set mate surface of the pump cover.
Replace the oil pump cover if it exhibits wear.



JEM00401-00360

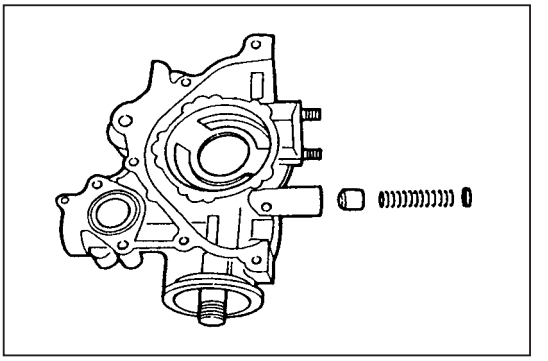
ASSEMBLY OF OIL PUMP

NOTE:
- Wash those parts to be assembled in cleaning solvent. Dry them using compressed air.

WARNING:
- When you use compressed air, be sure to protect your eyes,wearing goggles.

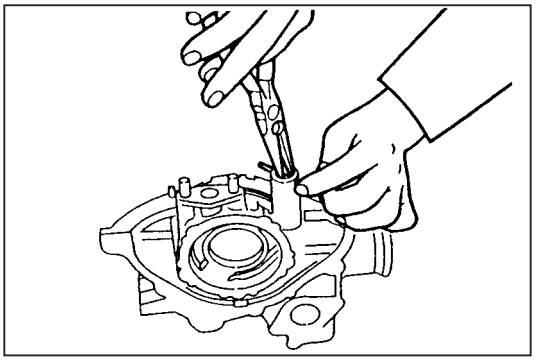
JEM00402-00000

1. Apply engine oil to the relief valve. Then, insert the relief valve into the oil pump body.
2. Insert the compression spring and retainer into the oil pump body.
NOTE:
- Install the retainer in such a direction that its projected side may come at the compression spring side.



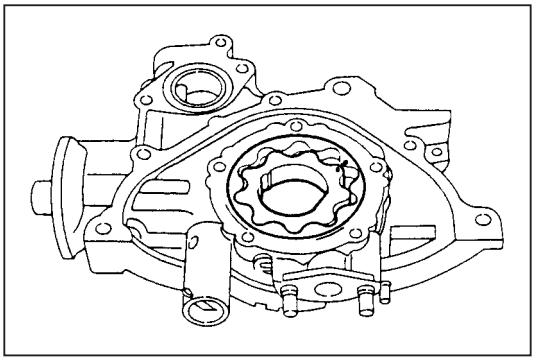
JEM00403-00361

3. Insert a new cotter pin into the retainer while the retainer is being compressed with pliers, etc. Split the end of the cotter pin to form an anchor-like shape.



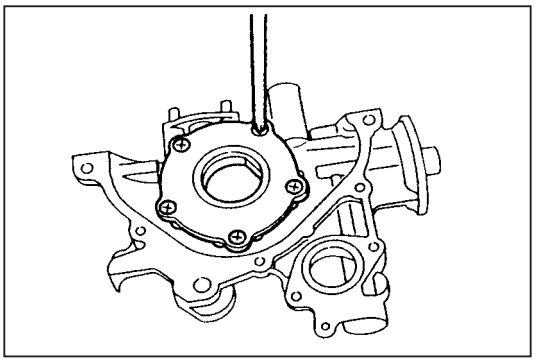
JEM00404-00362

4. Apply engine oil to the rotor set. Assemble the rotor set in the pump body in such a direction that the drilled mark of the rotor may be seen from the outside.



JEM00405-00363

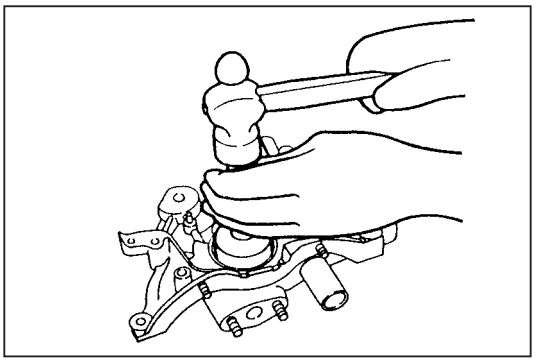
5. Install the oil pump cover. Tighten the cover to the specified torque.
   Tightening Torque: 7.8 - 12.7 N·m



JEM00406-00364

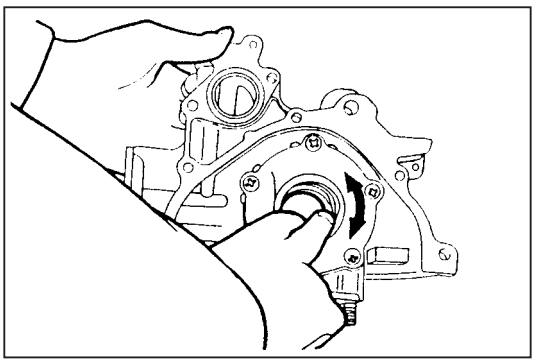
6. Drive a new oil seal into position, using the following SST.
   SST: 09310-87102-000

   NOTE:
   - Be very careful not damage the oil pump during the installation.
   - Make sure that the oil seal is not driven into position in a tilted state.



JEM00407-00365

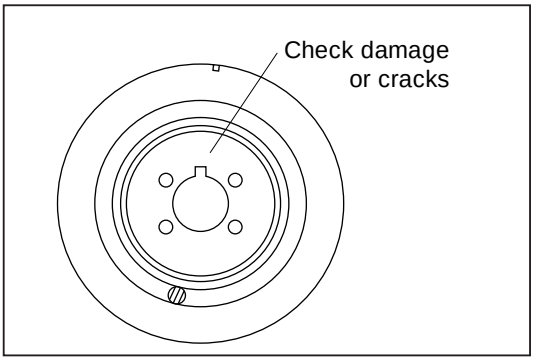
7. Turn the rotor by hand. Ensure that the rotor turns smoothly.
   If the rotor will not turn smoothly, overhaul the oil pump.
   NOTE:
   - The oil pump performance test procedure is described in the LU section.



JEM00408-00366

INSPECTION OF CRANKSHAFT PULLEY

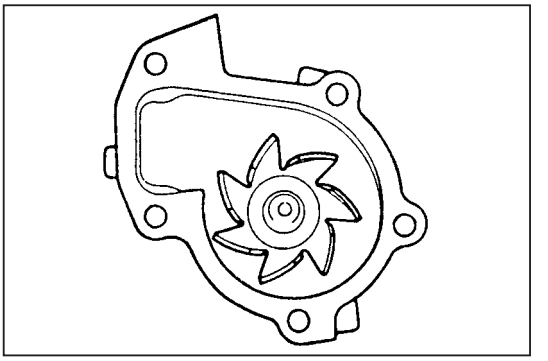
1. Visual inspection of crankshaft pulley
   (1) Check the crankshaft pulley attaching seat for deformation, wear or cracks.
   (2) Check the V-ribbed belt attaching surface for scratches, deformation or wear.
   Replace the crankshaft pulley, as required.



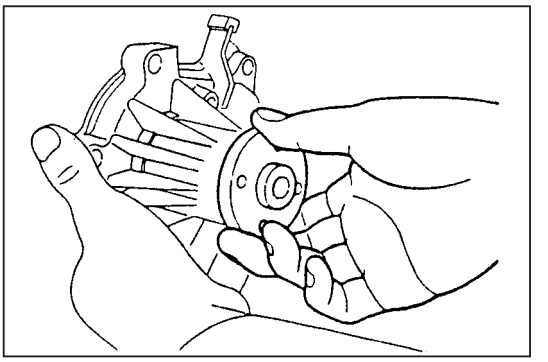
JEM00409-00367

INSPECTION OF WATER PUMP

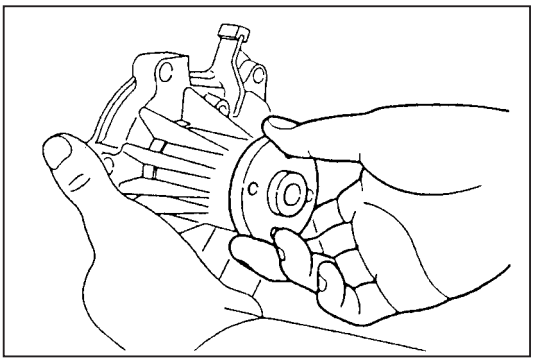
1. Visually inspect the water pump.
   (1) Mechanical seal section for evidence of water leakage
   (2) Rotary fin of water pump for scratches, deformation or cracks
   (3) Water pump attaching surface for scratches
   (4) Water pump pulley attaching seat for scratches or flattened condition
   Replace the water pump, as required.


JEM00410-00368

2. Check the water pump bearing and water pump pulley attaching section for excessive play.
   Replace the water pump, if necessary.

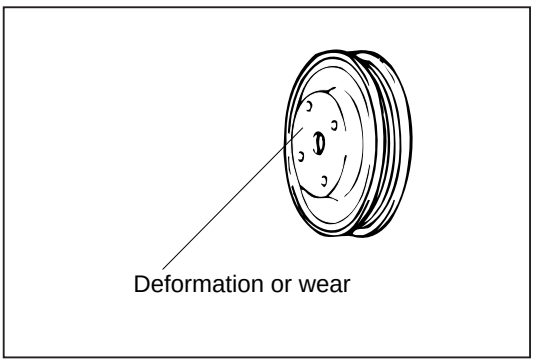

JEM00411-00369

3. Turn the water pump by hand. Ensure that the water pump turns smoothly.
   Replace the water pump, if necessary.


JEM00412-00370

INSPECTION OF WATER PUMP PULLEY

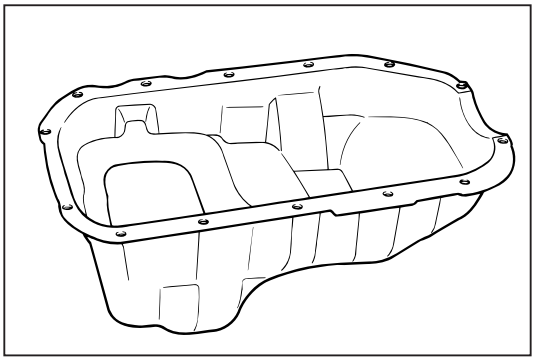
1. Visual inspection of water pump pulley
   (1) Inspect the water pump pulley attaching section for deformation or wear.
   (2) Inspect the V-ribbed belt attaching surface for deformation or wear.
   Replace the water pump pulley, if necessary.



JEM00413-00371

INSPECTION OF OIL PAN

Visually inspect the oil pan for damage or cracks.
Replace the oil pan, as required.



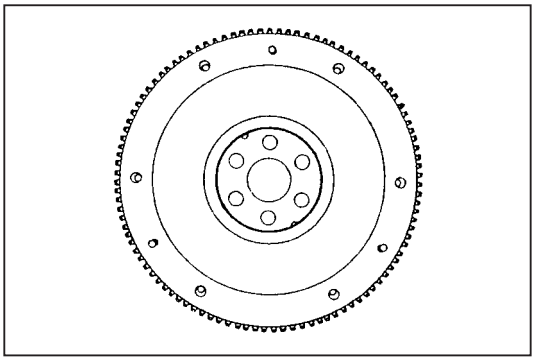
JEM00414-00372

INSPECTION OF FLYWHEEL

Inspect the flywheel for cracks or damage.
Replace the flywheel if it exhibits defects.

INSPECTION AND REPLACEMENT OF RING GEAR

Inspect the ring gear for damage.
Replace the flywheel if it exhibits defects.



JEM00415-00373

CAUTION:

- Never disassemble the flexible type flywheel by removing the flex-plate from the flywheel subassembly.
  If the flywheel has undergone disassembling, it would cause breakage of the flywheel due to unbalanced flywheel mass, while the engine is running.
- Never expose the flexible type flywheel to flame of a burner, etc. If the flywheel is exposed to flame of a burner, for example, at the time of replacement of the ring gear, the quenched state of the flex-plate will be weakened. This may lead to breakage during the engine running.

JEM00416-00000

ASSEMBLY OF CYLINDER BLOCK

NOTE:

- As for those parts to be reassembled, wash them in cleaning solvent (excluding those parts, such as grease-sealed type bearings, dust seals and electrical parts).
- Then, dry them using compressed air.
- Remove any remaining sealer, etc. from the threaded portions of the switches and sensors.

WARNING:

- Protect your eyes with goggles when using compressed air.

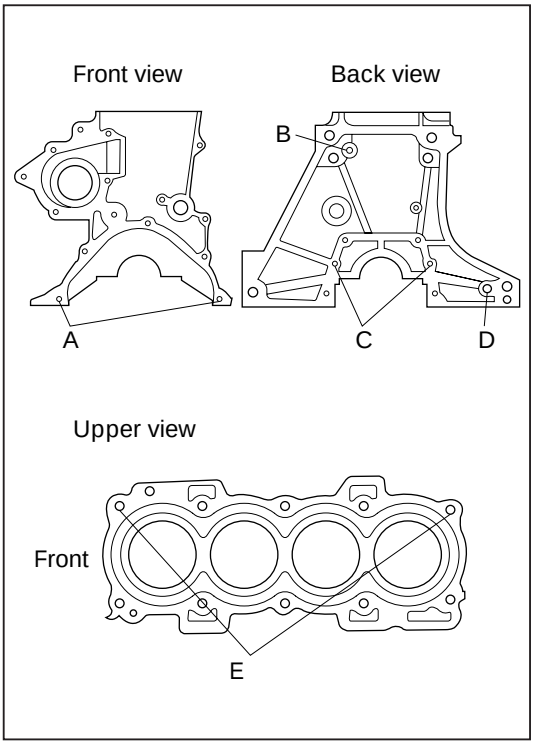
JEM00419-00000

1. Ensure that the straight pins are installed at the positions of the front, rear and upper sides of the cylinder block, as indicated in the right figure. Also, ensure that the protrusion of each straight pin conforms to the specified amount given below.

   Specified Amount of Protrusions

   A: 4 ± 0.5 mm
   B: 8 ± 1.0 mm
   C: 7 ± 1.0 mm
   D: 3 ± 1.0 mm
   E: 6.5 ± 1.0 mm

   If no straight pin is installed or its protrusion fails to conform to the specified value, replace the straight pin with a new one.

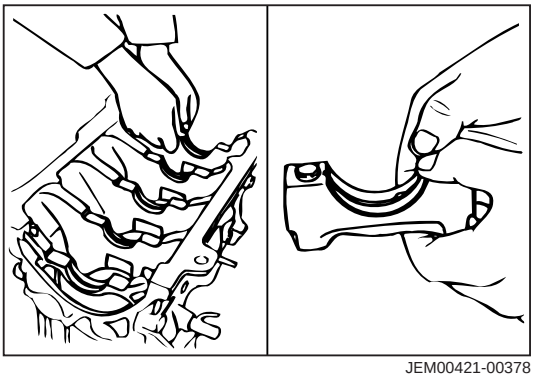


JEM00420-00377

2. Installation of crankshaft
   (1) Install the bearings to the cylinder block and crankshaft bearing caps.

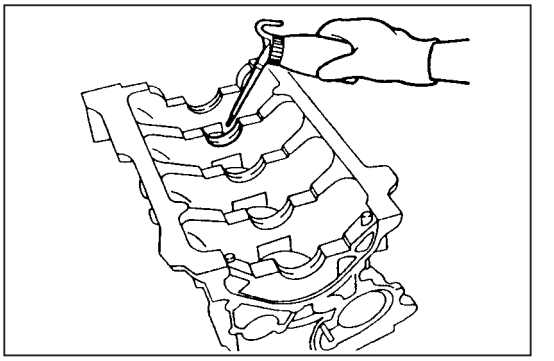
   NOTE:

   - Do not touch with the front and back surfaces of each bearing. Be sure to hold the bearing at its edge surfaces.

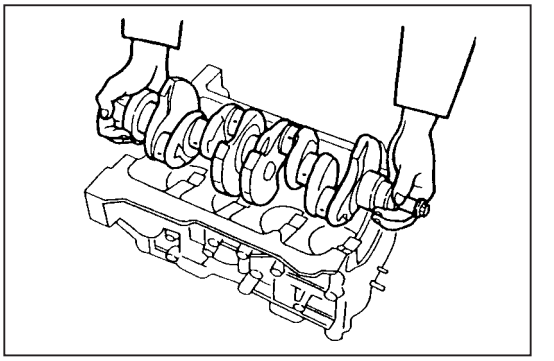


JEM00421-00378

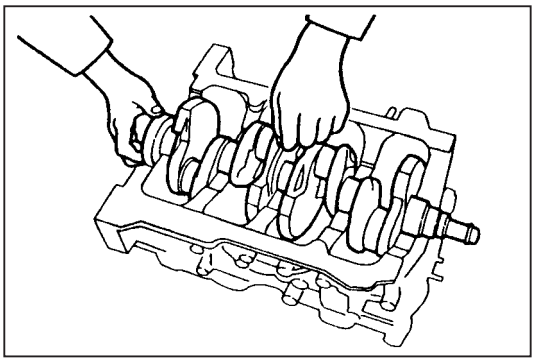
(2) Lubricate the surface of each bearing with engine oil.
NOTE:
- Do not touch with the front and back surfaces of each bearing.
- Never apply engine oil to the crankshaft bearing caps.


JEM00422-00379

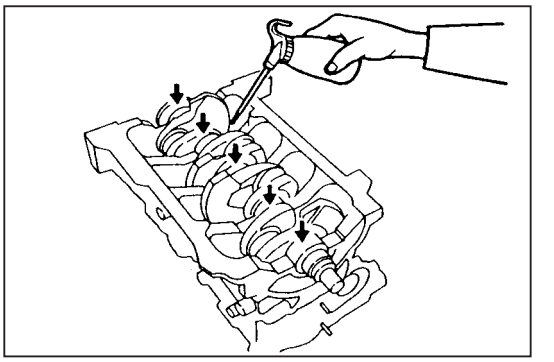
(3) Install the crankshaft in the cylinder block.


JEM00423-00380

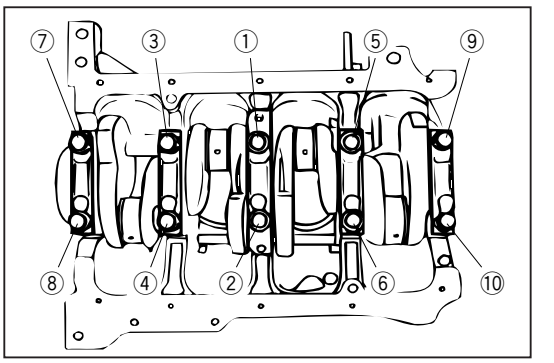
(4) Apply engine oil to the thrust washers. With the side having the oil groove facing toward the crankshaft side, insert each thrust washer between the crankshaft main journal No. 3 and the cylinder block.


JEM00424-00381

(5) Apply engine oil to the crankshaft main journal sections.
NOTE:
- Care must be exercised to ensure that no oil flows into the bearing cap attaching bolt holes.

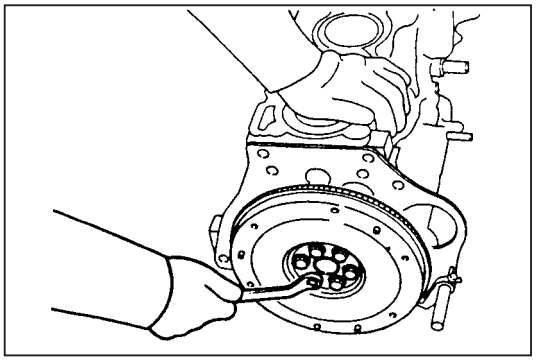

JEM00425-00382

(6) Install the crankshaft bearing caps with the arrow marks facing toward the oil pump side and also in the numerical sequence.
(7) Thinly apply engine oil to the crankshaft bearing cap bolts. Tighten the bolts to the specified torque over two or three stages in the sequence shown in the right figure.
Tightening Torque: 44.1 - 53.9 N·m



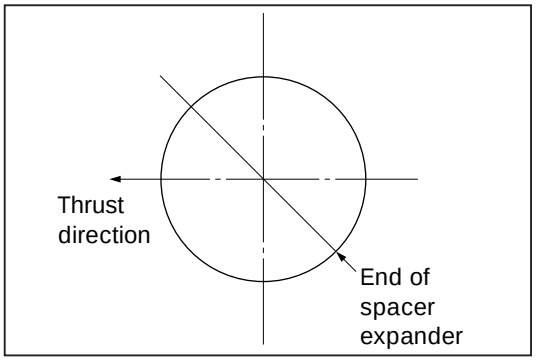
JEM00426-00383

3. Assembly of piston and connecting rod
   Install the flywheel on the crankshaft temporarily.
   NOTE:
   - Care must be exercised to ensure that no oil, etc. gets to the bolts or bolt holes.



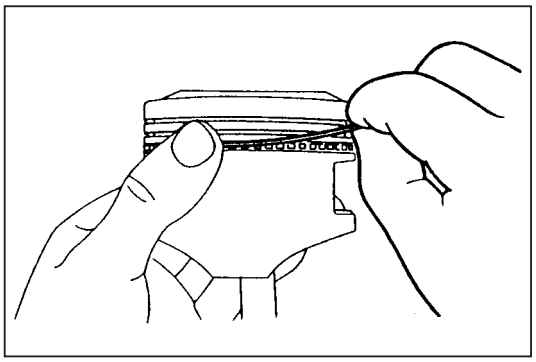
JEM00427-00384

   (1) Install the oil ring spacer expander in the oil ring groove. Ensure that the expander end may not line up with the thrust direction nor with the axial direction.
   NOTE:
   - Do not expand the spacer expander to an extent more than necessary.



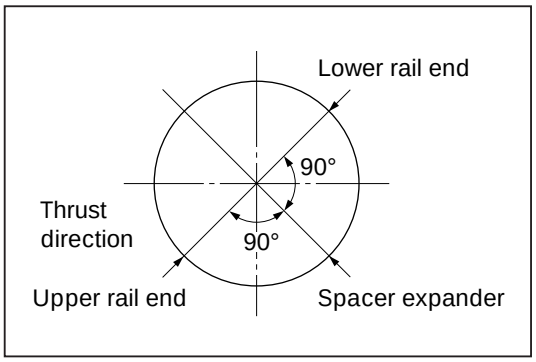
JEM00428-00385

   (2) Fit the upper rail into position in such a manner that it is wound up while pushing the edge section of the oil ring spacer expander with your thumb.



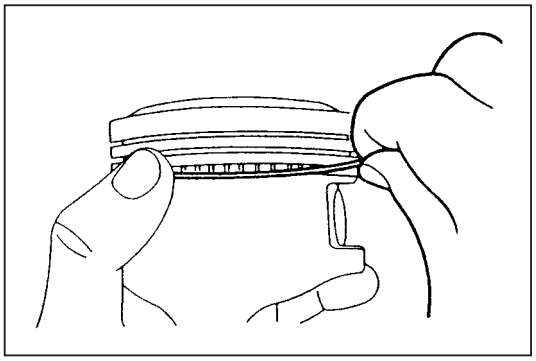
JEM00429-00386

   NOTE:
   - Ensure that the rail end is deviated 90 degrees to the left from the end of the oil ring spacer expander.
   - Do not expand the rail to an extent more than necessary.



JEM00430-00387

   (3) Fit the lower rail into position in such a manner that it is wound up.
   NOTE:
   - Ensure that the rail end is deviated 90 degrees to the right from the end of the oil ring spacer expander.
   - Do not expand the rail to an extent more than necessary.
   - Make sure that the oil ring can be rotated smoothly.

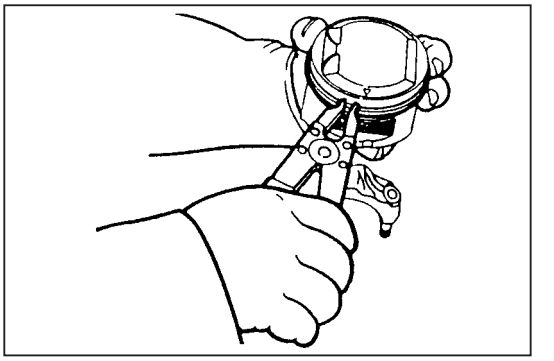


JEM00431-00388

(4) Install the compression ring No. 2 with the stamped mark of T, 2T, N or 2N facing upward, using a piston ring expander.

NOTE:

- Do not expand the piston ring to an extent more than necessary.



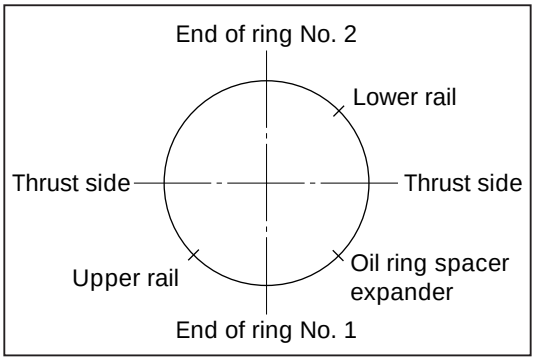
JEM00432-00389

(5) Install the compression ring No. 1 with the stamped mark of T or N facing upward, using a piston ring expander.

(6) Position the piston rings so that each ring end may come at the respective points as indicated in the right figure.

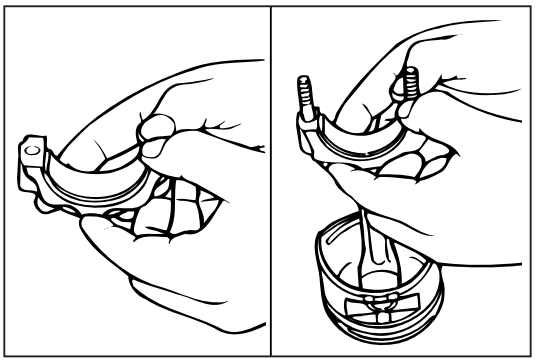
NOTE:

- It is not necessarily required to follow strictly the right figure. However, be sure that the ring end is not lined up with the thrust direction. Also, each ring should be deviated about 120 to 180 degrees from the adjacent ring.



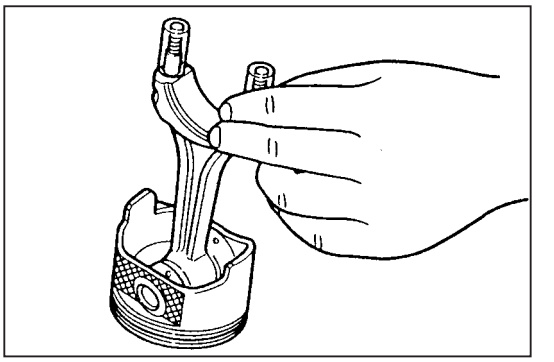
JEM00433-00390

(7) Install the connecting rod bearings on the connecting rod and connecting rod cap, making sure that your fingers will not touch with the front and back surfaces of the bearings.



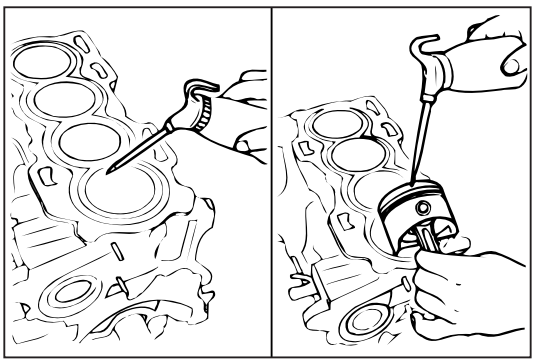
JEM00434-00391

(8) Cut an appropriate vinyl hose to a suitable length. Fit the vinyl hose to each connecting rod bolt sections.



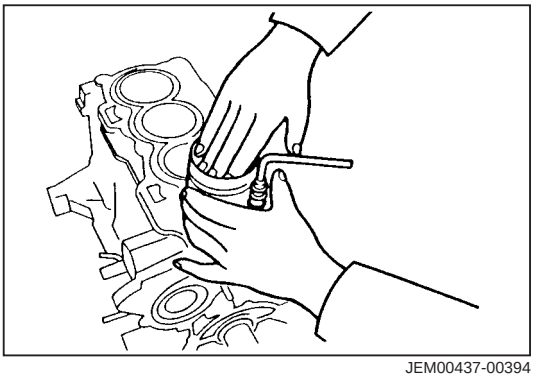
JEM00435-00392

(9) Apply engine oil to the piston rings, piston pins, connecting rod bearings, cylinder walls and crankpin journals.



JEM00436-00393

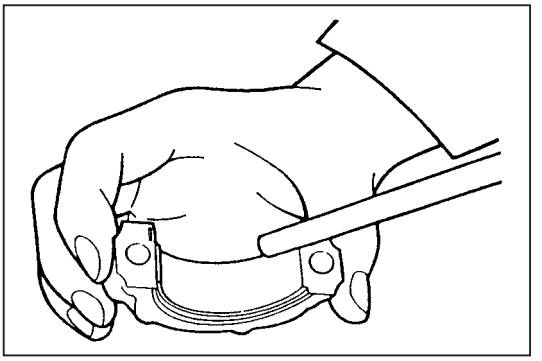
(10) Compress the piston rings by means of the piston ring compressor SST, making sure that the piston ring ends will not move during the installation.
SST: 09217-87001-000


JEM00437-00394

(11) Push the piston by hand into the cylinder bore with the front mark facing toward the oil pump side.
NOTE:
- Be very careful to avoid damaging the connecting rod bearings during the installation.
- Care must be exceised to ensure that the crankpin journal is not scratched by the connecting rod.

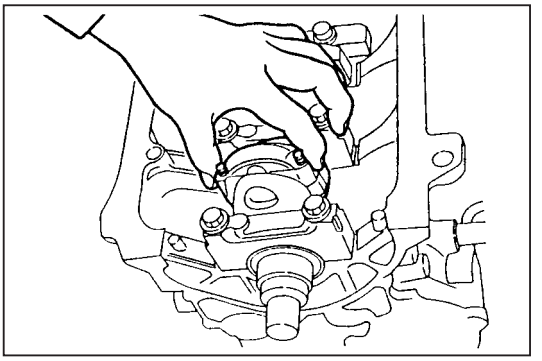
(12) Push the piston by hand until the connecting rod reaches the crankpin journal.

(13) Apply engine oil to the bearing surface of each connecting rod bearing.
NOTE:
- Do not touch with the bearing front surface.

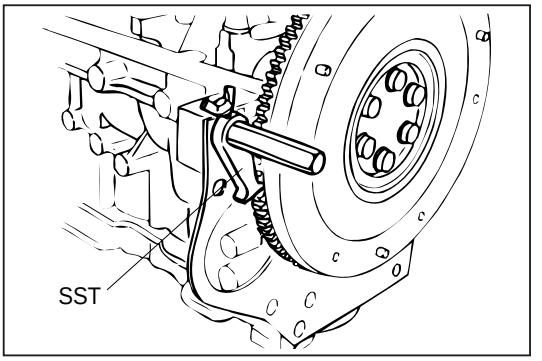

JEM00438-00395

(14) Remove the vinyl hoses which were attached to the connecting rod bolt sections.

(15) Install the connecting rod cap with the front mark facing toward the oil pump side.


JEM00439-00396

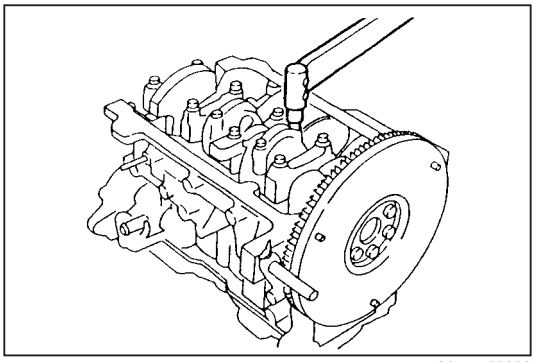
(16) Prevent the crankshaft from turning, using the following SST.
SST: 09210-87701-000



JEM00440-00397

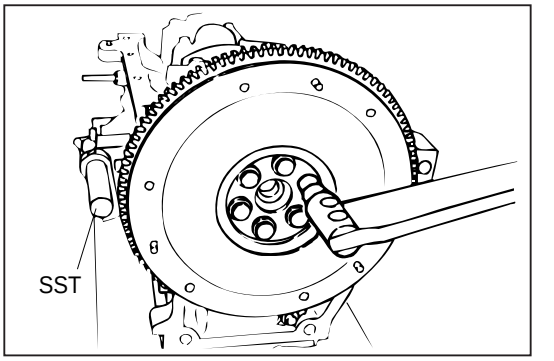
(17) Thinly apply engine oil to the connecting rod cap attaching nuts. Tighten the nuts to the specified torque evenly over two or three stages.
Tightening Torque: 34.3 - 44.1 N·m

(18) Perform the operations described in the steps (1) through (17) for each cylinder.



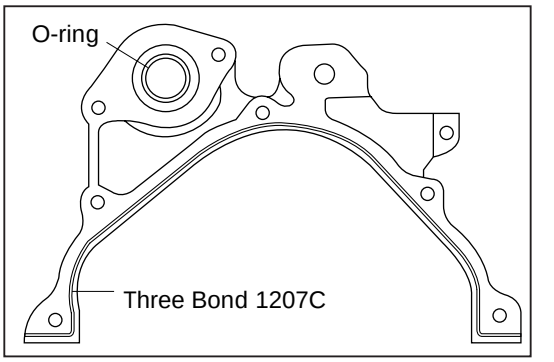
JEM00441-00398

(19) Remove the flywheel.
(20) Remove the following SST.
SST: 09210-87701-000



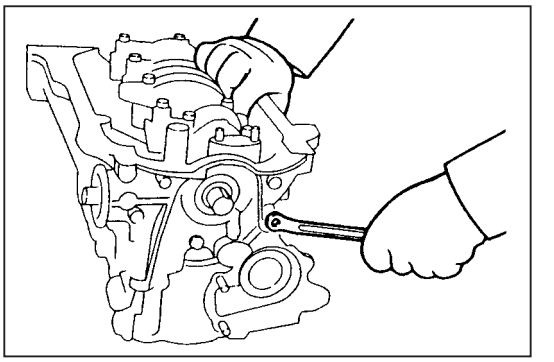
JEM00442-00399

4. Installation of oil pump
(1) Apply the Three Bond 1207C to the oil pump installation surface of the cylinder block, as indicated in the right figure.
(2) Replace the O-ring of the oil pump with a new part.



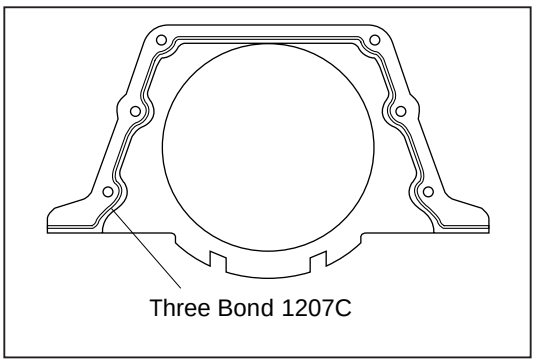
JEM00443-00400

(3) Apply engine oil to the inner surface of the oil seal. Install the oil pump to the cylinder block. Perform tightening to the specified torque.
Tightening Torque: 5.9 - 8.8 N·m



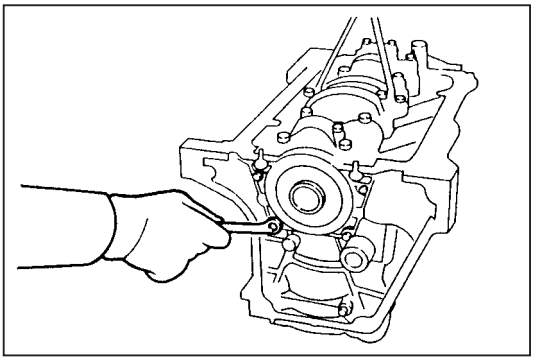
JEM00444-00401

5. Installation of oil seal retainer
(1) Apply the Three Bond 1207C to the oil seal retainer installation surface of the cylinder block, as indicated in the right figure.



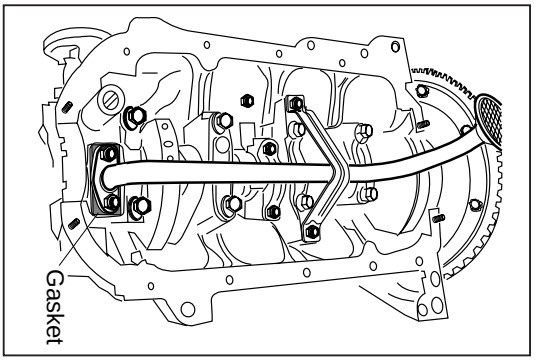
JEM00445-00402

(2) Apply engine oil to the inner surface of the oil seal. Install the oil seal retainer to the cylinder block. Perform tightening to the specified torque.
Tightening Torque: 5.9 - 8.8 N·m (0.6 - 0.9 kgf-m)



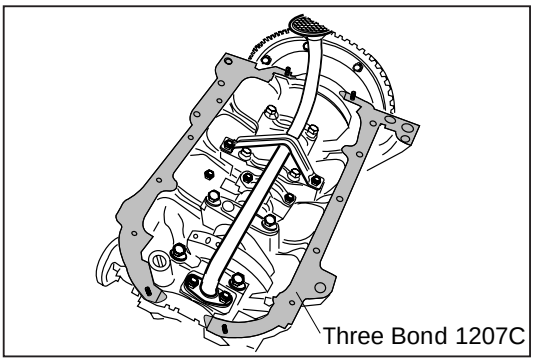
JEM00446-00403

6. Install the oil strainer with a new gasket interposed.



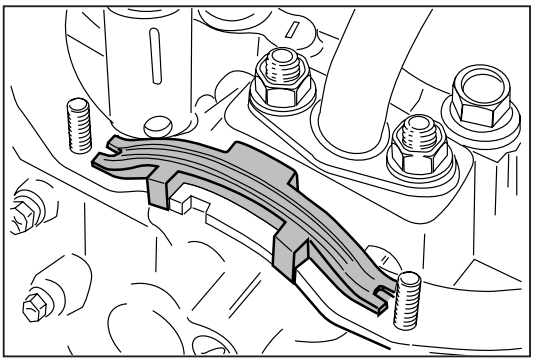
JEM00447-00404

7. Installation of oil pan
(1) Apply the Three Bond 1207C to the oil pan installation surface of the cylinder block, as indicated in the right figure.



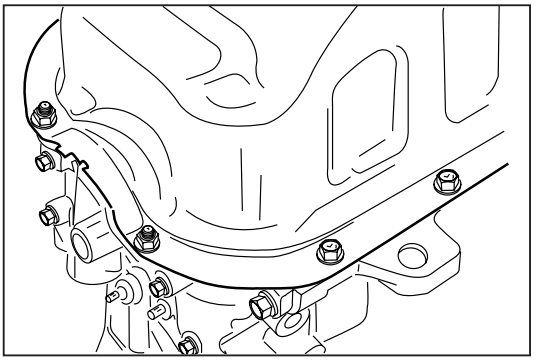
JEM00448-00405

(2) Place the oil pan gaskets.
NOTE:
- Ensure that the end section of the oil pan gasket is overlapped at least 10 mm with the Three Bond 1207C.



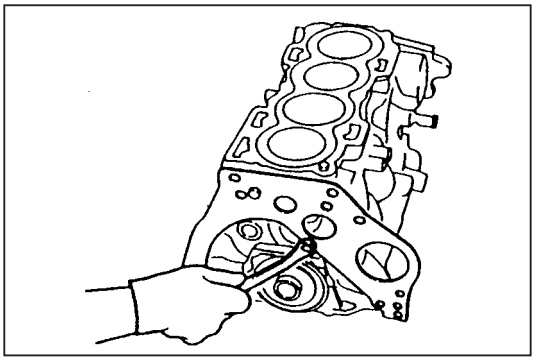
JEM00449-00406

(3) Install the oil pan. Tighten the oil pan attaching nuts and bolts to the specified torque over two or three stages.
Tightening Torque: 6.9 - 11.8 N·m



JEM00450-00407

8. Installation of rear end plate
   Install the rear end plate to the cylinder block with two attaching bolts.
   Tighten the attaching bolts to the specified torque.
   Tightening Torque: 14.7 - 21.6 N·m



JEM00451-00408

9. Installation of flywheel
   (M/T vehicle only)
   (1) Install the flywheel on the crankshaft with the spacer interposed.
   (2) Application of flywheel bolt sealing material
      ① Wash the flywheel bolts. Then, degrease and dry them.

NOTE:
- When degreasing the bolts, remove any oil completely, using a solvent such as a degreasing spraying agent or alcohol.

CAUTION:
- Make sure that no bond nor other foreign matter, such as dust, gets to the bolts.
- Even when new bolts are used, be sure to perform this operation.
- Be sure to interpose the spacer between the crankshaft and the flywheel.

② Check the flywheel bolts for damage. Replace any flywheel bolt which exhibits damage with a new one.

CAUTION:
- Even when a new bolt is used, be sure to perform the operation in the step (1).

③ Clean the flywheel bolt threaded holes at the rear end section of the crankshaft. Degrease and dry them.

CAUTION:
- Make sure that no bond nor other foreign matter, such as dust, gets to the bolt threaded holes.
- As for degreasing, wipe off any oil from the threaded portion with a cloth damped with alcohol.
- Never allow alcohol to get to resin or rubber parts, specifically, the rear oil seal.

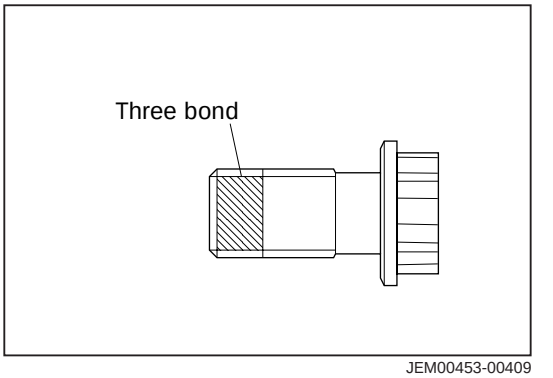
④ Clean the bolt seating surface of the flywheel and degrease it.

NOTE:
- As for degreasing, wipe the bolt seating surface with a cloth damped with alcohol.
- Never allow alcohol to get to resin or rubber parts.

JEM00452-00000

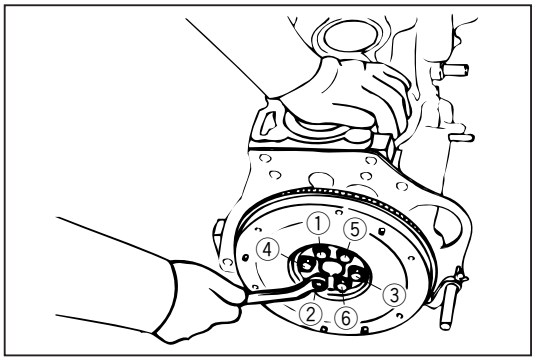
⑤ Apply two to three drops of the Three Bond 1324 to the forward end of the threaded portion of each flywheel bolt.

CAUTION:
- If the Three Bond 1324 is applied excessively beyond the specified amount, the oil will penetrate up to the bolt seating surface. This may cause loosening of the bolts.
- Never use bond sealers other than the designated one.
- Never allow the bond sealer to get to resin or rubber parts.



JEM00453-00409

(3) Tighten the flywheel attaching bolts to the specified torque in the sequence indicated in the right figure.
Tightening Torque: 44.1 - 63.7 N·m



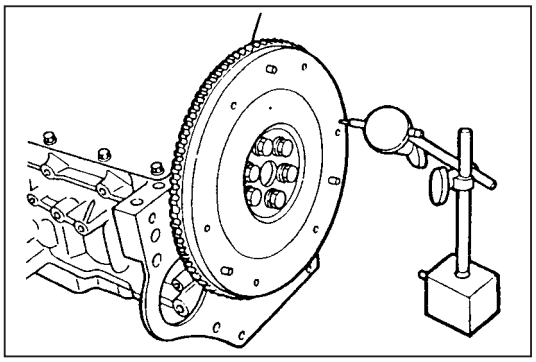
JEM00454-00410

NOTE:
- Prevent the crankshaft from turning at the ring gear section, using the following SST.
  SST: 09210-87701-000

CAUTION:
- When tightening the bolt, make sure that no bond is present on the bolt seating surface.
  If the bond oozes out, perform the operations again, starting the step (2).

(4) Tighten the flywheel attaching bolts to the specified torque in the sequence indicated in the right figure.
Tightening Torque: 78.5 - 98.0 N·m

(5) Measure the flywheel runout, using a dial gauge.
Allowable Runout Limit: 0.1 mm


JEM00455-00411

NOTE:
- Replace the flywheel if its runout exceeds the allowable limit.

10. Installation of drive plate
(A/T vehicle only)
(1) Application of flywheel bolt sealing material
① Wash the flywheel bolts. Then, degrease and dry them.

NOTE:
- When degreasing the bolts, remove any oil completely, using a solvent such as a degreasing spraying agent or alcohol.

CAUTION:
- Make sure that no bond nor other foreign matter, such as dust, gets to the bolts.
- Even when new bolts are used, be sure to perform this operation.

② Check the flywheel bolts for damage. Replace any flywheel bolt which exhibits damage with a new one.

CAUTION:
- Even when a new bolt is used, be sure to perform the operation in the step (1).

③ Clean the flywheel bolt threaded holes at the rear end section of the crankshaft. Degrease and dry them.

CAUTION:
- Make sure that no bond nor other foreign matter, such as dust, gets to the bolt threaded holes.
- As for degreasing, wipe off any oil from the threaded portion with a cloth damped with alcohol.

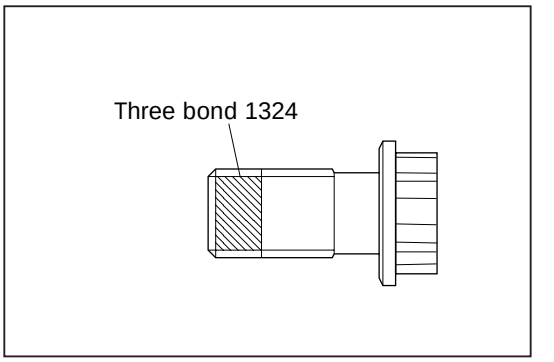
- Never allow alcohol to get to resin or rubber parts, specifically, the rear oil seal.

④ Wash the centering plate. Then, degrease and dry it.

NOTE:
- When degreasing the center plate, remove any oil completely, using a solvent such as a degreasing spraying agent or alcohol.
- Never allow the solvent to get to resin or rubber parts.

JEM00456-00000

⑤ Apply two to three drops of the Three Bond 1324 to the forward end of the threaded portion of each flywheel bolt.



JEM00457-00412

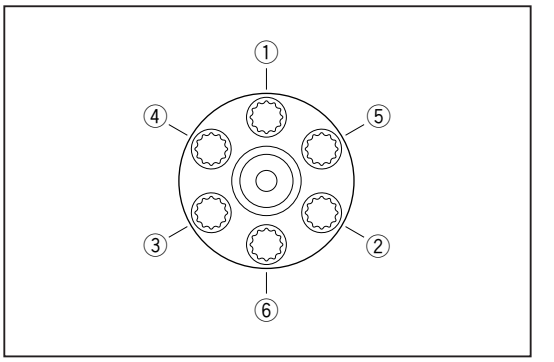
CAUTION:
- If the Three Bond 1324 is applied excessively beyond the specified amount, the oil will penetrate up to the bolt seating surface. This may cause loosening of the bolts.
- Never use bond sealers other than the designated one.
- Never allow the bond sealer to get to resin or rubber parts.

(2) Install the drive plate and centering plate to the crankshaft end. Tighten the attaching bolts temporarily.
Tightening Torque: 44.1 - 63.7 N·m

NOTE:
- Prevent the crankshaft from turning at the ring gear section, using the following SST.
SST: 09210-87701-000

JEM00458-00000

(3) Tighten the drive plate attaching bolts to the specified torque in the sequence indicated in the right figure.
Tightening Torque: 78.5 - 98.0 N·m



JEM00459-00413

NOTE:
- Prevent the crankshaft from turning at the ring gear section, using the following SST.
SST: 09210-87701-000

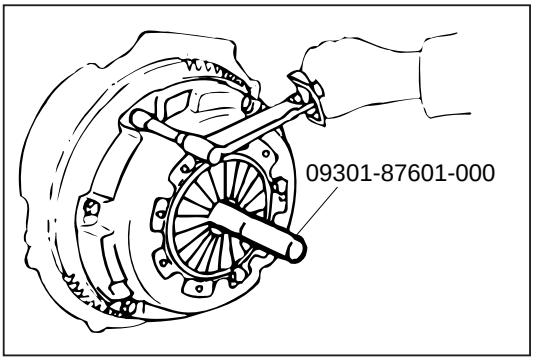
CAUTION:
- When tightening the bolt, make sure that no bond is present on the bolt seating surface.
If the bond oozes out, perform the operations again, starting the step (1).

11. Assembling of clutch disc and pressure plate
(M/T vehicle only)
(1) Insert the following SST into the crankshaft rear end.
SST: 09301-87703-000

(2) Install the clutch disc.

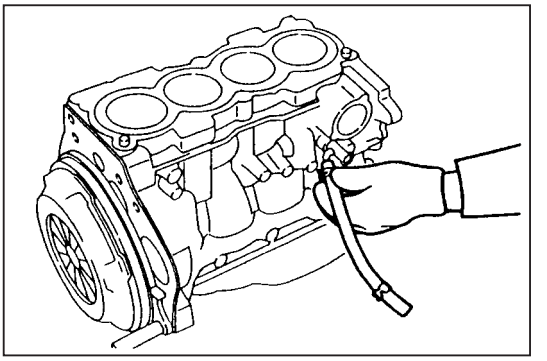
JEM00460-00000

(3) Install the pressure plate, lining up the locating pin of the pressure plate. Tighten the attaching bolts to the specified torque.
Tightening Torque: 14.7 - 21.6 N·m



JEM00461-00414

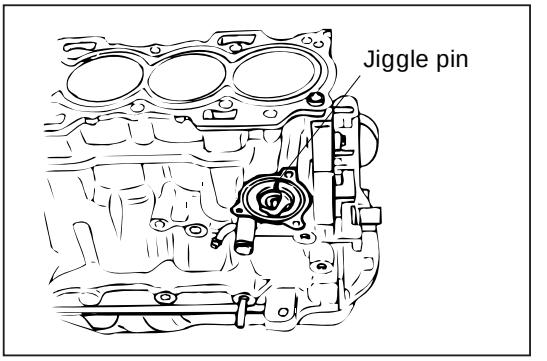
12. Install the water hose for the throttle body use to the cylinder block. Attach the hose bands.


JEM00462-00415

13. Install the thermostat in the cylinder block in such a way that the jiggle pin section may come at the upper side.
CAUTION:
- Make sure to install the jiggle pin of the thermostat in the correct direction. Failure to observe this precaution may cause overheating.

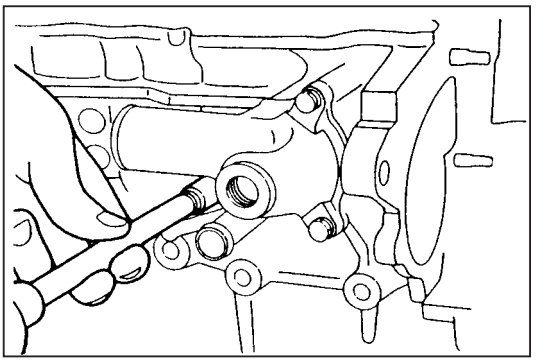
Identification of Thermostat

Destination	Identification color
European Cold spec.	Green
General spec.	Black

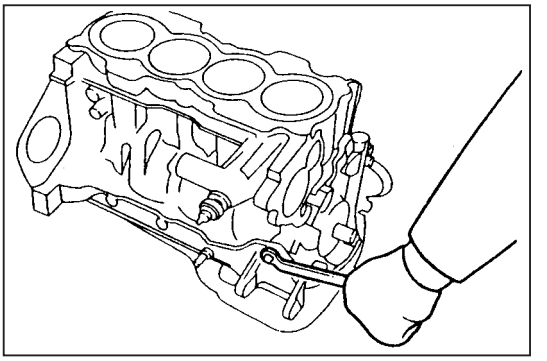


JEM00463-00416

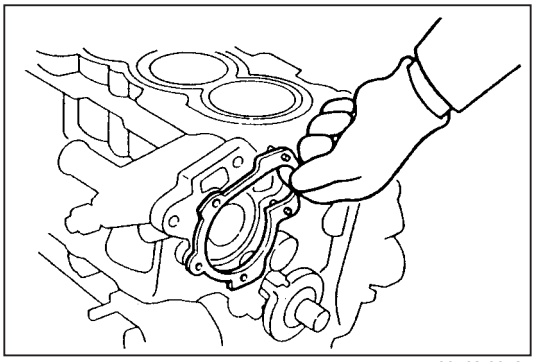
14. Install the water inlet.
Tightening Torque: 5.9 - 8.8 N·m


JEM00464-00417

15. Install the alternator bracket.
Tightening Torque: 34.3 - 49.0 N·m


JEM00467-00420

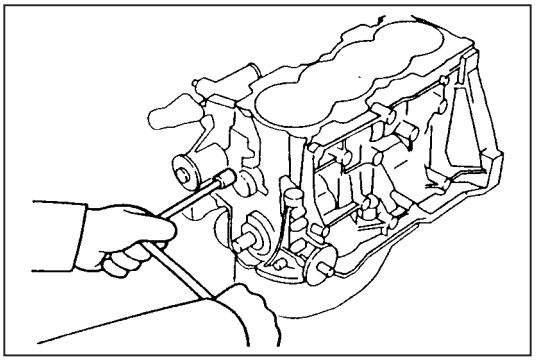
16. Installation of water pump
    (1) Install a new water pump gasket on the cylinder block.



JEM00468-00421

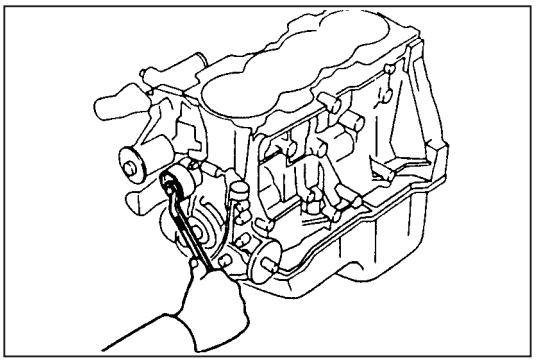
    (2) Install and tighten the water pump to the specified torque.
    Tightening Torque: 14.7 - 21.6 N·m

    NOTE:
    - When the stud bolts have been replaced, apply the Three Bond 1377B to the threaded portion at the cylinder block side.



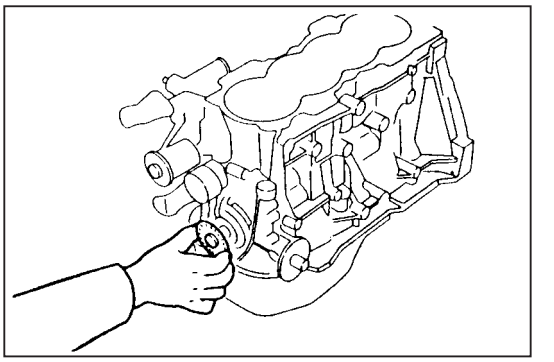
JEM00469-00422

17. Attach the tension spring to the timing belt tensioner. Hang the tension spring hook on the pin. Assemble the timing belt tensioner in place and install the bolt. Push the tensioner to the alternator side as far as it will go. Tighten the tensioner temporarily.



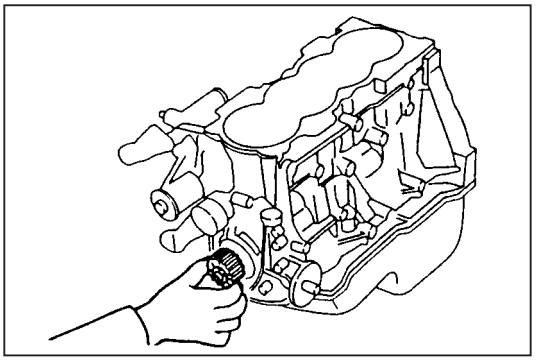
JEM00470-00423

18. Install the crankshaft pulley flange in such a way that its recessed side may come at the cylinder block side.



JEM00471-00424

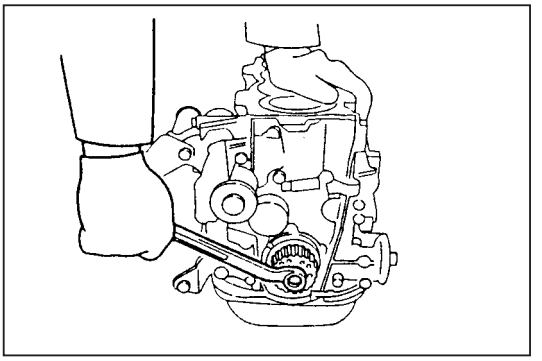
19. Install the crankshaft timing belt pulley.



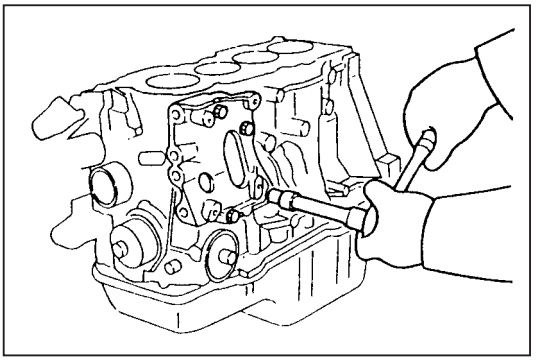
JEM00472-00425

20. Install the crankshaft timing belt pulley attaching bolt. Tighten the bolt to the specified torque.
    Tightening Torque: 88.3 - 98.0 N·m

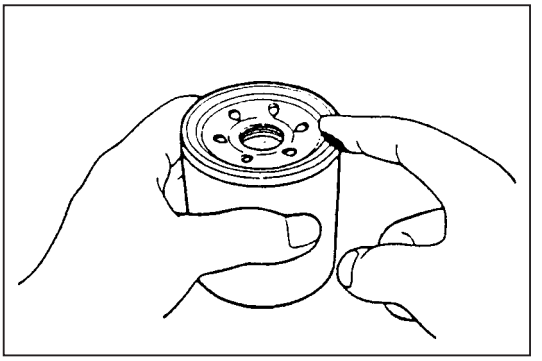
    NOTE:
    - Prevent the crankshaft from turning, using the following SST.
      SST: 09210-87701-000


JEM00473-00426

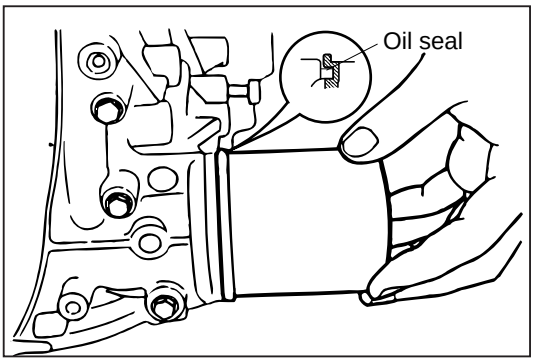
21. Install the air conditioner compressor bracket.
    Tightening Torque: 29.4 - 44.1 N·m


JEM00474-00427

22. Installation of oil filter
    (1) Thinly apply engine oil to the oil seal of the oil filter.

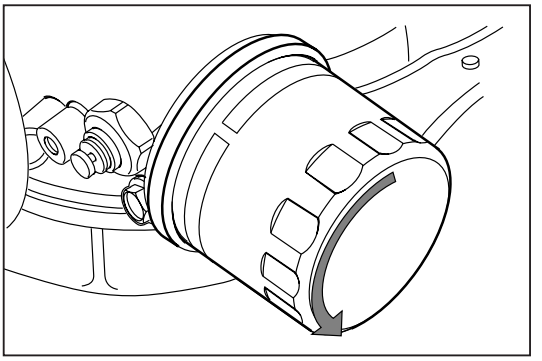

JEM00475-00428

    (2) Screw in the oil filter until the oil seal of the oil filter comes in contact with the oil pump or the contact surface of the oil cooler.

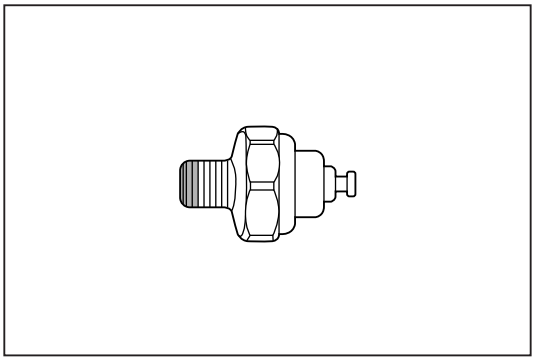


JEM00476-00429

    (3) Then, rotate the oil filter further one complete turn (360 degrees), using the following SST.
    SST: 09228-87201-000

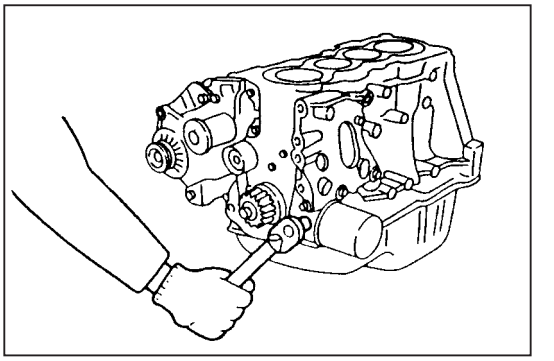

JEM00477-00430

23. Installation of oil pressure switch
    (1) Clean the threaded portion of the oil pressure switch. Wind seal tape around the threaded portion.
    NOTE:
    - The new oil pressure switch is coated with sealer. Hence, when the oil pressure switch is replaced with a new one, first remove the sealer thoroughly. Then wind the seal tape. Also, be sure to clean the threaded holes at the oil pump side.



JEM00478-00431

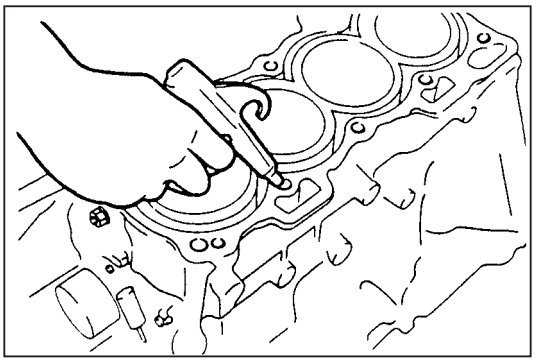
    (2) Tighten the oil pressure switch to the specified torque using a long box wrench having a hexagonal hole.
    Tightening Torque: 11.8 - 19.6 N·m



JEM00479-00432

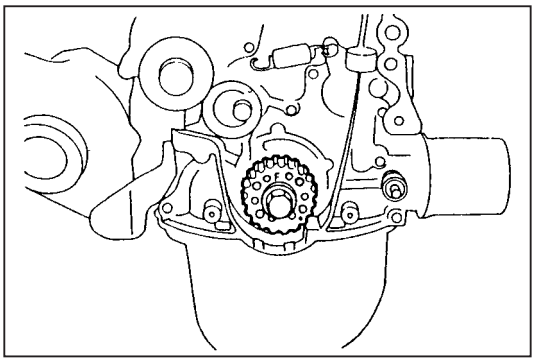
PREPARATION OF ENGINE INSTALLATION

1. Place the cylinder block on a suitable engine stand.
2. Clean and make dry the cylinder head bolt holes.
   WARNING:
   - When you use compressed air, be sure to protect your eyes, wearing goggles.



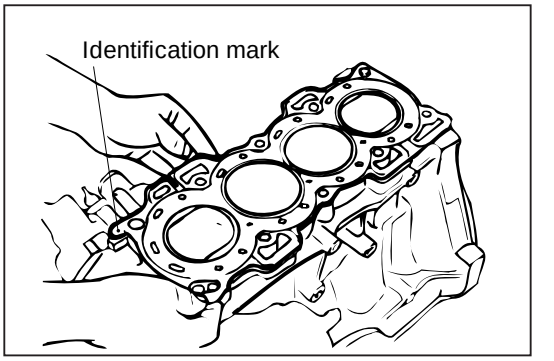
JEM00480-00433

2. Align the drilled mark of the crankshaft timing belt pulley with the indicator of the oil pump.



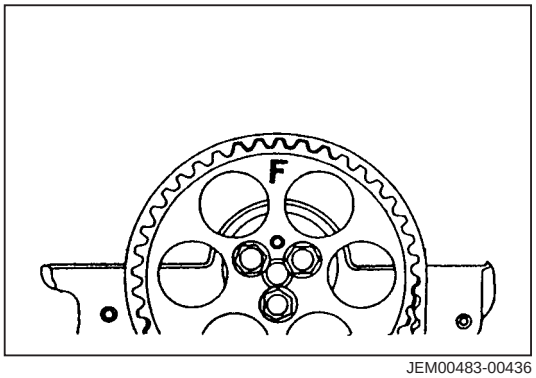
JEM00481-00434

3. Place the new cylinder head gasket on the cylinder block.



JEM00482-00435

4. Turn the crankshaft, until the “F” mark of the camshaft timing belt pulley comes exactly at the top position.



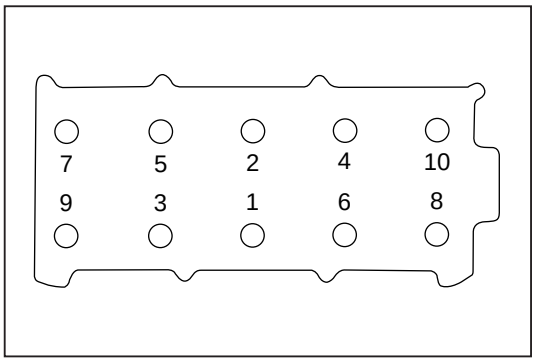
JEM00483-00436

5. Install the cylinder head assembly on the cylinder block.
   CAUTION:
   - Be very careful not to damage the cylinder head gasket and cylinder head gasket attaching surface.
   - Never turn the crankshaft or camshaft independently before installing the timing belt.

JEM00484-00000

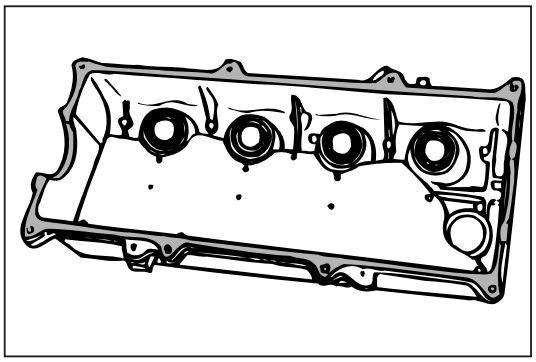
6. Apply engine oil to the threaded portion of the cylinder head bolts.
7. Install the bolts on the cylinder head.
   CAUTION:
   - As for the two bolts at the distributor side, use the bolts whose nominal length is 112 mm, which is shorter than that of others.

8. Tighten the cylinder head bolts evenly over two or three stages to the specified torque, following the sequence shown in the right figure.
   Tightening Torque: 58.8 - 66.7 N·m



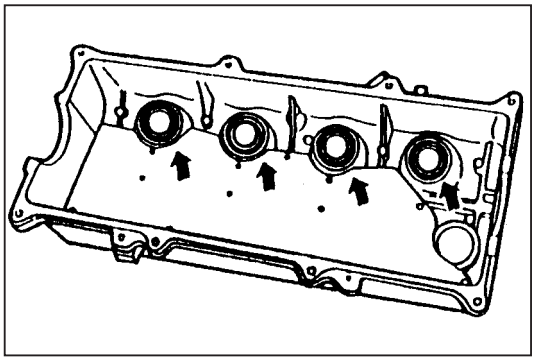
JEM00485-00437

9. Installation of cylinder head cover
   (1) Check the cylinder head cover gasket for damage. Replace the cylinder head gasket if it is damaged.
   (2) Replacement of cylinder head gasket
   (Only case where such replacement is required;)
   ① Remove the cylinder head cover gasket from the cylinder head cover.
   ② Install a new cylinder head cover gasket in such a way that the identification mark comes at the intake manifold side of the cylinder head cover.



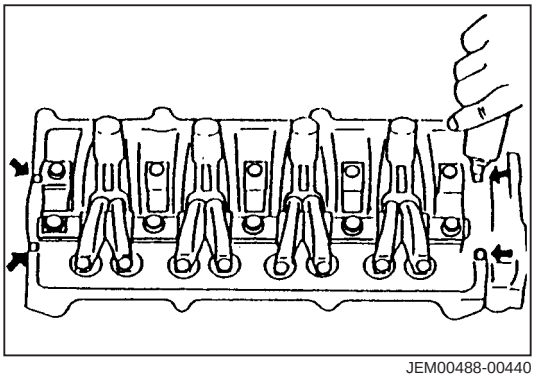
JEM00486-00438

   (3) Check the spark plug tube grommet for damage. Replace any grommet which exhibits damage.



JEM00487-00439

(4) Wipe off any oil from the cylinder head cover gasket attaching surface of the cylinder head.



JEM00488-00440

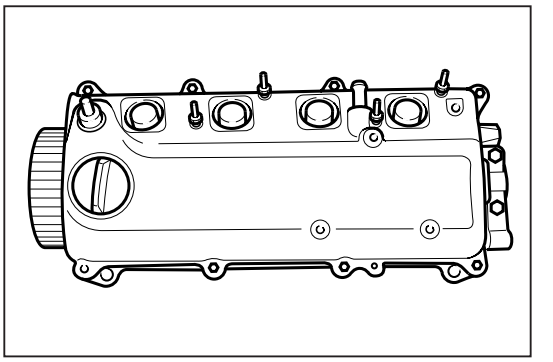
(5) Install the cylinder head cover to the cylinder head.

CAUTION:

- Be very careful not to damage the spark plug tube rubber grommet during installation.

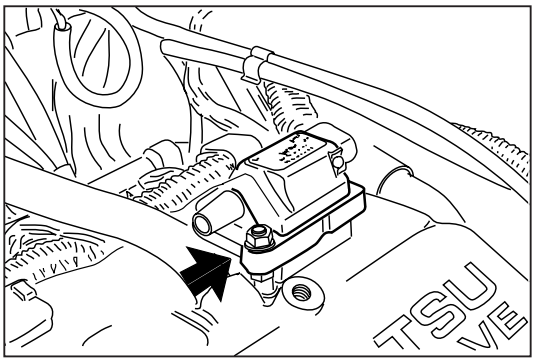
JEM00489-00000

(6) Install the tighten the cylinder head cover attaching bolts to the specified torque, following the sequence in the right figure.
Tightening Torque: 2.9 - 4.9 N·m



JEM00490-00441

(7) Install and tighten the ignition coils to the engine.
(8) Connect the resistive cords.

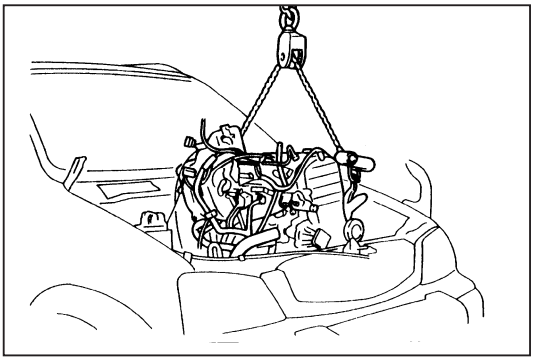


JEM00491-00442

10. Install the timing belt.
(Refer to the timing belt section)

JEM00492-00000

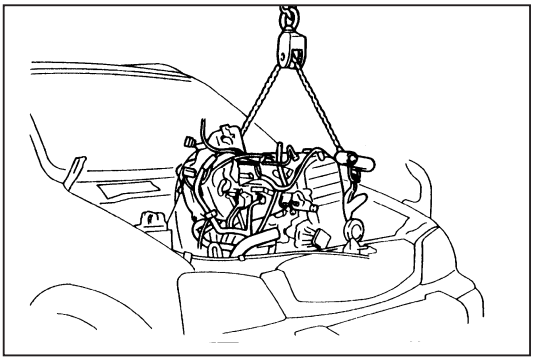
11. Install and tighten the engine mounting bracket with the mounting to the engine.
12. Sling the engine, using a chain block.



JEM00493-00443

INSTALLATION OF ENGINE

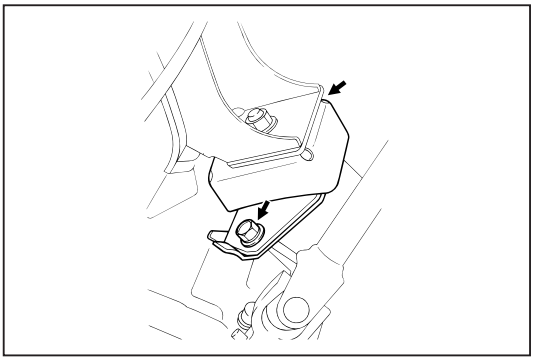
1. Insert the engine to the engine compartment.
2. Joint the engine to the transmission and temporarily install the transmission attaching bolt.



JEM00494-00444

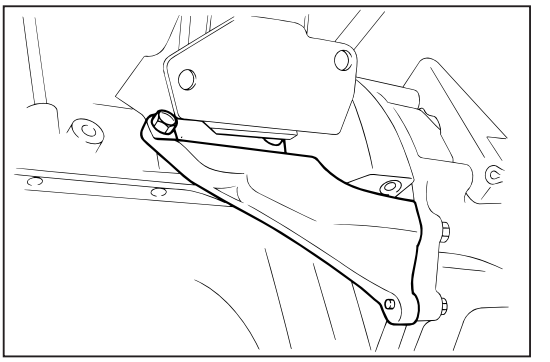
3. Place the engine to the engine mounting section of the engine support number.
4. Install and tighten the engine mounting attaching bolts.
   Tightening Torque: 21.6 - 39.2 N·m

   NOTE:
   - Be very careful not to allow the engine to hit the vehicle body and other parts.



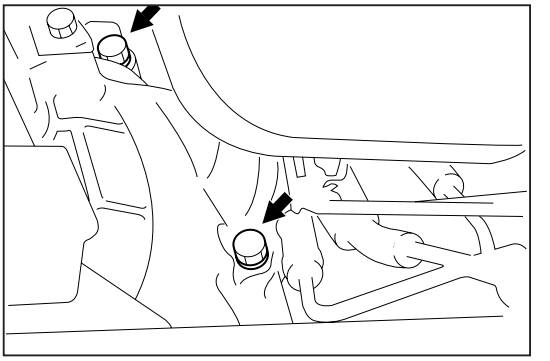
JEM00495-00445

5. Install and tighten the transmission attaching bolts with the power train stiffener bracket.
   Tightening Torque: 49.0 - 68.6 N·m



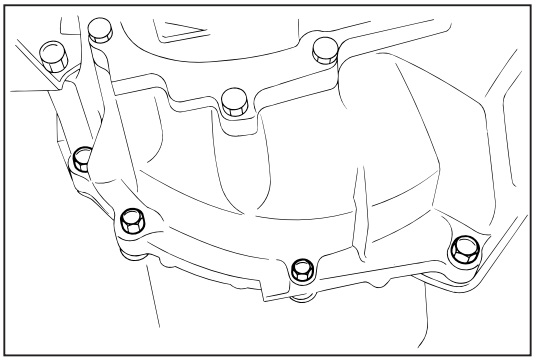
JEM00496-00446

6. Install the starter motor and starter motor attaching bolts. Tighten the attaching bolts to the specified torque.
   Tightening Torque: 31.2 - 46.8 N·m



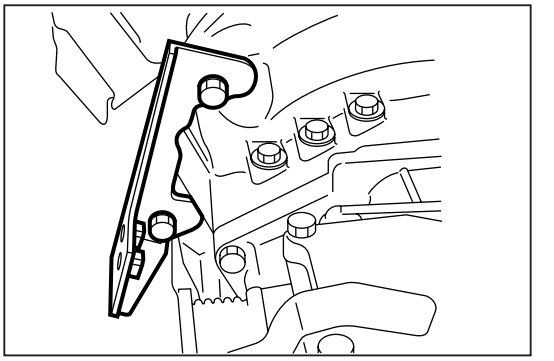
JEM00497-00447

7. Install the clutch housing under cover to the transmission.
   Tighten the attaching bolts to the specified torque.
   Tightening Torque: 49 - 68.6 N·m



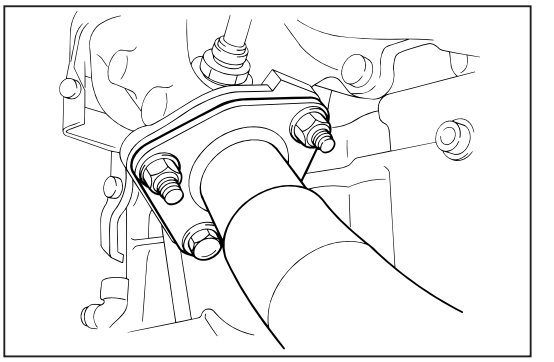
JEM00498-00448

8. Install the engine stiffener to the engine and tighten it to the specified torque.
   Tightening Torque: 29.0 - 44.0 N·m



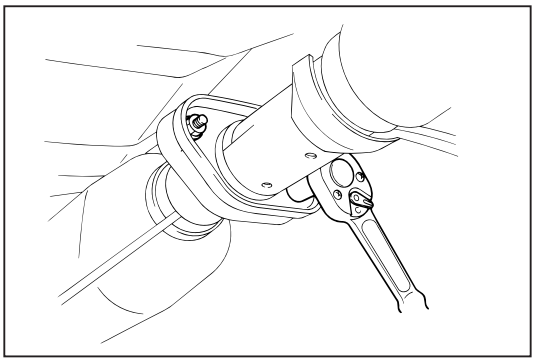
JEM00499-00449

9. Installation of exhaust pipe
   (1) Install the front exhaust pipe to the exhaust manifold with a new gasket interposed.
   NOTE:
   - Do not reuse the used gasket.



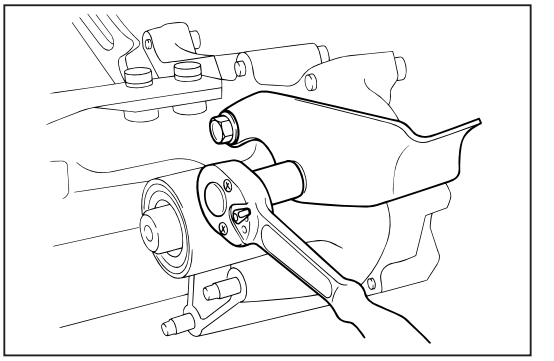
JEM00500-00450

   (2) Temporarily tighten the exhaust pipe attaching nut of the exhaust manifold.
   (3) Connect the front exhaust pipe to the main muffler with a new gasket interposed.
   (4) Tighten the attaching nuts to the specified torque.
   Tightening Torque: 41.6 - 62.4 N·m



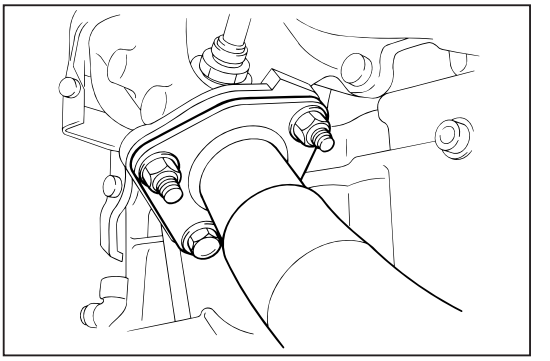
JEM00501-00451

   (5) Install the front exhaust pipe clamp bracket to the transmission.
   Tighten the attaching bolts to the specified torque.
   Tightening Torque: 15.2 - 22.8 N·m



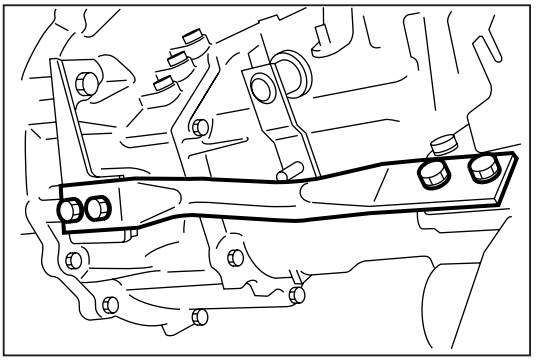
JEM00502-00452

(6) Clamp the front exhaust pipe to the clamp bracket.
(7) Tighten the front exhaust pipe attaching nuts of the exhaust manifold to the specified torque.
Tightening Torque: 15.2 - 22.8 N·m



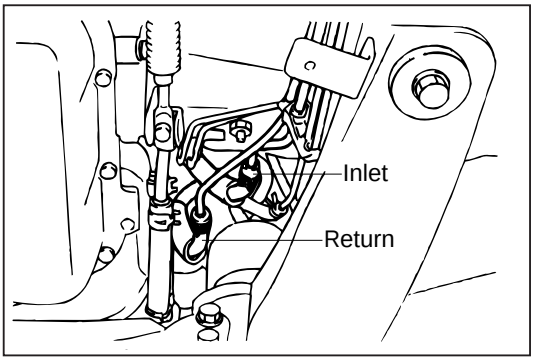
JEM00503-00453

10. Connect the power train stiffener between the engine .and transfer.
Tighten the stiffener attaching bolts to the specified torque.
Tightening Torque: 29.4 - 44.1 N·m



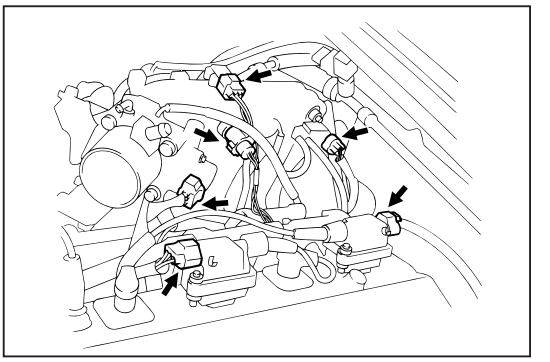
JEM00504-00454

11. Connect the heater hose.
12. Connect the fuel inlet hose and return hose.



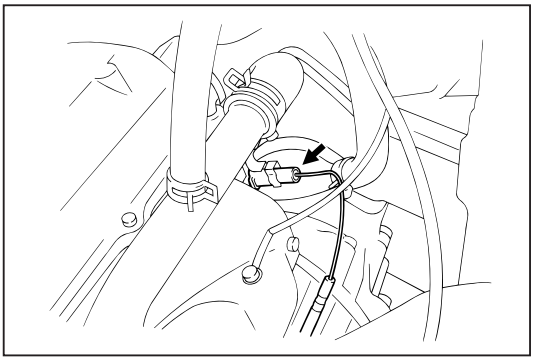
JEM00505-00455

13. Install the engine wire to the engine and connect the following connector.
(1) Ignition coils
(2) Injectors
(3) Pressure sensor
(4) Throttle sensor
(5) Intake air temperature sensor
(6) Idle-up VSV
(7) Water temperature sensor



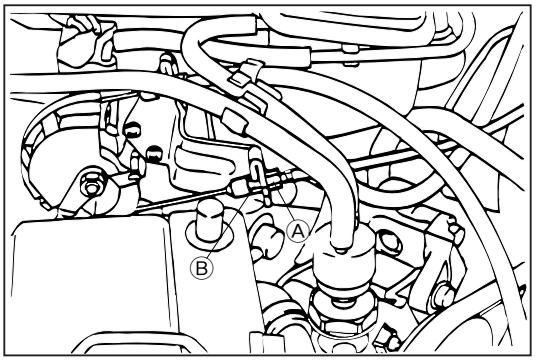
JEM00506-00456

(8) Oxygen sensor
(9) Cam angle sensor



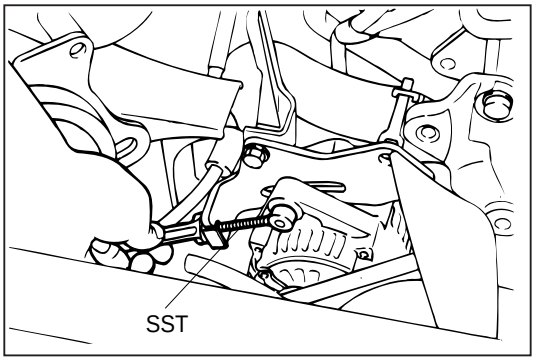
JEM00507-00457

14. Connect the starter wire to the starter motor.
15. Install the accelerator cable to the throttle body and adjust it.
16. Connect the rubber hoses.



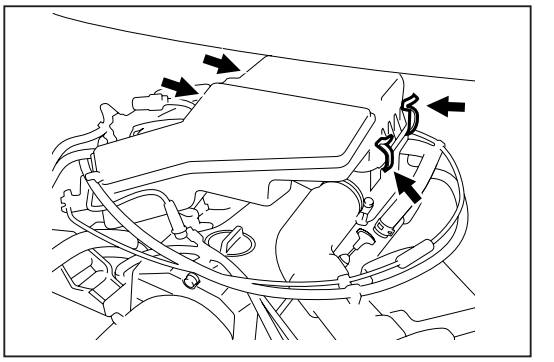
JEM00508-00458

17. Install the alternator to the engine and connect the connectors.

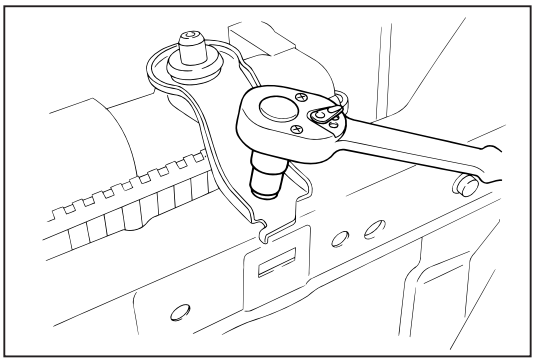


JEM00509-00459

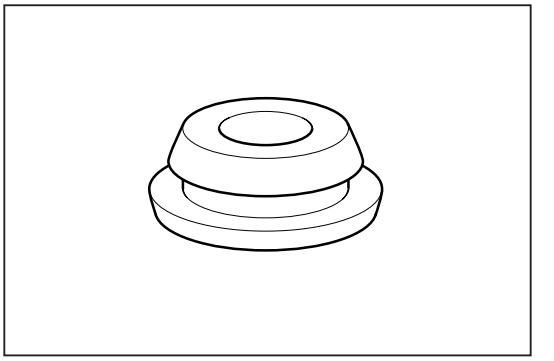
18. Install the air cleaner to the engine.


JEM00510-00460

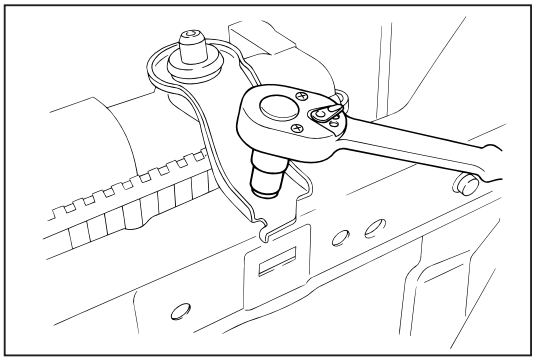
19. Installation of radiator
    (1) Ensure that the radiator lower grommet exhibits no deformation or damage.
    If any damage is existed, replace the radiator lower grommet with new one.


JEM00511-00461

    (2) Place the radiator into the radiator lower grommet.
    (3) Ensure that the radiator upper grommet for damage.
    Replace the radiator upper grommet with new one, if any damage is present.

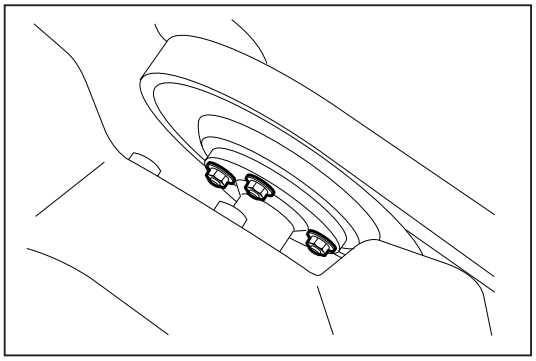

JEM00512-00462

(4) Secure the radiator by installing the radiator brackets with the attaching bolts.
(5) Connect the radiator lower hose and cramp the hose band.



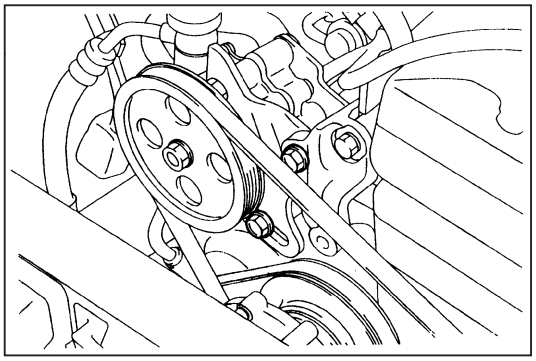
JEM00513-00463

20. Install the cooling fan with the fluid coupling together with the fan shroud.
Tighten the fluid coupling attaching nuts and the fan shroud attaching bolts.
21. Adjust the alternator driver belt tension to the specified value.
(Refer to timing belt section)



JEM00514-00464

22. Install the power steering vane pump drive belt and adjust it's belt tension.
Tightening Torque: 41.7 ± 7.3 N·m

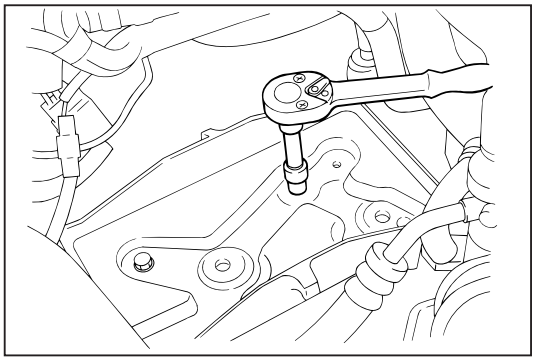


JEM00515-00465

23. Connect the water hoses to the radiator.

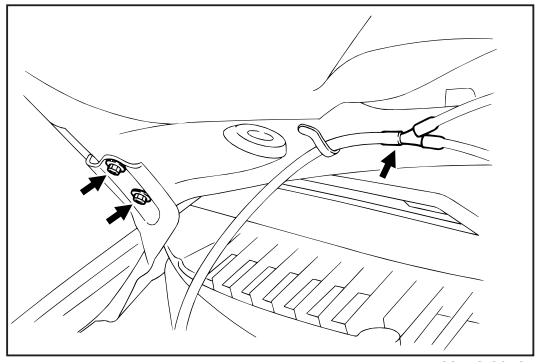
JEM00516-00000

24. Installation of battery
(1) Install the battery carrier and tighten it's attaching bolts.
(2) Install the battery to the battery carrier.
(3) Secure the battery by installing the hold down clamp with the attaching nuts.



JEM00517-00466

25. Installation of engine hood.
    (1) Install the engine hood, being very careful not to scratch the vehicle body and engine hood.
    (2) Tighten the engine hood attaching bolts and adjust the engine hood dimensions.

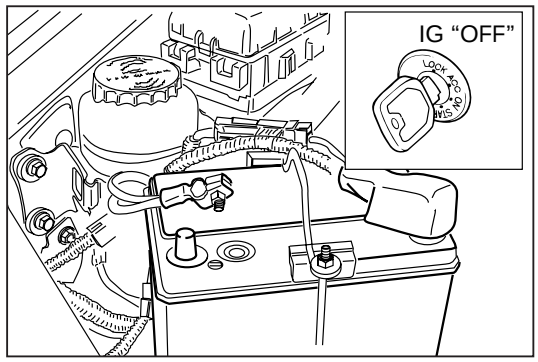


JEM00518-00467

    (3) Connect the windshield washer hose to the joint section.

JEM00519-00000

26. Fill the engine oil.
27. Fill the coolant to the radiator and reserve tank.
28. Connect the positive cable to the positive terminal of the battery.
29. Connect the battery ground cable to the negative terminal of the battery.
30. Perform the engine turn-up.



JEM00520-00468

ENGINE SPECIFICATION

Item \ Engine type						HC-EJ
Engine proper	Type					Petrol, 4-cycle
	Mounting location					Front
	Cylinder No. and arrangement					4-cylinder-in-line, mounted transversely
	Combustion chamber type					Pent roof type
	Valve mechanism					Belt-driven, SOHC
	Bore × stroke		mm			76.0 × 71.4
	Compression ratio					9.5 ± 0.3
	Compression pressure		kPa (kgf/cm²-rpm)			1372.9 (14 - 300)
	Maximum output	SAE net	kW/rpm	General specifications		61/6100
		European	kW/rpm	Australian specifications		↑
		DIN	kW/rpm	European specifications		↑
	Maximum torque	SAE net	Nm/rpm	General specifications		105/5100
		European	Nm/rpm	Australian specifications		↑
		DIN	Nm/rpm	European specifications		↑
	Engine dimensions [Length × width × height]		mm			630 × 510 × 655
	Number of piston rings			Compression ring		2
				Oil ring		1
	Valve timing			Intake	Open	BTDC 1°
					Close	ABDC 39°
				Exhaust	Open	BBDC 42°
					Close	ATDC 2°
	Valve clearance		mm		Intake	[HOT] 0.25
					Exhaust	[HOT] 0.33
	Idling speed		rpm		Manual transmission	800 ± 50
					Automatic transmission	850 ± 50
	Blow-by gas recirculating system					Closed type
Lubricating system	Lubricating method					Fully-forced feed method
	Oil pump type					Trochoid type
	Oil filter type					Fully-flow filter type, filter paper type
	Lubrication oil capacity		liter	Whole		3.6
				When only oil is changed		3.3
				When oil and oil filter are changed		3.5

Item \ Engine type			HC-EJ
Cooling system	Cooling method		V-ribed belt driven type
	Radiator type		Corrugation type forced circulation
	Coolant capacity [Including 0.434 liter for reserve tank] liter	Manual transmission	5.4
		Automatic transmission	5.3
	Water pump type		Centrifugal type belt-driven type
	Thermostat type		Wax pellet type bottom-by-pass type
Air cleaner	Type		Filter unwoven fabric type
	Number		1
	Fuel tank	Capacity liter	46
		Location	Underneath rear seat floor
	Fuel pipe material		Rubber and steel tube
	Fuel pump type		Electromotor type
	Fuel filter type		Filter paper type (Voltex type)
	Fuel injection device		Electronic type
	Injector	Type of nozzle retainer	With cushion rubber type
		Nozzle type	Electronic controlled throttle type
		Injection pressure kPa (kgf/cm^2)	284 (2.9)

Item \ Engine type					HC-EJ
Engine electrical system	Ignition system	Voltage V			12 [Negative ground]
		Type			Full transistorized type (ESA) battery ignition type
		Ignition timing			TDC 0° ± 2° with the check connector connected with ground terminal
		Firing order			1-3-4-2
		Spark plug	Manufacturer & Type	DENSO	K20TNR-S, K22TNR-S
				NGK	BKRU6EK, BKRU7EK
			Sparkplug gap mm	DENSO	0.9 - 1.0
				NGK	0.9 - 1.0
			Thread		1.25
	Battery	Type			36B20L
		Capacity AH			28 Ah
	Alternator	Type			Three-phase alternating current commuting type
		Output V-A	MT		12 - 50
			AT		12 - 55
		Regulator type			Contact pointless type (IC regulator type)
	Starter	Type			Magnet engaging type
		Output V-kW			12 - 0.8
	Radio noise suppressing device				Resistive cord

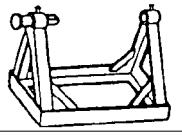
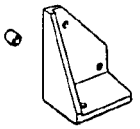
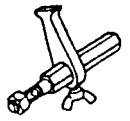
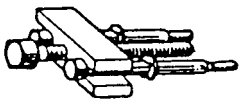
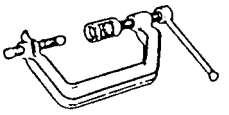
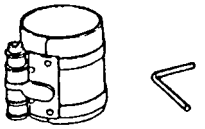
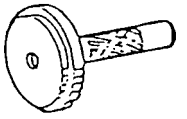
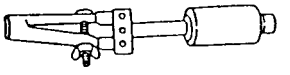
JEM00521-00000

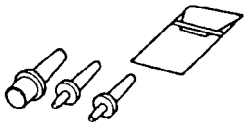
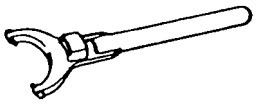
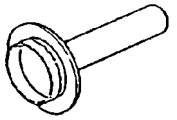
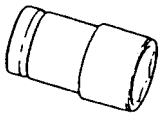
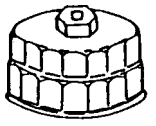
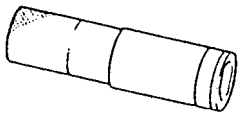
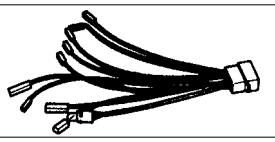
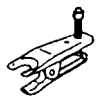
ENGINE MECHANICALS

Timing belt pulley	Wear limit	Camshaft	119.8 mm
		Crankshaft	59.3 mm
Timing belt tension spring		Free length	46.5 mm
		Installation load	29.4 ± 3 N at 50.9 mm (3.0 ± 0.3 kg at 50.9 mm)
Camshaft	Oil clearance (Cylinder head to camshaft)		0.035 - 0.076 mm
	Maximum limit		0.17 mm
	Thrust clearance		0.1 - 0.25 mm
	Maximum limit		0.45 mm
	Fuel pump cam diameter		
		Minimum	42.65 mm
	Fuel pump cam stroke		
		Standard	5.0 mm
		Minimum	4.8 mm
	Valve cam lobe height		
		Intake	33.434 - 33.634 mm
		Exhaust	33.17 - 33.37 mm
	Minimum limit		
		Intake	33.2 mm
		Exhaust	33.0 mm
	Maximum circle run out		0.03 mm
Cylinder head	Warpage	Cylinder block side	0.10 mm
		Intake manifold side	0.10 mm
		Exhaust manifold side	0.10 mm
	Valve seat angle	Intake	30° - 45° - 70°
		Exhaust	20° - 45° - 70°
	Valve contacting angle		45°
	Valve seat contacting width		
		Standard	1.4 mm
		Allowance	1.2 - 1.6 mm
	Maximum valve seat recession (Depth measured from cylinder head gasket attaching surface to uppermost part of a new valve inserted into position)		0.5 mm
		Intake	2.775 mm
		Exhaust	6.026 mm
Valves	Valve stem diameter	Intake valve	6.560 - 6.580 mm
		Exhaust valve	6.555 - 6.575 mm
	Valve length	Intake valve	112.8 mm
		Exhaust valve	114.5 mm
	Valve face angle		45.5°
	Valve stock thickness (Minimum)		
		Intake	0.8 mm
		Exhaust	1.0 mm
	Valve stem oil clearance		
	Intake	Standard	0.030 - 0.055 mm
		Maximum	0.080 mm
	Exhaust	Standard	0.035 - 0.060 mm
		Maximum	0.090 mm

Valve springs	Free length: Standard Pink marked spring Orange marked spring Minimum Pink marked spring Orange marked spring Installed tension at 38.0 mm Pink marked spring Orange marked spring Maximum out-of squareness	 45.2 ± 0.5 mm About 47.4 mm 43.9 mm 46.1 mm 244.9 N (24.97 kgf) 208.9 N (21.3 kgf) 1.6 mm
Valve rocker arm and valve rocker shaft	Oil clearance Standard Maximum Valve rocker arm bore diameter Valve rocker shaft outer diameter	0.012 - 0.053 mm 0.08 mm 19.500 - 19.521 19.468 - 19.488 mm
Valve rocker arm spacer	Free width	22.00 mm
Exhaust manifold	Warpage	0.1 mm
Intake manifold	Warpage Cylinder head side	0.1 mm
Cylinder block	Maximum cylinder head surface warpage Cylinder bore diameter Standard O/S 0.25 Bore honing angle Coarse degree	0.1 mm 76.000 - 76.030 mm 76.250 - 76.280 mm 35° ± 5° 1 - 4 Z
Piston, piston pin and piston rings	Piston-to-cylinder bore clearance Standard Maximum limit Piston ring groove-to-piston ring side clearance Standard No. 1 Other than below No. 2 Maximum Piston ring thickness Standard No. 1 Other than below No. 2 Piston ring end gap Standard No. 1 With “T” mark With “N” mark No. 2 With “2T” mark With “2N” mark Oil Shape of spacer A Shape of spacer B Maximum No. 1 No. 2 Oil Piston pin-to-connecting rod inference fit Piston-to-piston pin clearance	 0.025 - 0.045 mm 0.11 mm 0.03 - 0.07 mm 0.02 - 0.06 mm 0.12 mm 1.17 - 1.19 mm 1.47 - 1.49 mm 0.27 - 0.37 mm 0.27 - 0.40 mm 0.40 - 0.55 mm 0.40 - 0.55 mm 0.2 - 0.6 mm 0.15 - 0.60 mm 0.7 mm 0.8 mm 1.0 mm 0.015 - 0.044 mm 0.005 - 0.011 mm
Flywheel	Runout Maximum	0.1 mm
Connecting rod	Big end thrust clearance Standard Maximum Maximum bend Maximum twist	0.15 - 0.4 mm 0.45 mm 0.05 mm 0.05 mm
Crankshaft	Crankpin journal oil clearance Main journal oil clearance Crankpin journal diameter Main journal diameter Thrust clearance Standard Maximum limit Runout Maximum	0.020 - 0.044 mm 0.024 - 0.042 mm 44.976 - 45.000 mm 49.976 - 50.000 mm 0.02 - 0.22 mm 0.30 mm 0.06 mm

SST (Special Service Tools)

Shape	Part No. and Name	Purpose	Remarks
	09090-04010-000 Engine sling device	Removal and installation of engine	
	09219-87202-000 Engine overhaul stand	Stand for engine overhaul	This stand is to be used in combination with engine overhaul attachment.
	09219-87101-000 Engine overhaul attachment	Attaching engine to overhaul stand	This attachment is to be used in combination with engine overhaul stand.
	09210-87701-000 Flywheel holder	Preventing crankshaft from turning	
	09609-20011-000 Steering wheel puller	Removal of crankshaft timing belt pulley	
	09636-20010-000 Upper ball joint dust cover replacer	Installation of camshaft oil seal	
	09202-87002-000 Valve cotter remover & replacer	Installation and removal of valves	
	09217-87001-000 Piston replacing guide	Guiding piston during insertion	
	09223-41020-000 Crankshaft rear oil seal replacer	Installation of crankshaft rear oil seal	
	09201-87704-000 Valve stem oil seal cover	Removal of valve stem oil seals	
	09310-87102-000 Counter shaft front bearing replacer	Installation of crankshaft front oil seal	
	09221-87704-000 Piston pin remover & replacer body	Removal and installation of piston pins	This remover & replacer body is to be used in combination with piston pin remover & replacer guide
	09221-87705-000 Piston pin remover & replacer guide	Removal and installation of piston pins	This remover & replacer guide is to be used in combination with piston pin remover & replacer body.

Shape	Part No. and Name	Purpose	Remarks
	09201-87705-000 Valve guide bush remover & replacer	Removal and installation of valve guide bushes	
	09301-87703-000 Clutch guide tool	Assembling clutch	
	09258-00030-000 Plug set	Plugging rubber hoses	
	09648-87201-000 Drive shaft replacer	Disconnecting drive shafts	
	09388-87702-000 Transfer replacer	Press-fitting of rubber grommets	
*1 	09268-87704-000 Oil cooler set bolt box wrench	Removal and installation of oil cooler (only for oil cooler-equipped vehicle)	Only for oil cooler-equipped vehicle
	09032-00100-000 Oil pan seal cutter	Removal of oil pan	
	09228-87201-000 Oil filter wrench	Removal and installation of oil filter	
*2 	09268-87703-000 Plug wrench	Removal and installation of spark plugs	
*3 	09991-87401-000 Wire engine control system inspection	EFI system inspection ABS system inspection Measure engine speed	
*4 	09611-87701-000 Tie rod end puller	Disconnection of tie rod end	

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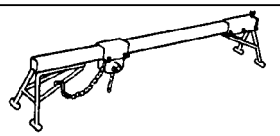
REFERENCE:

	ESB-1 Engine support bridge	Handled by BANZAI Limited	

JEM00524-00470

TIGHTENING TORQUE

Tightening component		Tightening torque	
		N·m	kgf-m
Cylinder head × Spark plug		14.7 - 21.6	1.5 - 2.2
Cylinder head × Cylinder head cover		2.9 - 4.9	0.3 - 0.5
Cylinder head × Rocker shaft (camshaft cap)	M10	28.4 - 36.3	2.9 - 3.7
	M8	12.7 - 16.7	1.3 - 1.7
Cylinder head × Cylinder block		58.8 - 66.7	6.0 - 6.8
Cylinder head × Exhaust manifold		29.4 - 44.1	3.0 - 4.5
Cylinder head × Intake manifold		14.7 - 21.6	1.5 - 2.2
Cylinder head × Water outlet		14.7 - 21.6	1.5 - 2.2
Cylinder block × Water inlet		5.9 - 8.8	0.6 - 0.9
Cylinder block × Crankshaft main bearing cap		44.1 - 53.9	4.5 - 5.5
Cylinder block × Oil pump		5.9 - 8.8	0.6 - 0.9
Cylinder block × Rear oil seal retainer		5.9 - 8.8	0.6 - 0.9
Cylinder block × Water pump		14.7 - 21.6	1.5 - 2.2
Cylinder block × Transmission		49.0 - 68.6	5.0 - 7.0
Cylinder block × Alternator bracket		34.3 - 49.0	3.5 - 5.0
Cylinder block × Rear end plate		9.8 - 14.7	1.0 - 1.5
Crankshaft × Flywheel		78.5 - 98.0	8.0 - 10.0
Crankshaft × Drive plate		78.5 - 98.0	8.0 - 10.0
Crankshaft × Crankshaft timing belt pulley		88.3 - 98.0	9.0 - 10.0
Camshaft × Camshaft timing belt pulley		14.7 - 21.6	1.5 - 2.2
Connecting rod × Connecting rod cap		34.3 - 44.1	3.5 - 4.5
Intake manifold × Gas filter		11.8 - 19.6	1.2 - 2.0
Intake manifold × Union bolt for brake booster		11.8 - 19.6	1.2 - 2.0
Intake manifold × Plug screw		11.8 - 19.6	1.2 - 2.0
Intake manifold × Delivery pipe		14.7 - 21.6	1.5 - 2.2
Intake manifold × Rear stiffener		49.0 - 68.6	5.0 - 7.0
Exhaust manifold × Front exhaust pipe		41.6 - 62.4	4.2 - 6.4
Engine mounting stiffener RH × Transmission (MT)		29.4 - 44.1	3.0 - 4.5
Engine mounting stiffener LH × Transmission		29.4 - 44.1	3.0 - 4.5

Tightening component		Tightening torque	
		N·m	kgf-m
Oil pump × Oil pressure switch		11.8 - 19.6	1.2 - 2.0
Oil pump body × Oil pump cover		7.8 - 12.7	0.8 - 1.3
Oil pan		6.9 - 11.8	0.7 - 1.2
Water inlet × Thermo control switch		24.5 - 34.3	2.5 - 3.5
Pressure plate		14.7 - 21.6	1.5 - 2.2
Lower member subassembly		48.1 - 89.2	4.9 - 9.1
Drive plate × Torque converter		22.6 - 32.4	2.3 - 3.3
Power train stiffener × Clutch housing under cover		6.9 - 9.8	0.7 - 1.0
Power train stiffener	A	29.4 - 44.1	3.0 - 4.5
	B	14.7 - 21.6	1.5 - 2.2
Ball joint × Steering knuckle		29.4 - 44.1	3.0 - 4.5
Lower arm bracket connecting rod		39.2 - 92.2	4.0 - 9.4
Water outlet × Water temperature sensor		24.5 - 34.3	2.5 - 3.5
Front exhaust pipe × Rear exhaust pipe		15.2 - 22.8	1.6 - 2.3

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