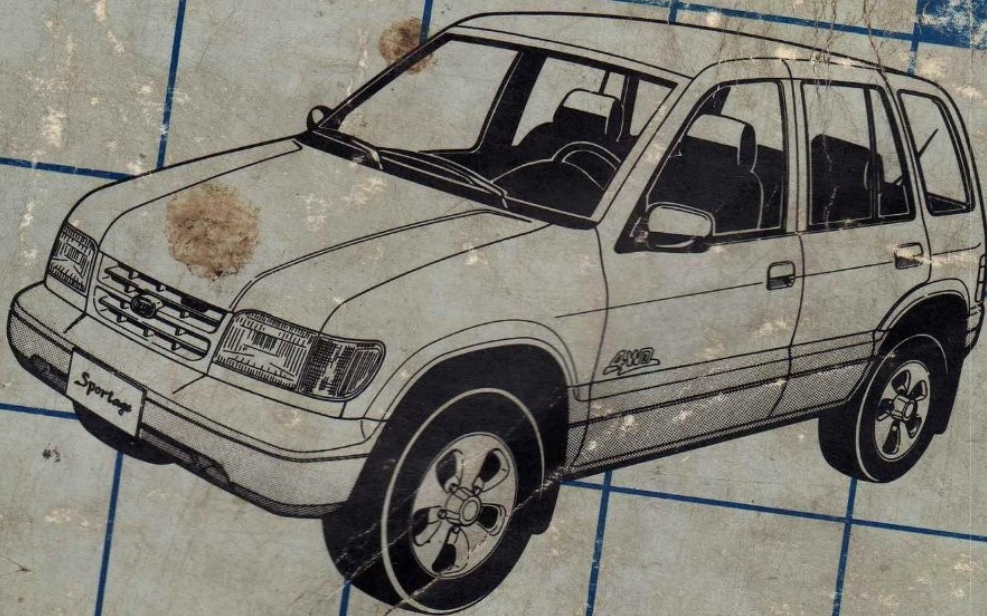


Sportage

ENGINE
CHASSIS
BODY
ELECTRICAL
SPECIFICATION

WORKSHOP MANUAL



94 - 03

1994 Kia Motors Corporation



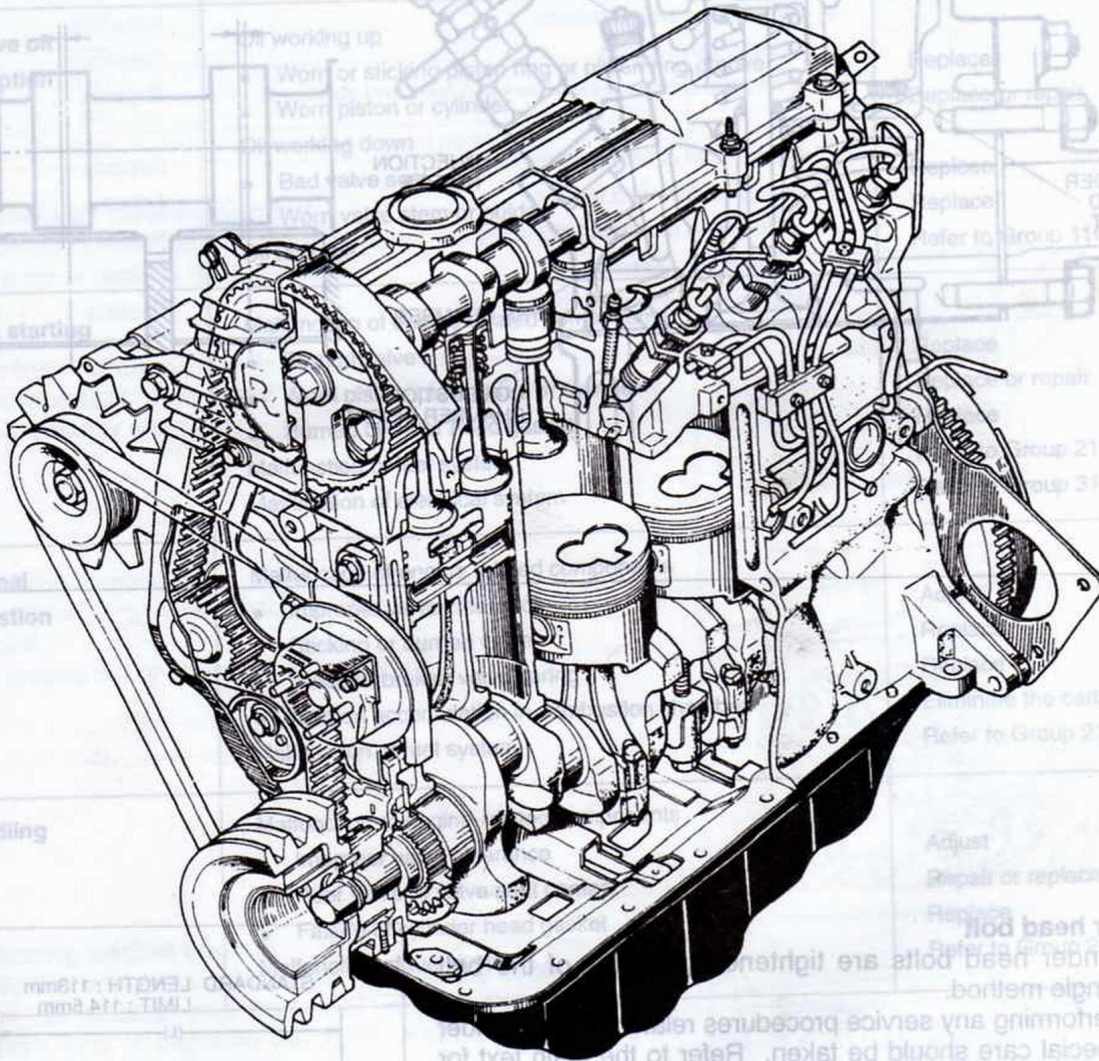
DESCRIPTION

OUTLINE OF CONSTRUCTION

The new magma diesel engine, by using the latest technological advances, is an excellent balance of output, fuel consumption, durability and quiet operation.

Its main features are.

1. Aluminum alloy cylinder head
2. Direct-drive OHC
3. Timing belt
4. New tightening method for cylinder head bolts
5. Oil baffle plate for vibration reduction



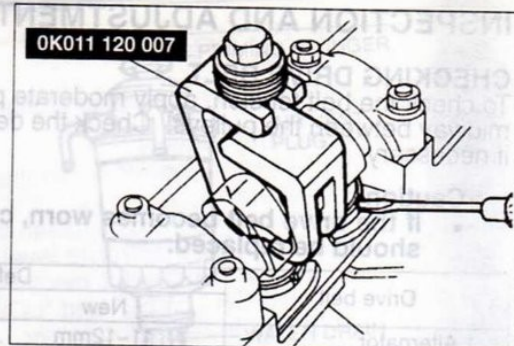
Adjust the valve clearances by following the procedures below if they are not within the standard.

Face the intake cam straight upward.

Move the tappet so that its notch is at the manifold side, so that access to the adjusting disc is easy.

Using the **tappet holder** (0K011 120 007), press the tappet down to the position where the adjusting disc becomes accessible.

Using a small screw driver or similar tool, take out the adjusting disc.



10C007

Select an appropriate disc depending on the valve clearance measured. Install it and check the clearance again.

Example (Intake valve) :

Thickness of original adjusting disc + (measured clearance - standard clearance) = **thickness of new adjusting disc.**

$$4.00 + (0.30 - 0.25) = 4.05\text{mm}$$

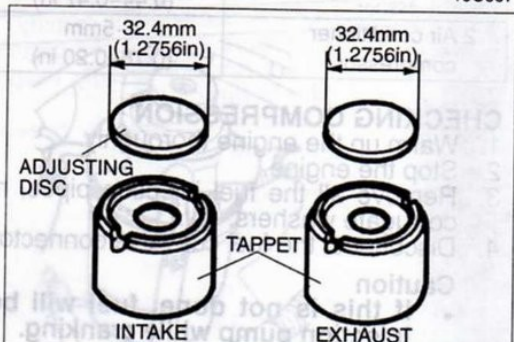
$$0.157 + (0.012 - 0.010) = 0.159\text{ in}$$

Note

- The number marked on the disc indicates its thickness.

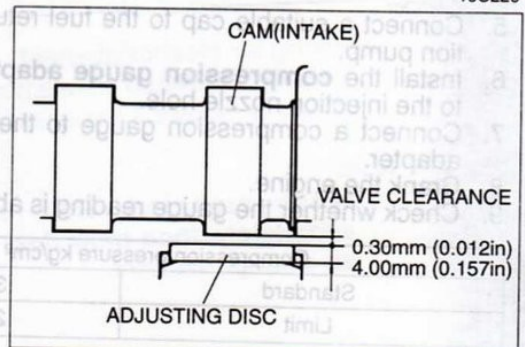
Example : 3825 means 3.825mm (0.1056in).

Adjusting discs are available in 37 different thickness within the 3.400-3.650mm (0.134-0.144in), 4.350-4.600mm (0.171-0.181in) range, at intervals of 0.050mm (0.002 in) and 3.700-4.275mm (0.146-0.169in) range, at intervals of 0.25mm (0.00984in).

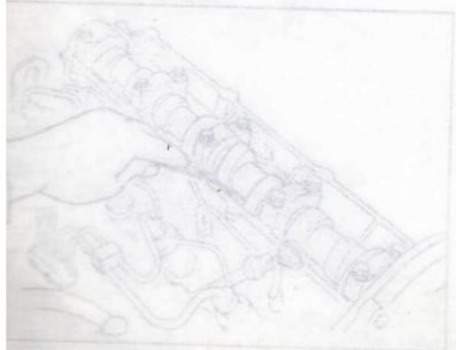
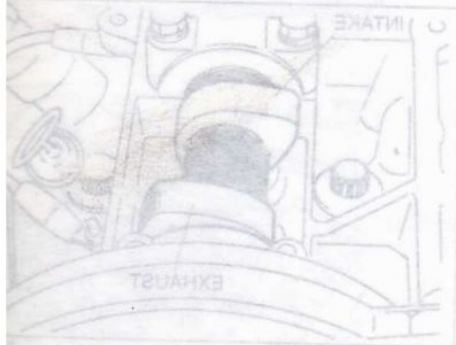


10C229

Measure and adjust cylinder 2 to 4 in the same way.



10C008



ADJUSTMENT OF VALVE CLEARANCE

- Remove the cylinder head cover.
- Set the No. 1 cylinder to compression TDC.

Note

- Turn the crankshaft so that the intake and exhaust cam lobes face upward.

- Measure the valve clearance of No. 1 cylinder by using a thickness gauge.

Standard valve clearances (engine cold condition) :

Intake : 0.20-0.30mm (0.008-0.012in)
Exhaust : 0.30-0.40mm (0.012-0.016in)

Timing belt

- Before removing the timing belt and timing belt tensioner, align each timing mark.

Cautions

- After removing the timing belt, don't rotate the crankshaft pulley and camshaft pulley to prevent damaging the valves.

- If reusing the timing belt, draw a direction arrow on the timing belt to replace it in the same direction.

Inspection

Timing belt

- Replace the belt if there is any oil, grease, or moisture on it.
- Check for damage, wear, peeling, cracks, or hardening. Replace if necessary.

Cautions

- Never forcefully twist the timing belt, turn it inside out, or bend it.
- Be very careful not to allow oil, grease, or moisture to get on the timing belt.

Timing belt tensioner

- Check the rotation of the timing belt pulley, and check for play or abnormal noise. Replace if necessary.

Cautions

- Do not clean the timing belt tensioner with cleaning fluids.
- If it is dirty, use a rag to wipe it clean, so as to avoid scratching it.

Timing belt pulley, camshaft pulley and injection pump pulley

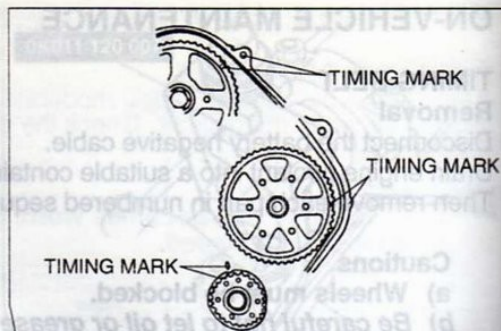
- Check the pulley teeth for damage, wear, deformation, etc. Replace if necessary.

Caution

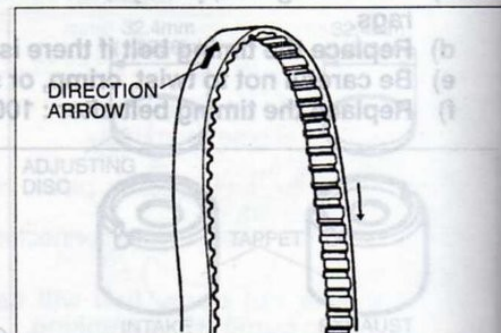
- Do not wash the pulley. If it is dirty, use a rag to wipe it clean, so as to avoid it being contaminated by oil etc.

Installation

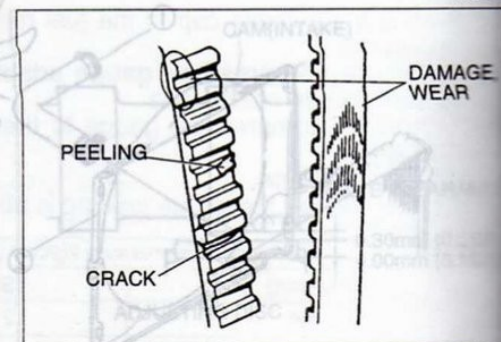
- Check to be sure that the timing marks of camshaft pulley, timing belt pulley and crankshaft pulley match to each timing mark.



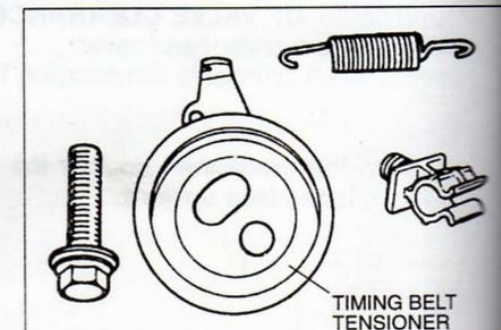
10C041



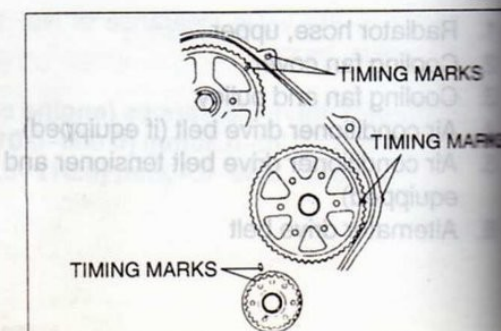
10C042



10C043

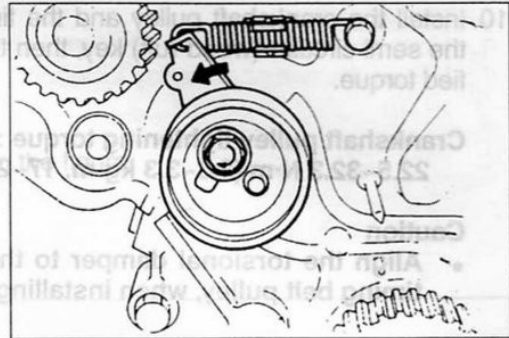


10C044



10C045

2. Install the timing belt tensioner, lock bolt and spring in fully loosened position, and then push timing belt tensioner left as far as it will go and the temporarily tighten it.



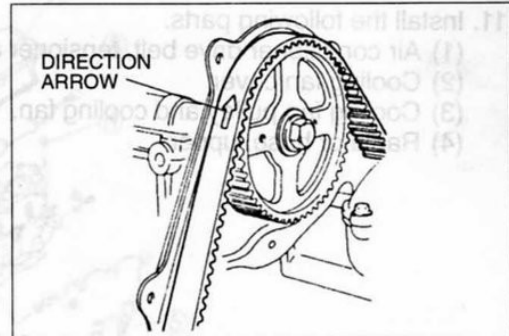
10C046

3. Install the timing belt.

Caution

- The timing belt must always be reinstalled in the same direction of previous rotation for continued durability.

Teeth of timing belt : 164



10C047

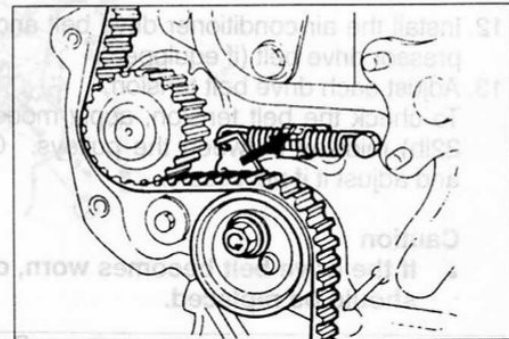
4. Release the timing belt tensioner lock bolt to allow spring pressure to bear on the timing belt.
5. Turn the crankshaft twice in the direction of rotation (clock-wise) to equalize tension on the timing belt.

Caution

- Do not turn in reverse direction.

6. Tighten the timing belt tensioner lock bolt.

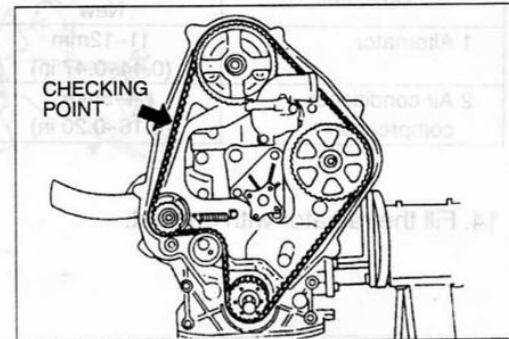
Tensioner lock bolt tightening torque :
31.4~46.1 N·m (3.2~4.7 kg-m, 23~34 lb-ft)



10C048

7. Re-check the timing marks on the crankshaft, injection pump and camshaft pulley, and check the timing belt deflection when pressed with a force of 10kg (22 lb).

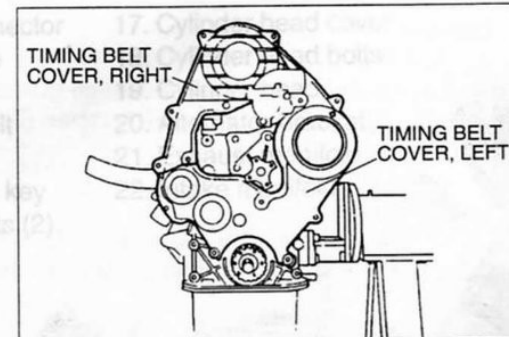
Standard deflection : (under cold engine condition)
10.8~12.9mm (0.43~0.51 in)



10C049

8. Install the timing belt cover left with rubber seal.
9. Install the timing belt cover right with rubber seal.

Timing belt covers tightening torque :
7.0~9.81 N·m (0.7~1.0 kg-m, 5~7 lb-ft)



10C050

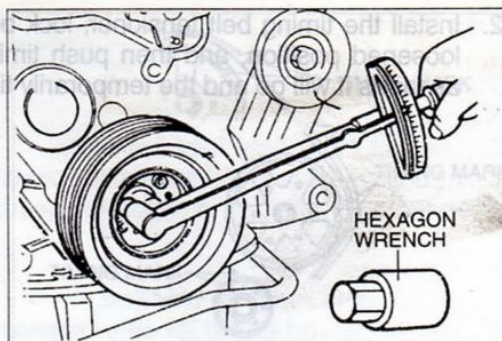
10. Install the crankshaft pulley and the timing belt pulley with the semi circular (wood-ruff) key, then tighten it to the specified torque.

Crankshaft pulley tightening torque :

22.5~32.3 N·m (2.3~3.3 kg-m, 17~24 lb-ft)

Caution

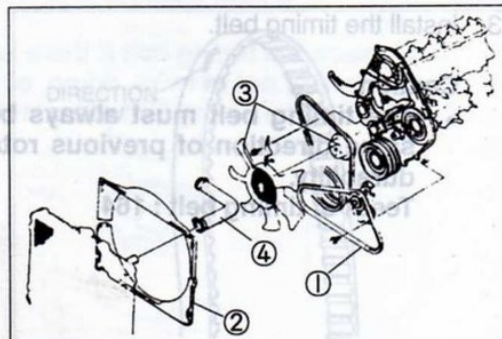
- Align the torsional damper to the knock pin on the timing belt pulley, when installing.



10C051

11. Install the following parts.

- (1) Air conditioner drive belt, tensioner and bracket.
- (2) Cooling fan cover
- (3) Cooling fan pulley and cooling fan.
- (4) Radiator hose, upper



10C052

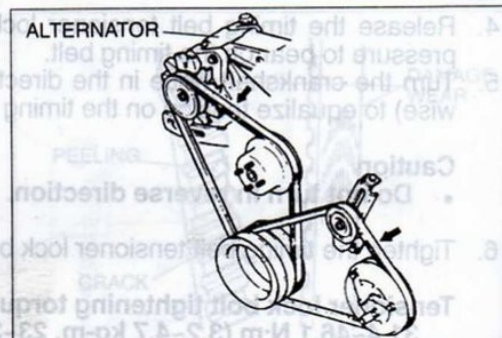
12. Install the air conditioner drive belt and air conditioner compressor drive belt (if equipped).

13. Adjust each drive belt tension.

To check the belt tension, apply moderate pressure (10kg, 22lb) midway between the pulleys. Check the deflection, and adjust it if necessary.

Caution

- If the drive belt becomes worn, cracked, or frayed, it should be replaced.



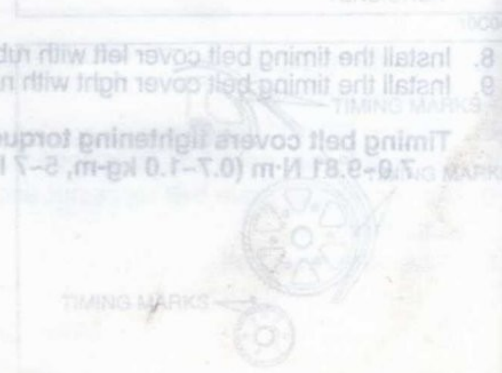
10C053

Drive belt	Deflection	
	New	Used
1 Alternator	11~12mm (0.44~0.47 in)	12~14mm (0.47~0.55 in)
2 Air conditioner compressor	4~5mm (0.16~0.20 in)	5~6mm (0.20~0.24 in)

14. Fill the radiator with coolant.



10C054



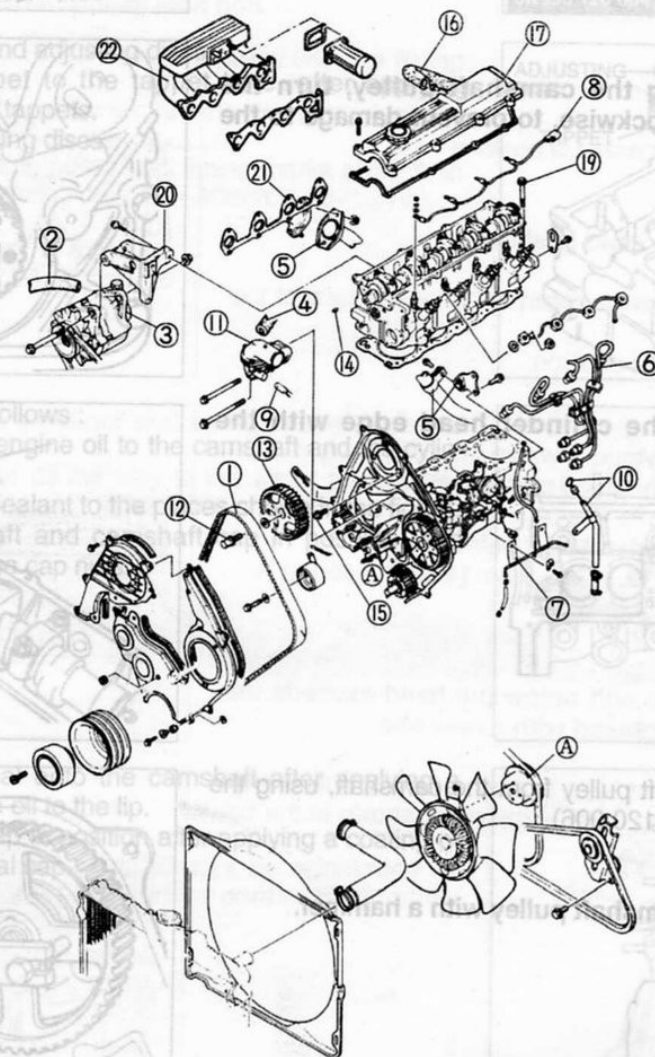
10C054

CYLINDER HEAD**Removal**

1. Disconnect the battery negative cable from the battery.
2. Drain engine coolant into a suitable container.
3. Then remove each part in the numbered sequence as shown in the figure.
4. Install in the reverse order of removal.

Caution

- Wheels must be blocked during maintenance.



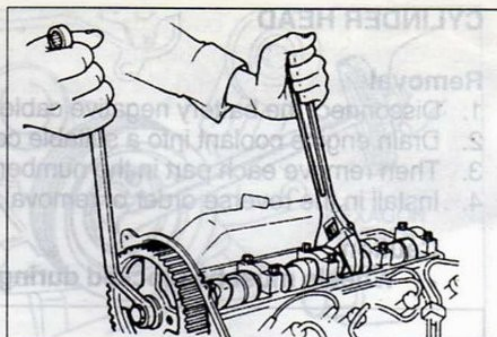
1. Timing belt
2. Vacuum hose
3. Alternator
4. Oil cooler hose
5. Exhaust pipe and bracket
6. Injection pipes
7. Fuel return pipe
8. Glow plug connector

9. Thermo unit gauge connector
10. Oil level gauge and pipe
11. Thermostat assembly
12. Camshaft pulley lock bolt
13. Camshaft pulley
14. Semi circular (woodruff) key
15. Seal plate attaching bolts (2)
16. Beather hose

17. Cylinder head cover
18. Cylinder head bolts
19. Cylinder head
20. Alternator bracket
21. Exhaust manifold
22. Intake manifold

Camshaft pulley

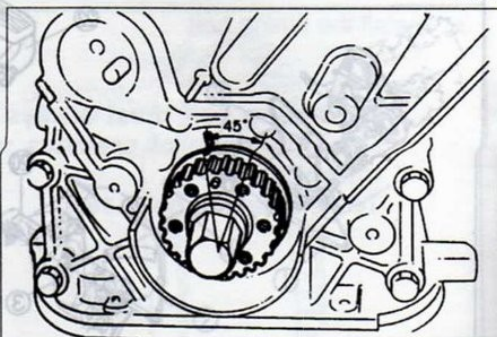
1. Hold the camshaft with the wrench (29mm, 1.14 in) and loosen the camshaft pulley lock bolt.



10C011

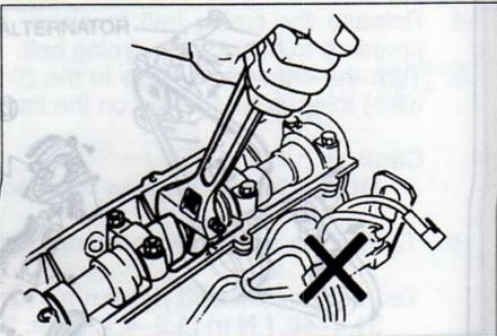
Cautions

- a) Before removing the camshaft pulley, turn the crankshaft 45° clockwise, to prevent damage to the valve.



10C230

- b) Don't damage the cylinder head edge with the wrench.



10C231

2. Separate the camshaft pulley from the camshaft, using the pulley puller (OK710 120 006).

Caution

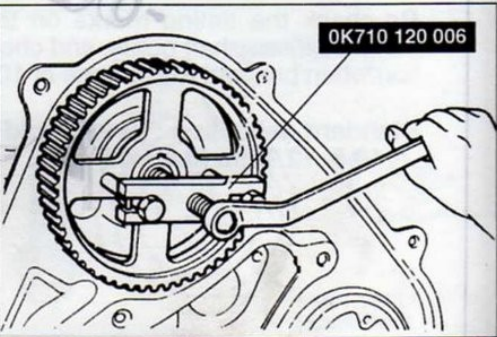
- Do not hit the camshaft pulley with a hammer.

Disassembly

Refer to page 10C-29.

Inspection

Refer to page 10C-19.



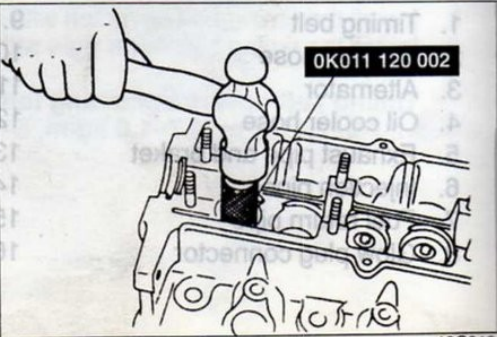
10C012

Assembly

1. Install the valve seals.
 - (1) Apply engine oil to the valve guides.
 - (2) Using the valve seal pusher (OK011 120 002), install the valve seals.

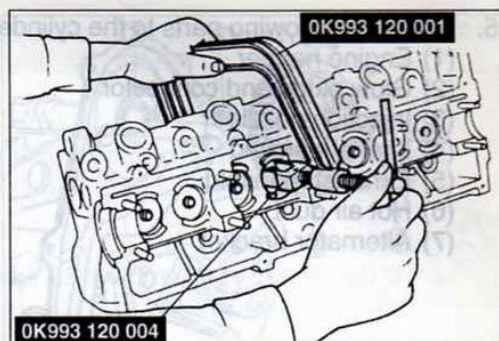
Caution

- Be sure to use the special tool for installation. If it is not installed correctly, the oil might work down.



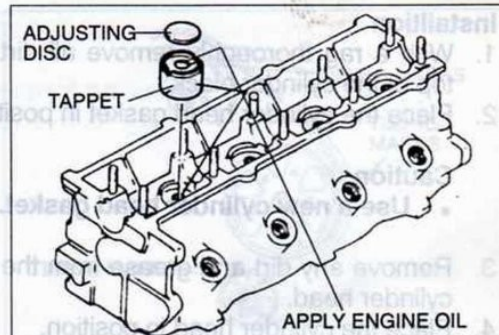
10C013

2. Install the valves on to the cylinder head.
 - (1) Install the valve spring seat, lower.
 - (2) Insert the valve after applying grease (use a molybdenum disulphide grease) to the valve stem.
 - (3) Install the valve spring and valve spring seat, upper.
 - (4) Using the **valve spring lifter** (0K993 120 001) and **pivot** (0K993 120 004), Press the valve spring. And then install the spring retainer securely.



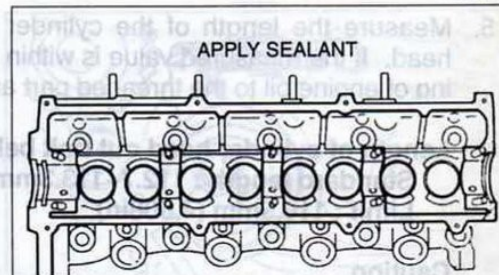
10C014

3. Install the tappets and adjusting discs.
 - (1) Install the tappet to the tappet hole, after applying engine oil to the tappets.
 - (2) Install the adjusting discs.



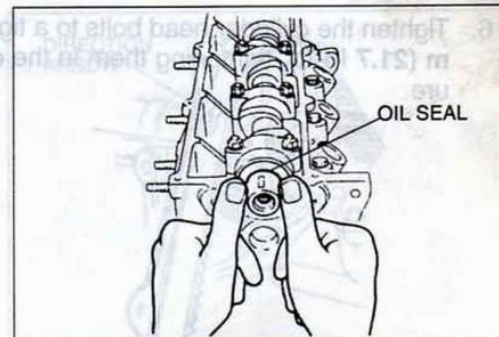
10C015

4. Install camshaft as follows :
 - (1) Apply a coat of engine oil to the camshaft and the cylinder head journal.
 - (2) Apply a coat of sealant to the places shown in the figure.
 - (3) Set the camshaft and camshaft cap in position, and loosely tighten the cap nuts.



10C016

- (4) Insert the oil seal onto the camshaft after applying a coating of engine oil to the lip.
- (5) Insert the seal cap in position after applying a coating of sealant to the seal cap.



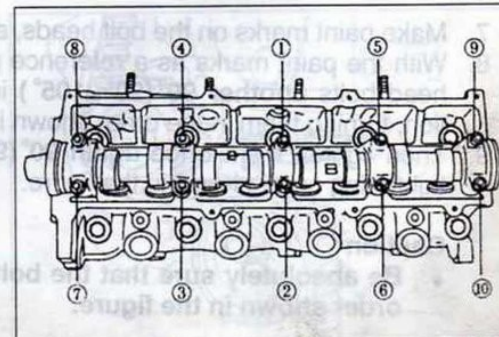
10C017

- (6) Tighten the camshaft cap nuts to the specified torque.

Camshaft cap tightening torque :
20.6~26.4 N·m (2.1~2.7 kg-m, 15~22 lb-ft)

Caution

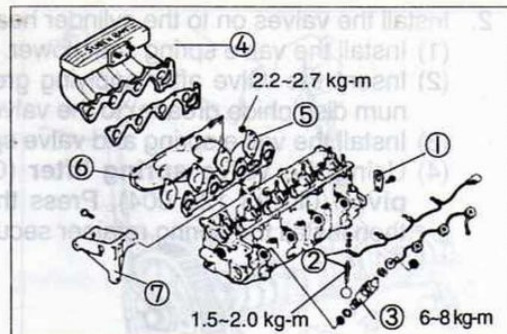
- Tighten the left and right camshaft cap nuts alternately, as shown in the figure, two or three times each.



10C018

5. Install the following parts to the cylinder head.

- (1) Engine hanger
- (2) Glow plugs and connector
- (3) Injection nozzles
- (4) Intake manifold
- (5) Exhaust manifold
- (6) Hot air duct
- (7) Alternator bracket



10C019

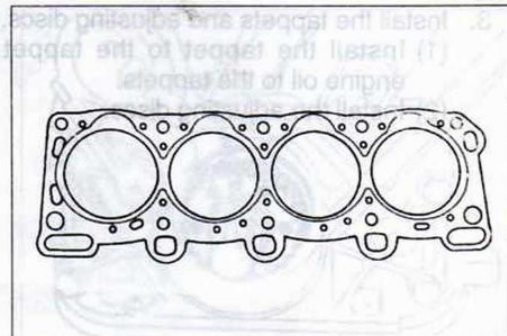
Installation

1. With a rag thoroughly remove all dirt and grease from the top of the cylinder block.
2. Place the cylinder head gasket in position.

Caution

- Use a new cylinder head gasket.

3. Remove any dirt and grease from the bottom surface of the cylinder head.
4. Place the cylinder head in position.



10C020

5. Measure the length of the cylinder head bolt below the head. If the measured value is within the limit, apply a coating of engine oil to the threaded part and install.

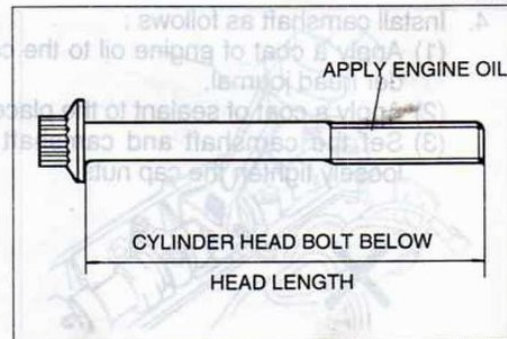
Length of cylinder head out bolt below head

Standard length : 112.7~113.3mm (4.437~4.460in)

Limit : 114.5mm (4.508in)

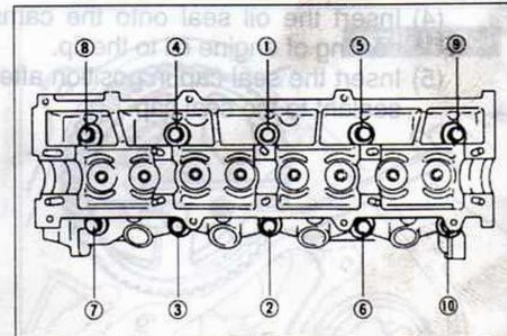
Caution

- If the length of the bolt below the head exceeds the limit, it must be replaced with a new one.



10C021

6. Tighten the cylinder head bolts to a tightening torque of **3kg-m (21.7 lb-ft)**, tightening them in the order shown in the figure.

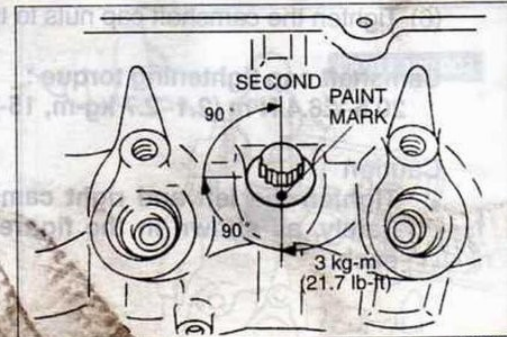


10C022

7. Make paint marks on the bolt heads, as shown in the figure.
8. With the paint marks as a reference point, turn the cylinder head bolts **another 90° (90°~105°)** in the tightening direction, turning them in the order shown in the figure.
9. Then tighten them **once again 90° (90°~105°)** more in the tightening order shown in the figure.

Caution

- Be absolutely sure that the bolts are tightend in the order shown in the figure.



10C023

Disassembly related to lubrication system and flywheel

MAINTENANCE NOTES

Before inspection, clean each part, taking care to remove any gasket fragments, dirt, oil or grease, carbon, moisture or other contaminants. Be careful not to damage the parts of aluminum alloy components such as cylinder head pistons.

Inspection and repair should be done in the following order:

Cylinder head inspection and repair of cylinder head

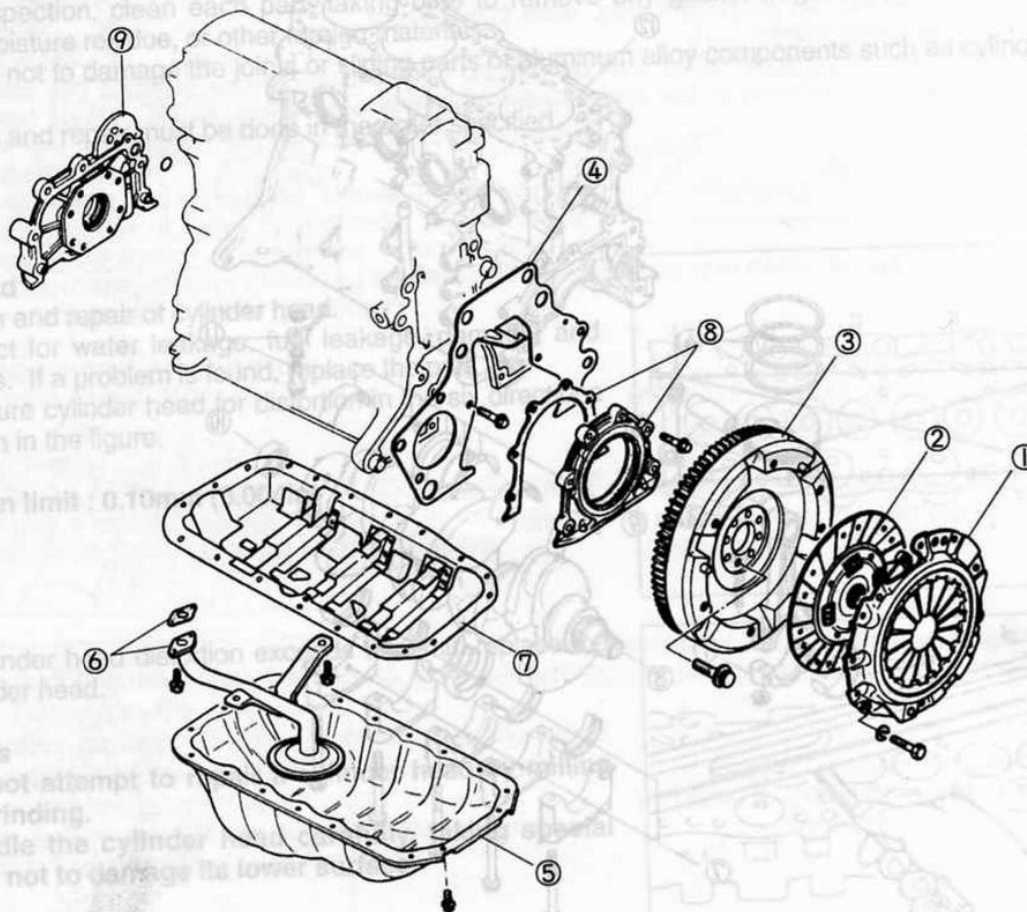
- (1) Inspect for water leakage, rust, cracks. If a problem is found, replace the cylinder head.
- (2) Measure cylinder head for distortion shown in the figure.

Distortion limit : 0.10mm

- (3) If cylinder head is distorted, replace the cylinder head.

Cautions

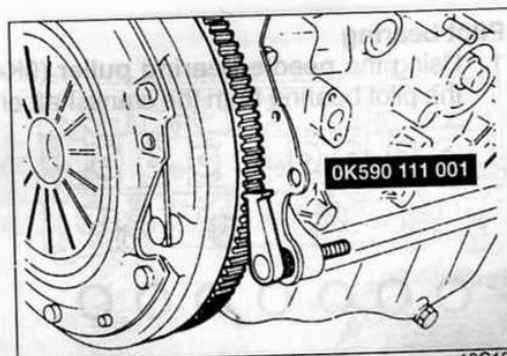
- a) Do not attempt to grind or grinding.
- b) Handle the cylinder head with care not to damage its lower surface.



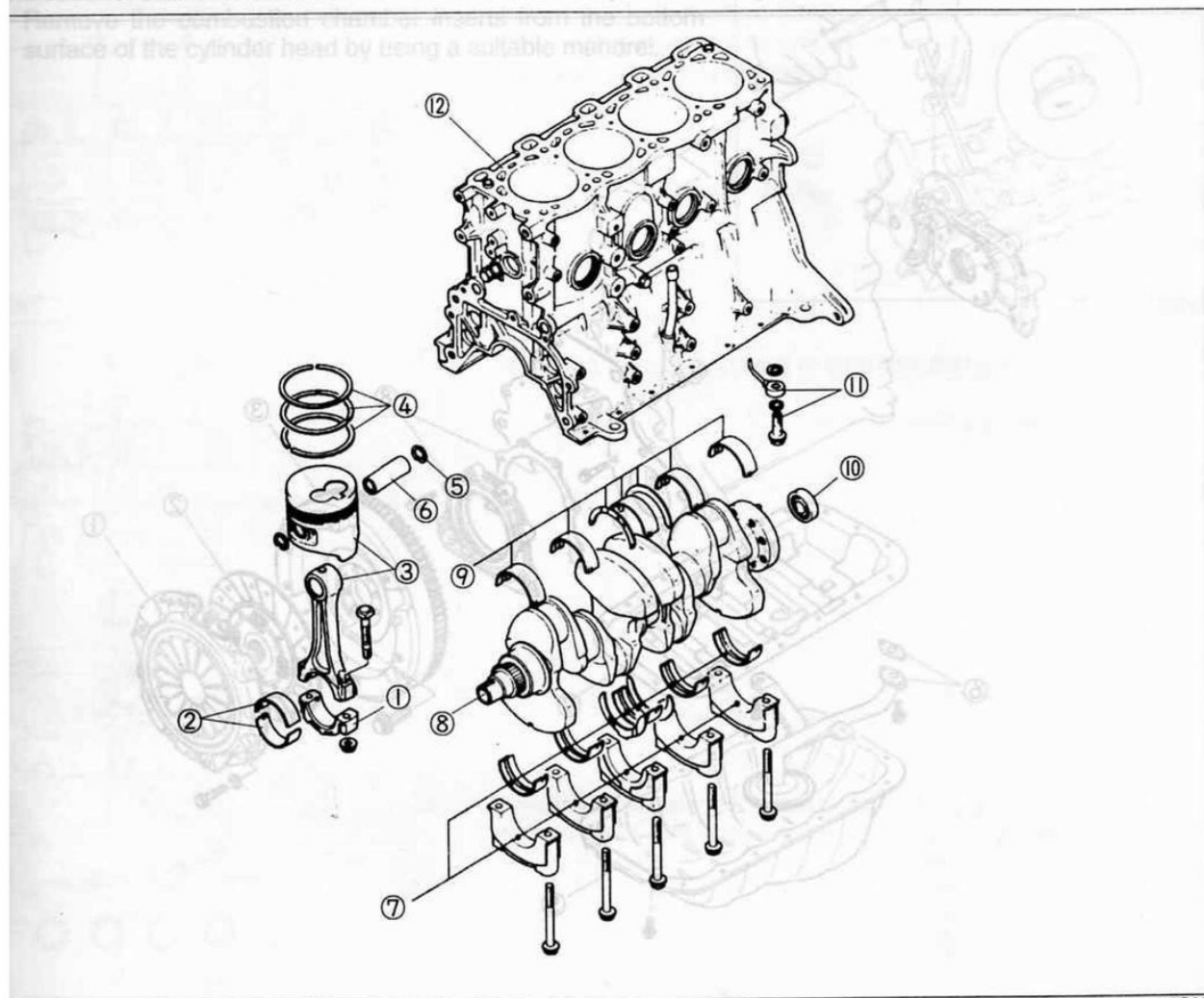
- | | | |
|-----------------|----------------------------|-----------------------------------|
| 1. Clutch cover | 4. End plate | 7. Oil baffle plate |
| 2. Clutch disc | 5. Oil pan | 8. Rear cover assembly and gasket |
| 3. Flywheel | 6. Oil strainer and gasket | 9. Oil pump assembly |

Flywheel

1. Connect the **ring gear brake** (OK590 111 001) to the flywheel securely. Remove the clutch cover, clutch disc and flywheel.



assembly relate to crankshaft and pistons



10C251

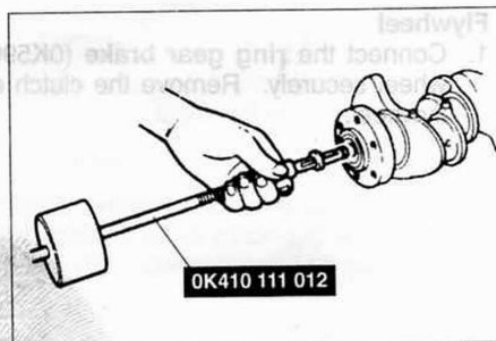
Connecting rod bearing caps
Connecting rod bearings
Connecting rods and pistons
Piston rings
Snap rings

6. Piston pins
7. Main bearing caps, main bearings and thrust bearings
8. Crankshaft
9. Main bearings and thrust bearings

10. Pilot bearing
11. Oil jets
12. Cylinder block

Pilot bearing

Using the **needle bearing puller** (OK410 111 012), remove the pilot bearing from the crankshaft end.



10C108

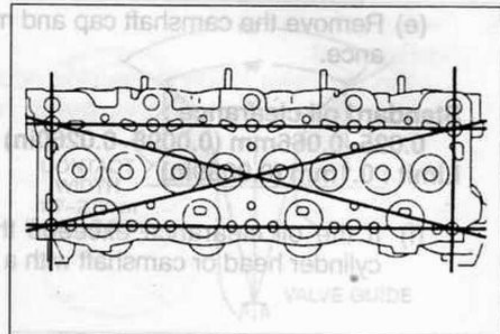
INSPECTION AND REPAIR**MAINTENANCE NOTES**

1. Before inspection, clean each part, taking care to remove any gasket fragments, dirt, oil or grease, carbon, moisture residue, or other foreign materials.
2. Be careful not to damage the joints or sliding parts of aluminum alloy components such as cylinder head, pistons.
3. Inspection and repair must be done in the order specified.

Cylinder head

1. Inspection and repair of cylinder head.
 - (1) Inspect for water leakage, fuel leakage, damage, and cracks. If a problem is found, replace the part.
 - (2) Measure cylinder head for distortion in the six directions shown in the figure.

Distortion limit : 0.10mm (0.004in)

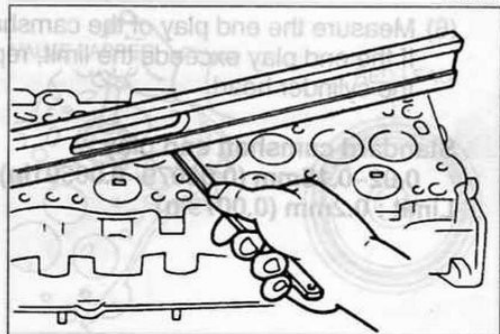


10C109

- (3) If cylinder head distortion exceeds the limit, replace the cylinder head.

Cautions

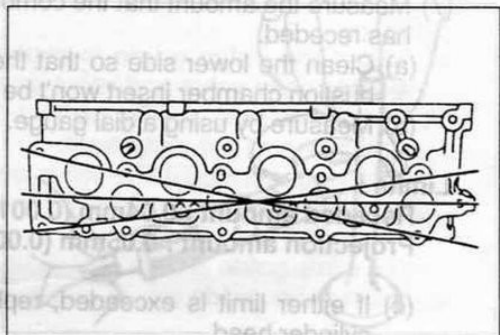
- a) Do not attempt to repair a cylinder head by milling or grinding.
- b) Handle the cylinder head carefully, taking special care not to damage its lower surface.



10C110

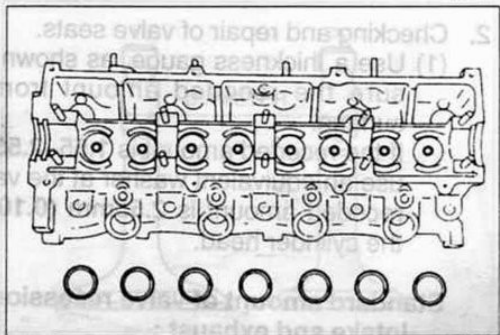
- (4) Measure the manifold contact surface distortion. If the distortion exceeds the limit, grind the surface, or replace the cylinder head.

Distortion limit : 0.20mm (0.008in) max.



10C111

- (5) Measure the oil clearance of the camshaft.
 - (a) Remove the tappet and adjusting disc from the cylinder head, and separate them by cylinder.
 - (b) Clean away oil or dirt from the camshaft or cylinder head journal.
 - (c) Set a platinum gauge on the camshaft journal (in the axial direction of the journal).
 - (d) Set the camshaft cap, and tighten to the specified torque.

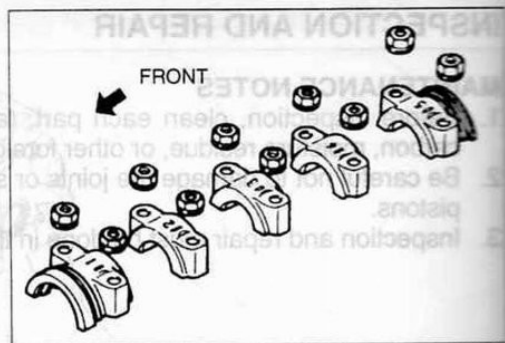


10C112

Camshaft cap tightening torque :
19.6~26.4 N·m (2.0~2.7 kg-m, 15~20 lb-ft)

Cautions

- When installing the camshaft cap, note the correct order and arrow marks.
- When tightening the camshaft cap nut, do so evenly and in the order shown in the engine assembly section.

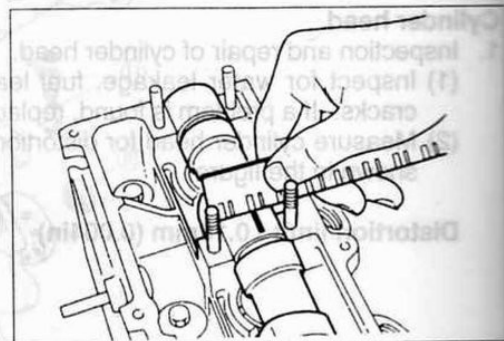


10C113

- Remove the camshaft cap and measure the oil clearance.

Standard oil clearance :
0.025~0.066mm (0.0098~0.0260in)
Limit : 0.1mm (0.0039in)

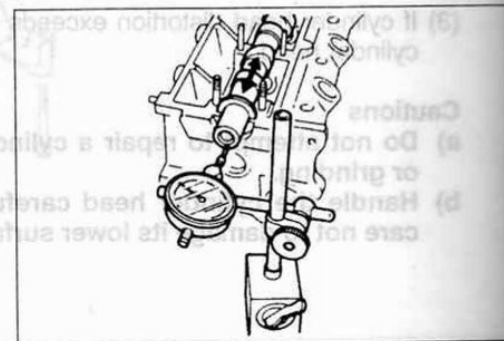
- If the oil clearance exceeds the limit, replace the cylinder head or camshaft with a new one.



10C114

- Measure the end play of the camshaft.
If the end play exceeds the limit, replace the camshaft or the cylinder head.

Standard camshaft end play :
0.02~0.15mm (0.00079~0.00591in)
Limit : 0.2mm (0.0079in)



10C115

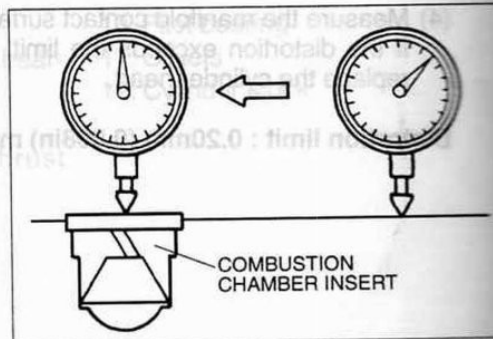
- Measure the amount that the combustion chamber insert has receded.

- Clean the lower side so that the surface of the combustion chamber insert won't be scarred.
- Measure by using a dial gauge.

Limits :

Receded amount : 0.04mm (0.0016in)
Projection amount : 0.05mm (0.0020in)

- If either limit is exceeded, replace the insert or the cylinder head.

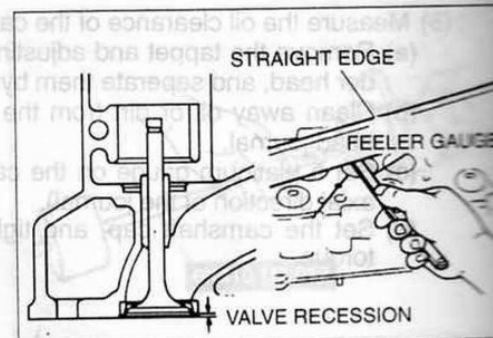


10C116

2. Checking and repair of valve seats.

- Use a thickness gauge, as shown in the figure, to measure the receded amount from the cylinder head surface.
If the receded amount is 1.55~2.55mm (0.061~0.100in), use an equivalent washer at the valve spring seat. If the receded amount is 2.55mm (0.100in) or more, replace the cylinder head.

Standard amount of valve recession :
Intake and exhaust :
0.75~1.05mm (0.030~0.041in)



10C117

- (2) Check the surface which contacts the valve face for roughness or damage. If necessary, use a valve seat cutter or valve seat grinder to repair to the specified shape.

Notes

- a) To check the contact width, apply a thin coating of red lead to the valve seat, and press the valve against the valve seat. Be sure not to turn the valve when doing so.
- b) When grinding the valve seat, use a 15°, 45° or 60° valve seat cutter or valve seat grinder to grind away the roughness and/or scars (to the minimum limit) of the seat surface, always checking the contact which and contact position while grinding.

Standard valve seat contact width :
1.7~2.3mm (0.067~0.091in)

- (3) Seat the valve.
To seat the valve, apply a thin coating of engine oil mixed with a small amount of compound to the seat surface, and then lightly tap while turning the valve.

Cautions

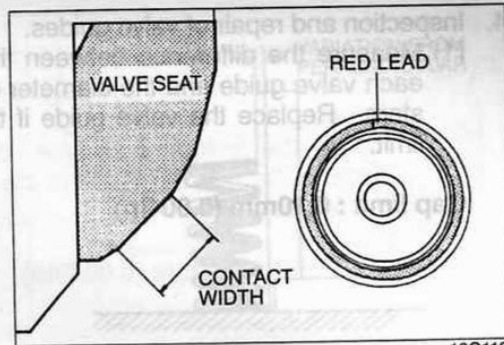
- a) When seating the valve, be careful not to let compound adhere to the valve stem.
- b) The valve contact position in relation to the valve seat must be at the center of the circumference, and the contact width must be the standard value.
- c) Check to be sure that the amount of valve recession is within the specification.

3. Inspection and repair of valves.

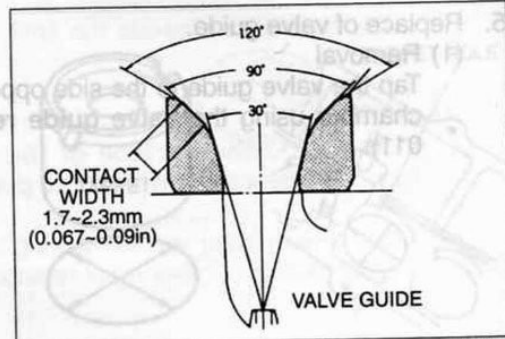
- (1) Inspect each valve and replace any that show valve stem wear, damage, bending, or dents.
- (2) Inspect each valve for roughness or damage on its faces. If the problem is slight, repair the valve with valve refacer.

Standard valve stem diameter :

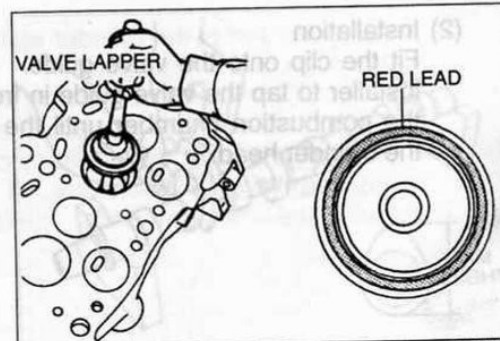
Intake : 7.970~7.985mm (0.3138~0.3144in)
Exhaust : 7.965~7.980mm (0.3136~0.3142in)



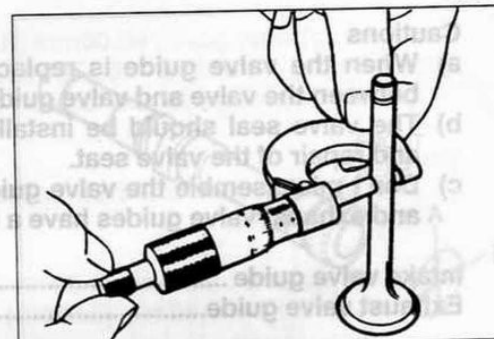
10C118



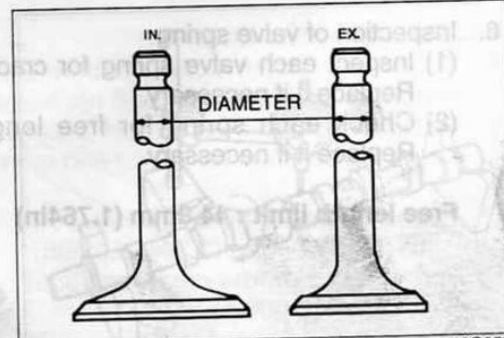
10C119



10C120



10C252

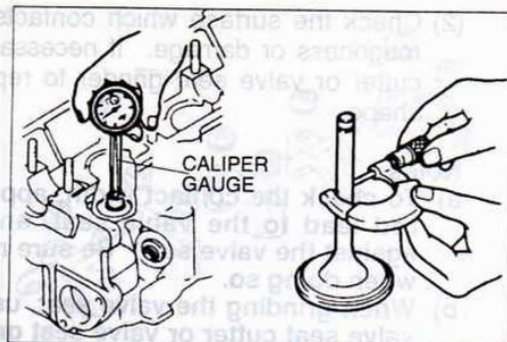


10C253

4. Inspection and repair of valve guides.

- (1) Measure the difference between the inner diameter of each valve guide and the diameter of the corresponding stem. Replace the valve guide if the gap exceeds the limit.

Gap limit : 0.10mm (0.004in)

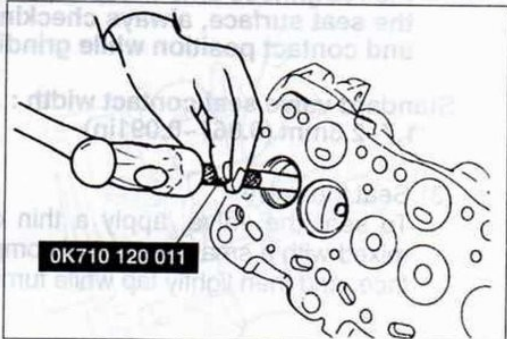


10C121

5. Replace of valve guide.

(1) Removal

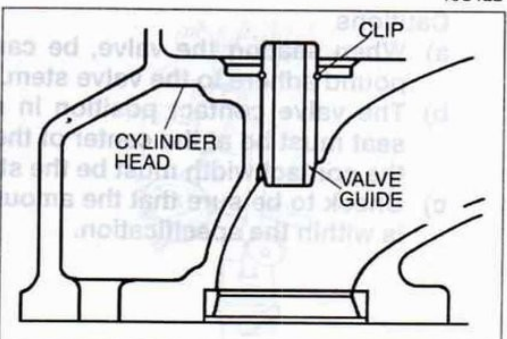
Tap the valve guide to the side opposite the combustion chamber using the **valve guide remover** (OK710 120 011).



10C122

(2) Installation

Fit the clip onto the valve guide. Use the valve guide installer to tap the valve guide in from the side opposite the combustion chamber until the clip barely contacts the cylinder head.

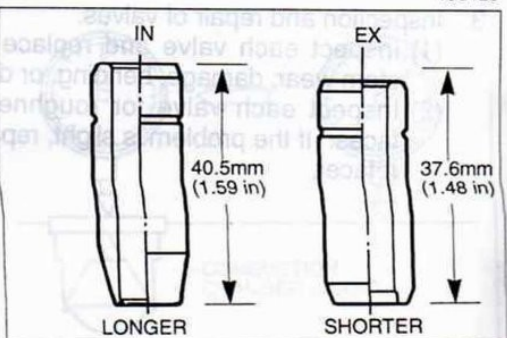


10C123

Cautions

- a) When the valve guide is replaced, check the gap between the valve and valve guide once again.
- b) The valve seal should be installed after inspection and repair of the valve seat.
- c) Don't misassemble the valve guides because intake and exhaust valve guides have a different seat.

Intake valve guide longer
Exhaust valve guide..... shorter

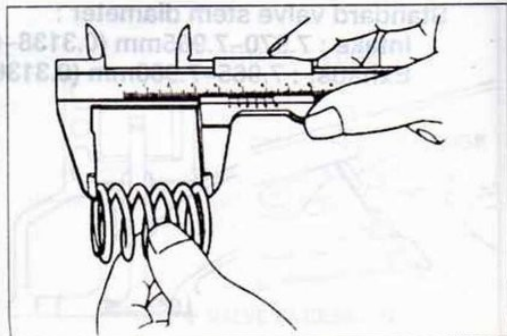


10C124

6. Inspection of valve spring

- (1) Inspect each valve spring for cracks or other damage. Replace it if necessary.
- (2) Check each spring for free length and angle limit. Replace it if necessary.

Free length limit : 44.8mm (1.764in)



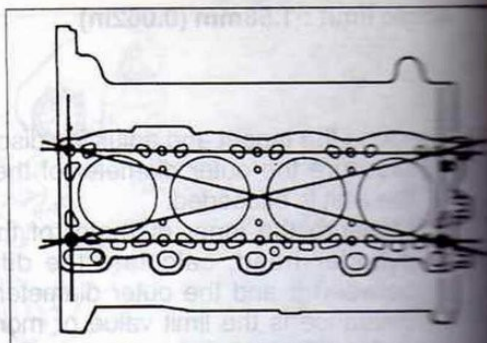
10C126

Cylinder block

1. Cylinder block inspection and repair

- (1) Check each cylinder for damage and cracks. Replace if necessary.
- (2) Measure the distortion (degree of flatness) of the top surface of the cylinder block in the six directions shown in the figure.

Distortion limit : 0.10mm (0.0040in)

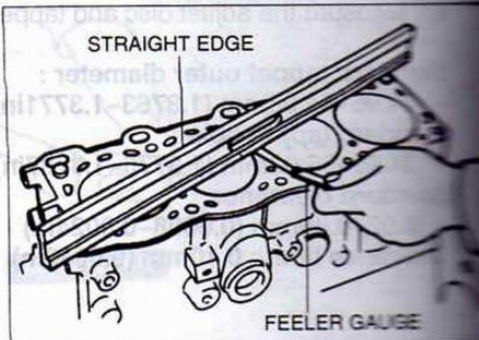


- (3) If the distortion exceeds the limit, replace the cylinder block.

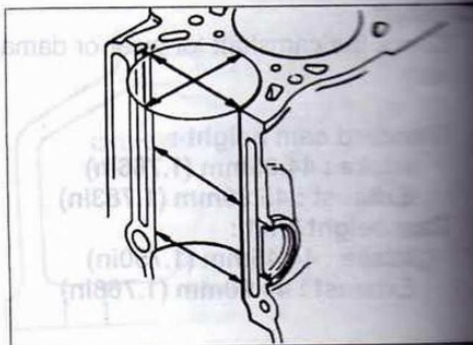
Caution

- **Don't grind the surface of the cylinder block. If grinded, the valves will hit the pistons.**

- (4) Check the cylinder wall for scoring or signs of seizure. If a problem exists, reboring or replacement is necessary.



- (5) If the upper part of the cylinder wall shows uneven wear, use a ridge reamer to repair.
- (6) Measure the cylinder diameter at the six place shown in the figure. Check the amount of wear. The amount of wear is the difference between the maximum and minimum diameters. If the amount of wear exceeds the limit, the cylinder must be rebored.



Standard cylinder bore : 86.00mm (3.386in)

Cylinder bore wear limit : 86.17mm (3.392in)

Difference between cylinder bores : 0.022mm (0.0009in)

Caution

- **The boring size should be based on the size of an oversize piston.**

Over-size pistons : 0.10mm (0.0040in)

0.50mm (0.020in)

Pistons and piston rings

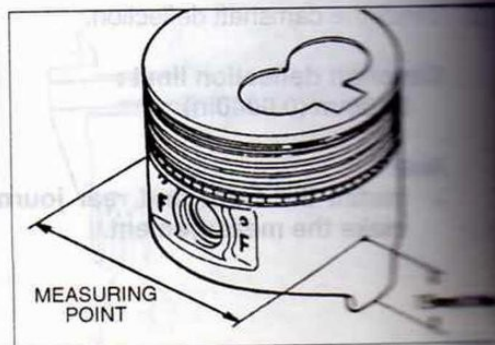
1. Inspect the piston outer circumferences of all pistons for seizure or scoring. Replace if necessary.
2. Measure the outer diameter of each piston, and be sure the clearance between the piston and cylinder is correct.

Piston standard outer diameter :

85.95~85.98mm (3.384~3.385in)

Piston and cylinder clearance limit :

0.15mm (0.006in)



Cautions

- a) Measure the piston outer diameter in the thrust direction, 19mm (0.75in) above the bottom of piston.
- b) If the piston is replaced, replace the piston ring also.

Oversize piston rings :

0.10mm (0.0040in), 0.50mm (0.020in)

3. Inspect the piston rings for damage, abnormal wear, or breakage. Replace if necessary.
4. Insert the piston ring into the cylinder by hand, and push it in by using the piston.
5. Measure the ring opening clearance.

Opening clearance limit : 1.0mm (0.039in)

6. Measure the clearance of the piston and ring groove.

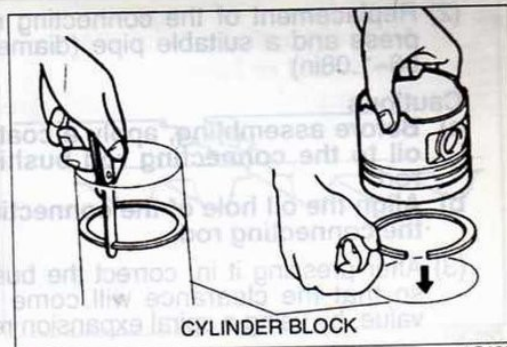
Clearance limit : 0.2mm (0.008in)

Top ring : 0.2mm (0.008in)

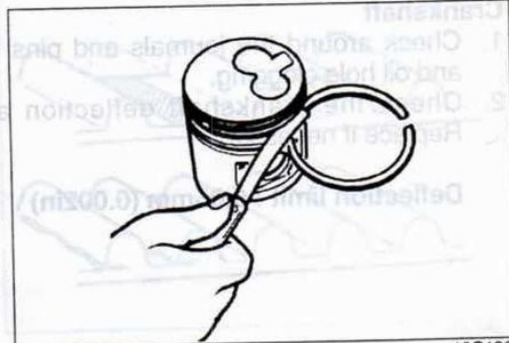
2nd & oil ring : 0.15 (0.006in)

Caution

- Measure the clearance around the entire circumference of the ring groove.



10C135



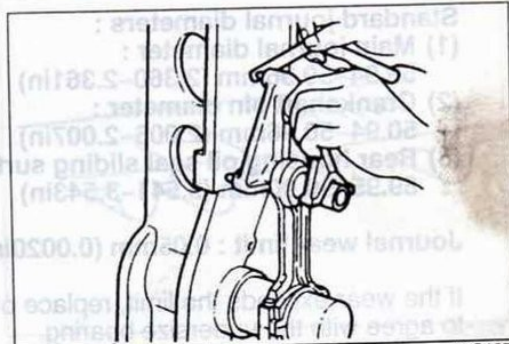
10C136

Connecting rods

1. Check each connecting rod for bending or torsion.

Connecting rod bending limit :

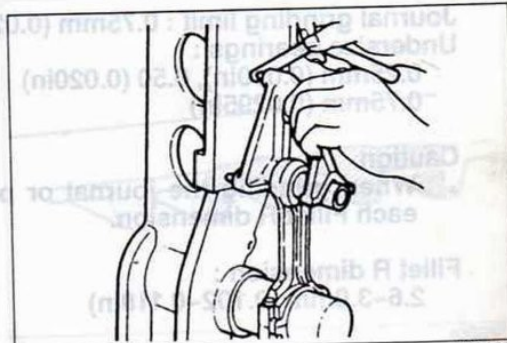
0.16mm (0.006in) per 100mm (3.94in)



10C137

Connection rod torsion limit :

0.16mm (0.006in) per 100mm (3.94in)



10C138

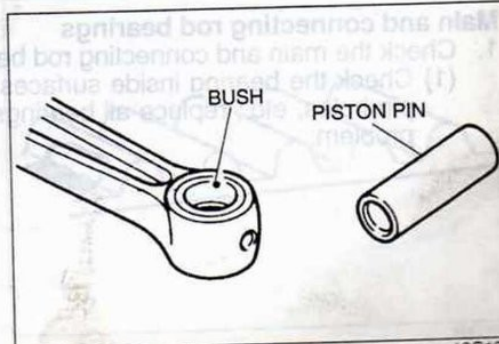
2. Connecting rod bushing inspection and repair.

- (1) Measure the clearance between the outer diameter of the piston pin and the inner diameter of the bushing. If the clearance exceeds the limit, replace the connecting rod bushing.

Standard connecting rod bushing inner diameter :

25.01~25.03mm (0.9846~0.9854in)

Clearance limit : 0.05mm (0.002in)

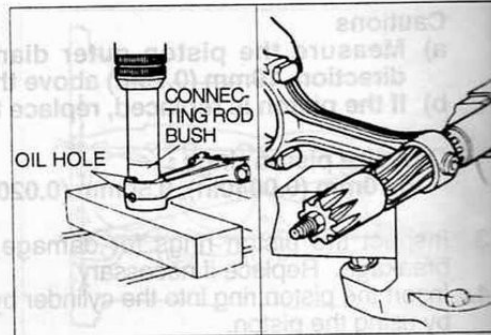


10C139

- (2) Replacement of the connecting rod bushing. Use a press and a suitable pipe (diameter=27~27.5mm, 1.06~1.08in)

Cautions

- a) Before assembling, apply a coating of clean engine oil to the connecting rod bushing and connecting rod.
- b) Align the oil hole of the connecting rod bushing and the connecting rod.
- (3) After pressing it in, correct the bushing inner diameter, so that the clearance will come within the standard value, by using a spiral expansion reamer.

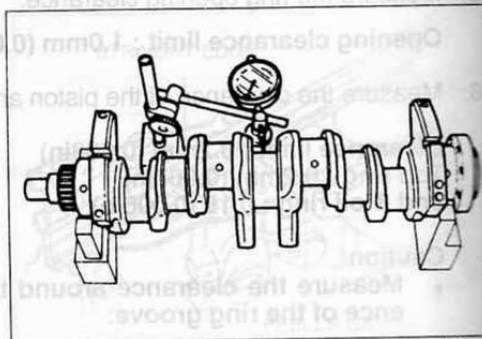


10C138

Crankshaft

1. Check around the journals and pins for damage, scoring, and oil hole clogging.
2. Check the crankshaft deflection and each diameter. Replace if necessary.

Deflection limit : 0.05mm (0.002in)



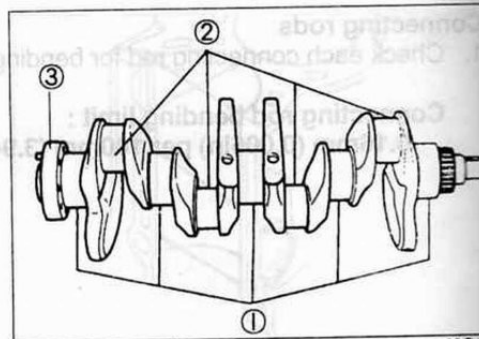
10C140

Standard journal diameters :

- (1) Main journal diameter : 59.94~59.96mm (2.360~2.361in)
- (2) Crankshaft pin diameter : 50.94~50.96mm (2.006~2.007in)
- (3) Rear housing oil seal sliding surface : 89.95~90.00mm (3.541~3.543in)

Journal wear limit : 0.05mm (0.0020in)

If the wear exceeds the limit, replace or grind the crankshaft to agree with the undersize bearing.



10C141

Journal grinding limit : 0.75mm (0.0295in)

Undersize bearings :

- 0.25mm (0.010in), 0.50 (0.020in)
- 0.75mm (0.0295in)

Caution

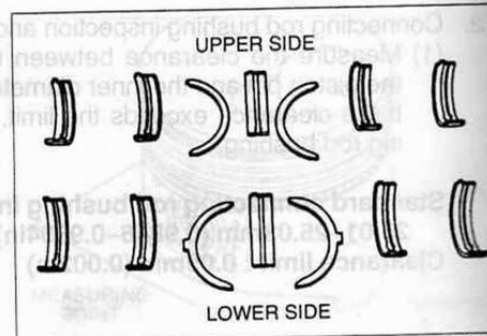
- When grinding the journal or pin, pay attention to each Fillet R dimension.

Fillet R dimension :

2.6~3.0mm (0.102~0.118in)

Main and connecting rod bearings

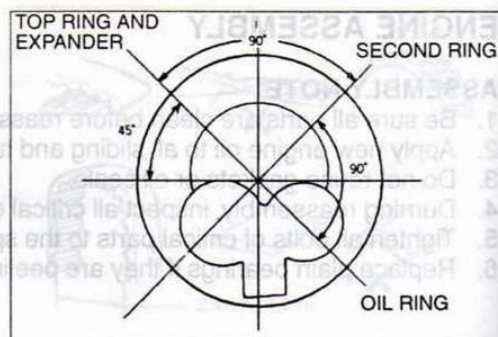
1. Check the main and connecting rod bearings
 - (1) Check the bearing inside surfaces for streaking, flaking, pin holes, etc.; replace all bearings as a set if there is a problem.



10C142

2. Assembly of the piston rings

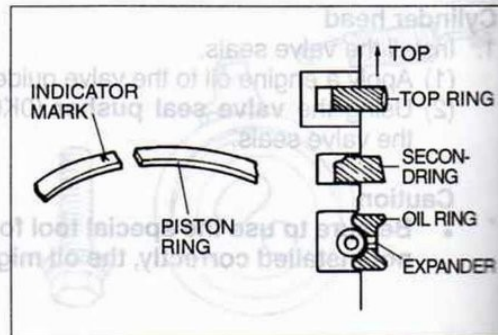
- (1) Assemble the piston ring to the piston by using a piston ring inserting tool (commercially available).
The order of assembly is : oil ring expander, oil ring, second ring, top ring.
- (2) Align the piston ring matching places, as shown in the figure.



10C153

Cautions

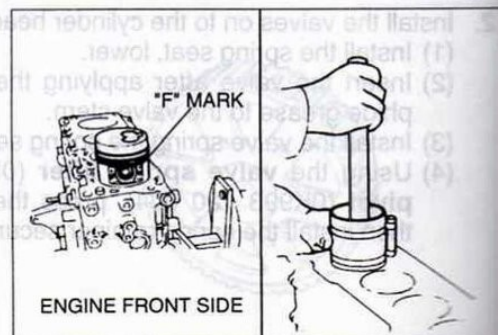
- a) Apply a liberal coat of engine oil during installation.
 - b) The rings must be mounted so the "Y" mark face upward.
 - c) When assemble the top ring & oil ring for reuse. Do not change the upward and downward of each ring.
3. Install the piston and connecting rod
 - (1) Fit the connecting rod bearing to the connecting rod, and apply a coating of engine oil.
 - (2) After cleaning the inner surface of the cylinder, apply a coating of engine oil.
 - (3) Insert each piston and connecting rod into the cylinder block using a piston insertion tool (commercially available).



10C076

Cautions

- a) The pistons must be inserted so that the "F" marks face the front of the cylinder block.
- b) Apply a liberal coating of engine oil to the cylinder walls, piston circumference, and rings.



10C153

Crankshaft assembly

1. Install the oil jets to the cylinder block.

Oil jet tightening torque :

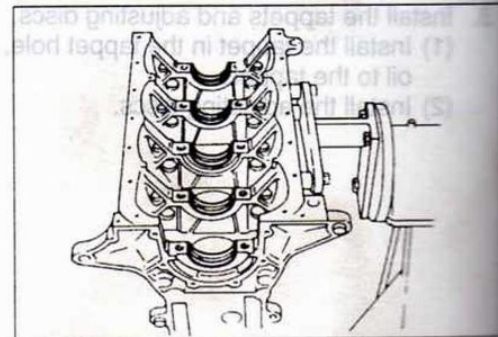
11.7~17.6 N·m (1.2~1.8 kg-m, 9~13 lb-ft)

2. Install the crankshaft.

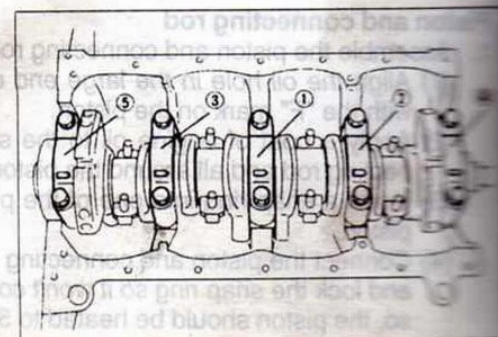
- (1) Install the main bearings.

Cautions

- a) No oil, dirt, etc. should be on the back surface of the bearings.
 - b) Because width of the center main bearings are wider than those of the others, there isn't interchangeability between the center main bearings and others.
- (2) Check the oil clearance of the crankshaft and main bearings with a plasti-gauge.
 - (a) Remove any foreign material from the journal or bearing.
 - (b) Position the Plasti-gauge on top of the journal (in the journal axial direction).
 - (c) Set the main bearing cap in position, and tighten it to the specified torque, and in the order shown in the figure.



10C153



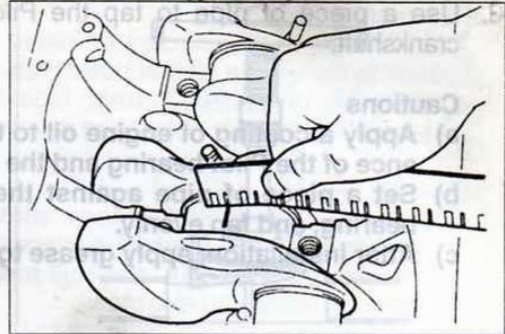
Main bearing cap tightening torque :

82.4~88.2 N·m (8.4~9.0 kg-m, 61~65 lb-ft)

- (d) Remove the main bearing cap, and measure the oil clearance.

Standard oil clearance : 0.031~0.049mm (0.0012~0.0019in)
Oil clearance limit : 0.08mm (0.0031in)

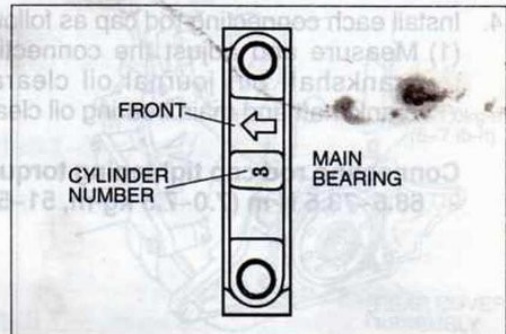
- (e) If the oil clearance exceeds the limit, replace the main bearings with new ones. And measure the oil clearance again.
 (f) In case the oil clearance exceeds the limit even if the main bearings are replaced, repair the crankshaft by grinding, and use undersize bearings.



10C158

Cautions

- Position the Plasti-gauge horizontally on the crankshaft, away from the oil hole.
- Do not rotate the crankshaft when measuring the oil clearance.
- Install the main bearing cap according to the cap No. and \leftarrow mark.

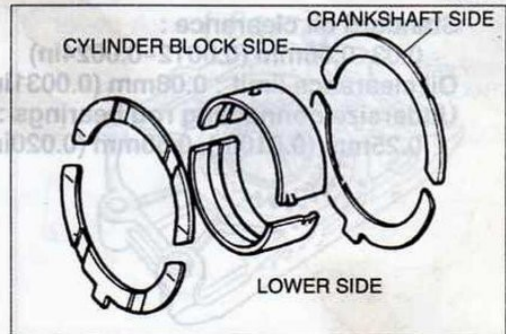


10C260

- After checking and correcting the oil clearance, apply a coating of engine oil to the main bearing and main journal, and then install the crankshaft.
- Apply a coat of engine oil to the thrust bearing, and install to the center part of the main journal.

Caution

- Install the thrust bearing so that the inner surface of the oil groove faces toward the cylinder block side.



10C160

- With the main bearing cap in the set condition, manually push the crankshaft toward the front, and then, with it pulled toward the rear, tighten the bolt to the specified torque.

Main bearing cap tightening torque :
82.4~88.2 N·m (8.4~9.0 kg-m, 61~64 lb-ft)

- Measure the end play of the crankshaft, and confirm that it is within the standard range. At this time, check to be sure that the crankshaft can be lightly turned.

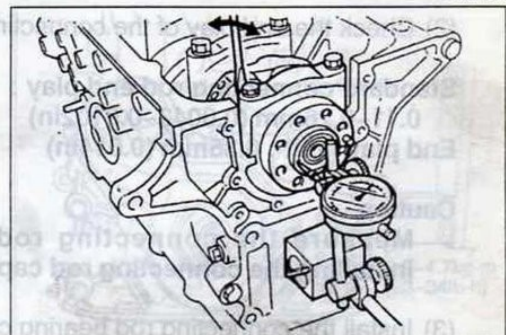
Standard crankshaft end play : 0.04~0.28mm (0.0016~0.0111 in)
End play limit : 0.3mm (0.0118 in)

- If the end play is not within the standard range, select another thrust bearing.

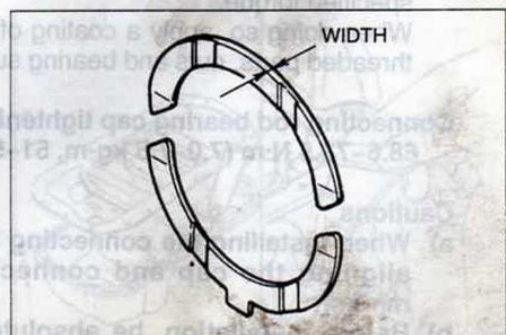
Undersize thrust bearing width :
2.18~2.23mm (0.0858~0.0878in)
Standard thrust bearing width :
2.00~2.05mm (0.0787~0.0807in)

Caution

- First replace the rear thrust bearings, if still not within limit, replace the front thrust bearings also.



10C161

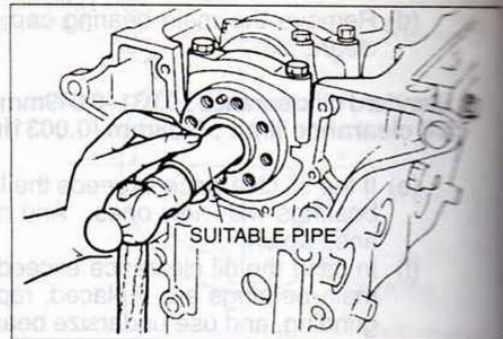


10C162

3. Use a piece of pipe to tap the Pilot bearing onto the crankshaft.

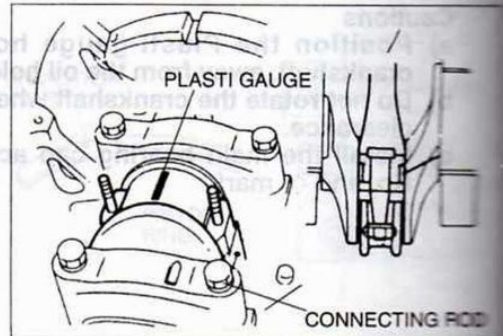
Cautions

- a) Apply a coating of engine oil to the outer circumference of the Pilot bearing and the crankshaft.
- b) Set a piece of pipe against the outer race of the bearing, and tap evenly.
- c) After installation, apply grease to the bearing.

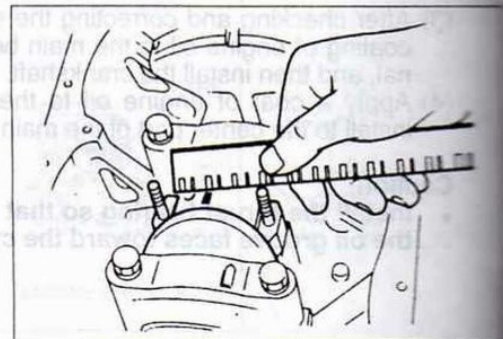


4. Install each connecting rod cap as follows :
 - (1) Measure and adjust the connecting rod bearing and crankshaft pin journal oil clearance by adjust the crankshaft and main bearing oil clearance.

Connecting rod cap tightening torque :
 68.6~73.5 N·m (7.0~7.5 kg-m, 51~54 lb-ft)



Standard oil clearance :
 0.03~0.06mm (0.0012~0.0024in)
Oil clearance limit : 0.08mm (0.0031in)
Undersize connecting rod bearings :
 0.25mm (0.010in), 0.50mm (0.020in), 0.75mm (0.030in)



- (2) Check the end play of the connecting rod.

Standard connecting rod end play :
 0.11~0.26mm (0.0043~0.0102in)
End play limit : 0.35mm (0.014in)

Caution

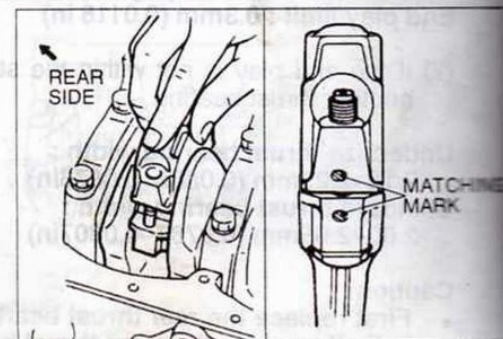
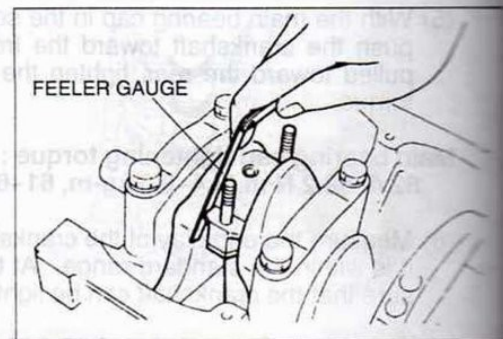
- Measure the connecting rod end play before installing the connecting rod cap.

- (3) Install the connecting rod bearing cap, and tighten to the specified torque.
 When doing so, apply a coating of engine oil to the bolt threaded parts, nuts and bearing surfaces.

Connecting rod bearing cap tightening torque :
 68.6~73.5 N·m (7.0~7.5 kg-m, 51~54 lb-ft)

Cautions

- a) When installing the connecting rod cap, do so after aligning the cap and connecting rod matching marks.
- b) Before installation, be absolutely sure to apply a coating of engine oil to the bearing.



SPECIFICATIONS

ENGINE MODEL			MAGMA
Type			4 (In-line)
Number of cylinders			4
Valve system			Direct drive, OHC
Displacementcc			2184
Bore and stroke mm (in)			86.0 X 94.0 (3.39 X 3.70)
Compression ratio			22.9 : 1
Compression pressurekg/cm ² (lb/in ²) - rpm			30(427) - 200
Valve timing	Intake	Open	BTDC 10°
		Close	ABDC 42°
	Exhaust	Open	BBDC 57°
		Close	ATDC 11°
Valve clearance (cold engine)		Intake mm (in)	0.25 (0.098)
		Exhaust mm (in)	0.35 (0.138)
Idling speedrpm			750~800
Injection order			1-3-4-2