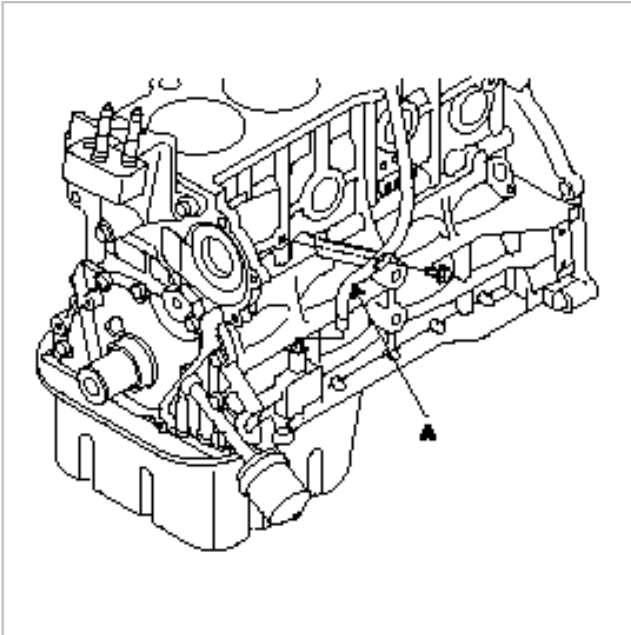


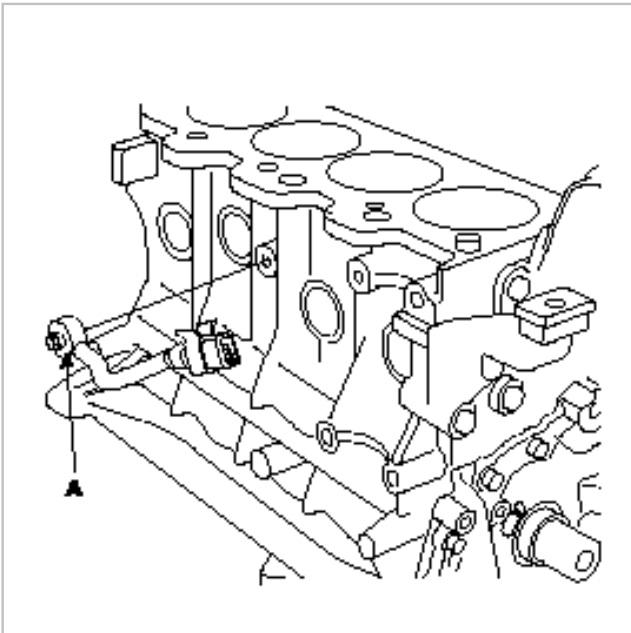


DISASSEMBLY

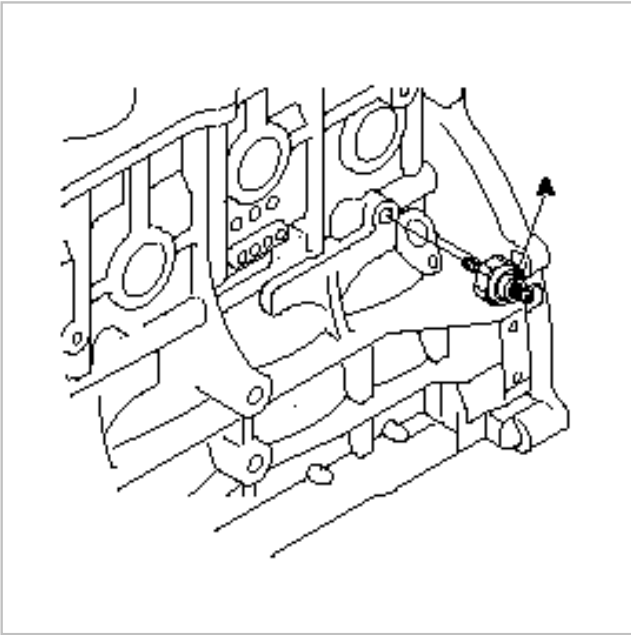
1. M/T : remove flywheel.
2. A/T : remove drive plate.
3. Install engine to engine stand for disassembly (A).
4. Remove timing belt(see page EM-25).
5. Remove cylinder head(see page EM-39)
6. Remove oil level gauge assembly (A).



7. Remove knock sensor (A).

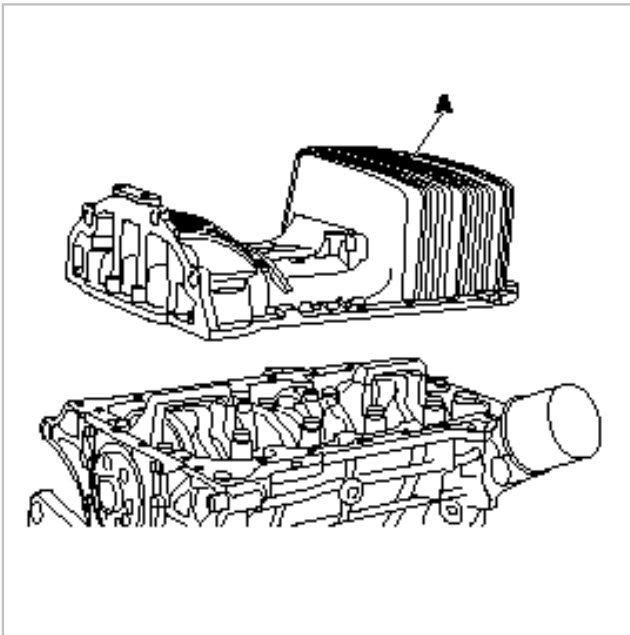


8. Remove oil pressure sensor (A).



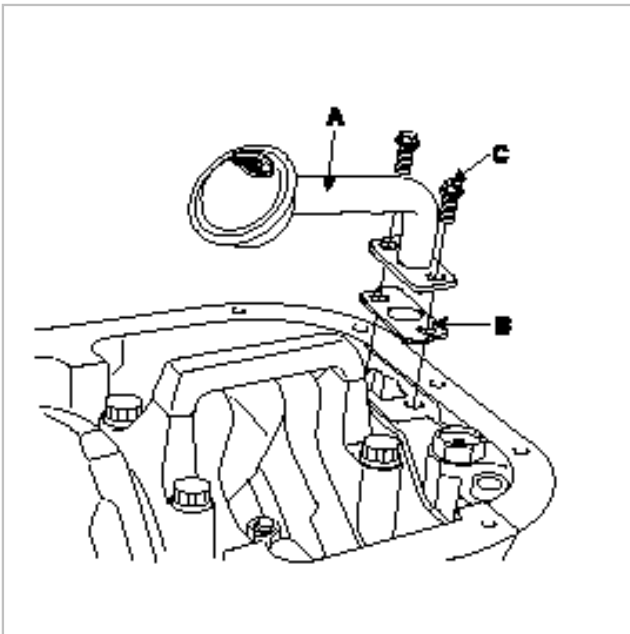
9. Remove water pump.(see page EM-99)

10. Remove oil pan (A).



11. Remove oil screen.

Remove the 2bolts(C), oil screen (A) and gasket (B).

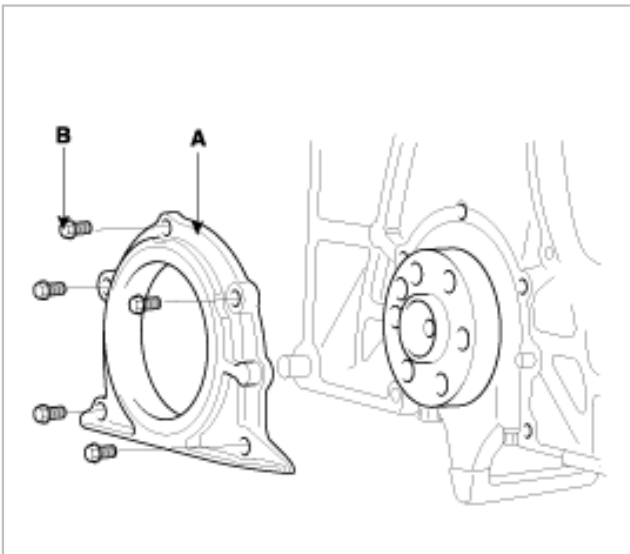


12. Check the connecting rod end play. (see page EM-77)
13. Remove the connecting rod caps and check oil clearance.(see page EM-77)
14. Remove piston and connecting rod assemblies.
 - (1) Using a ridge reamer, remove all the carbon from the top of the cylinder.
 - (2) Push the piston, connecting rod assembly and upper bearing through the top of the cylinder block.

NOTE

- Keep the bearings, connecting rod and cap together.
- Arrange the piston and connecting rod assemblies in the correct order.

15. Remove front case. (see page EM-114)
16. Remove rear oil seal case.
Remove the 5 bolts (B) and rear oil seal case (A).

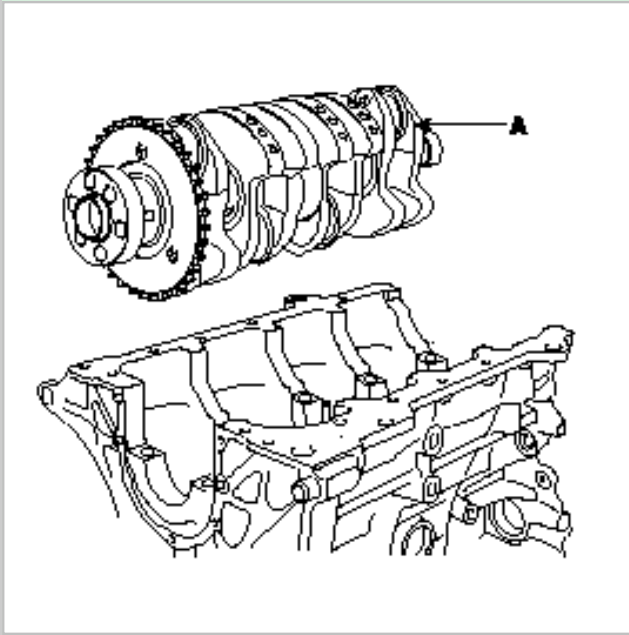


17. Remove crankshaft bearing cap and check oil clearance.(see page EM-80)
18. Check the crankshaft end play.(see page EM-82)

19. Lift the crankshaft out of the engine, being careful no to damage journals.

NOTE

Arrange the main bearings and trust washers in the correct order.



20. Check 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 pin as a set.

21. Remove piston rings.

- (1) Using a piston ring expander, remove the 2 compression rings.
- (2) Remove the 2 side rails and oil ring by hand.

NOTE

Arrange the piston rings in the correct order only.

22. Disconnect connecting rod from piston.

INSPECTION

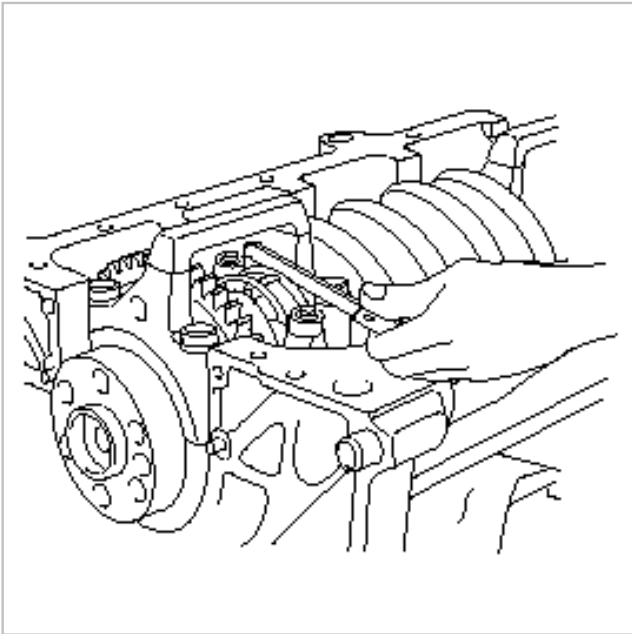
CONNECTING ROD AND CRANKSHAFT

1. Check the connecting rod end play.

Using a dial indicator, measure the end play while moving the connecting rod back and forth.

Standard end play : 0.1~ 0.25mm(0.004 ~ 0.010in.)

Maximum end play : 0.4mm(0.016in.)



A. If out-of-tolerance, install a new connecting rod.

B. If still out-of-tolerance, replace the crankshaft.

2. Check the connecting rod bearing oil clearance.

- (1) Check the matchmarks on the connecting rod and cap are aligned to ensure correct reassembly.
- (2) Remove the 2 connecting rod cap nuts.
- (3) Remove the connecting rod cap and bearing half.
- (4) Clean the crank pin and bearing.
- (5) Place plastigage across the crank pin.
- (6) Reinstall the bearing half and cap, and torque the nuts.

Tightening torque

50 ~ 53 N.m (500 ~ 530kgf.cm, 36.9 ~ 39lb.ft)

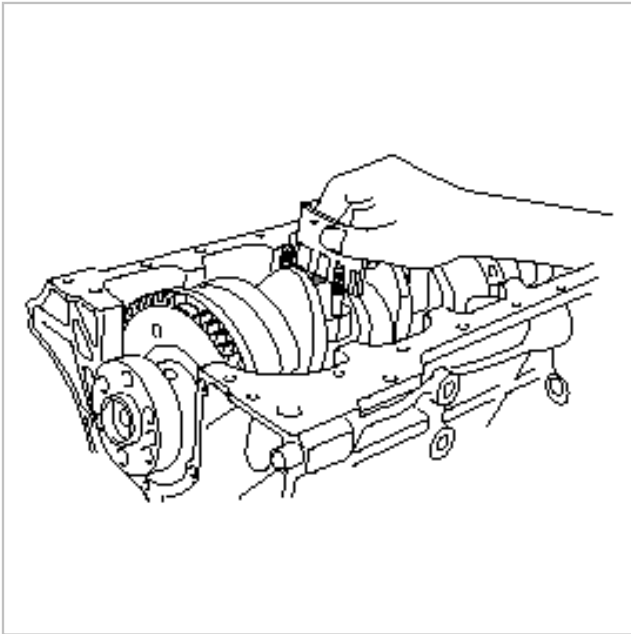
NOTE

Do not turn the crankshaft.

- (7) Remove the 2 nuts, connecting rod cap and bearing half.
- (8) Measure the plastigage at its widest point.

Standard oil clearance :

0.024 ~ 0.042mm(0.0009 ~ 0.0017in.)



- (9) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

- (10) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

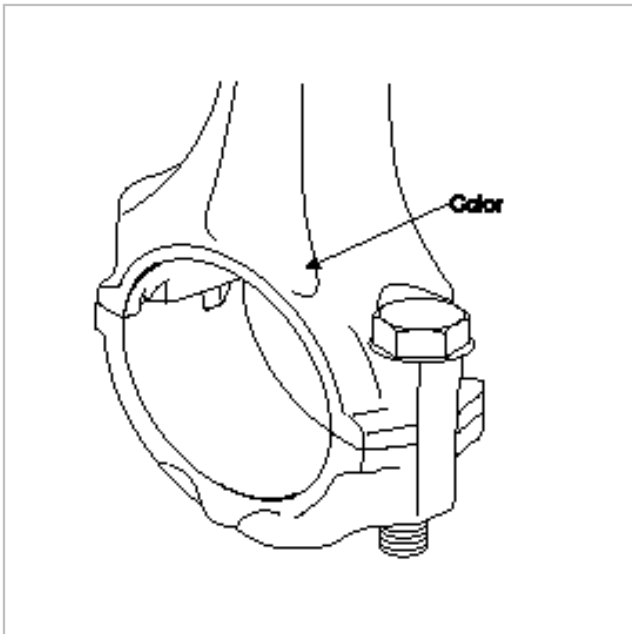
NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

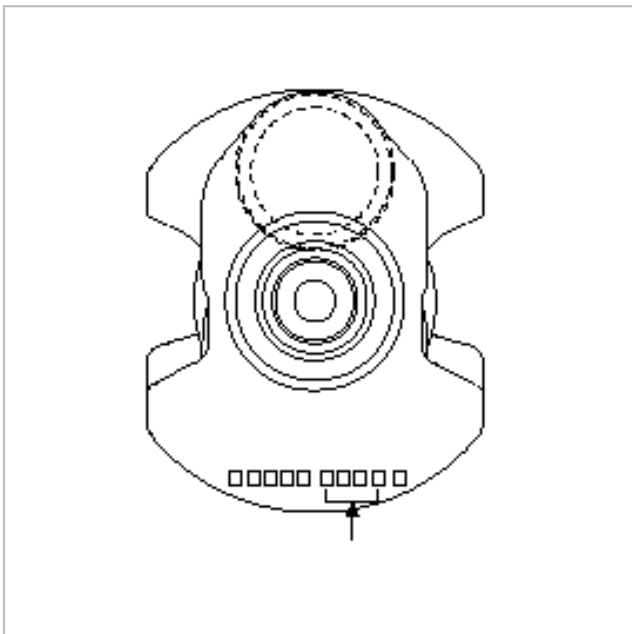
Connecting rod mark location

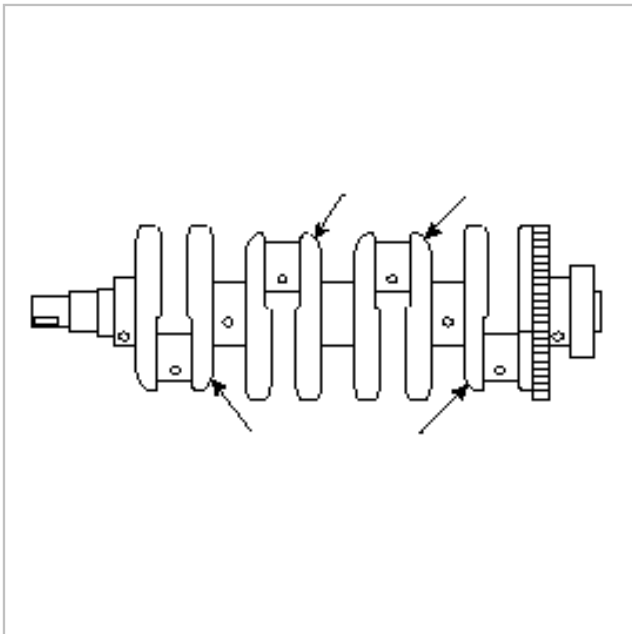


Discrimination of connecting rod

CLASS	MARK	INSIDE DIAMETER
a	WHITE	48.00 ~ 48.006mm (1.8896 ~ 1.8899in.)
b	NONE	48.006 ~ 48.12mm (1.8899 ~ 1.8902in.)
c	YELLOW	48.012 ~ 48.018mm (1.8902 ~ 1.8904in.)

Crankshaft pin mark location

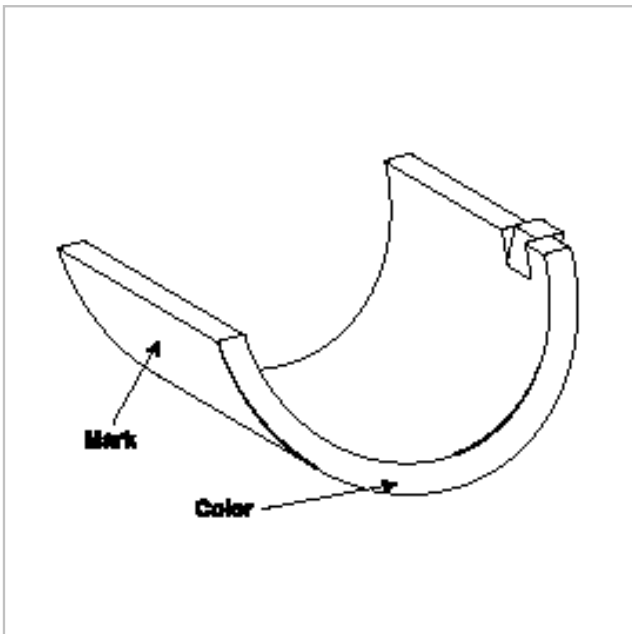




Discrimination of crankshaft

CLSASS	MARK	OUTSIDE DIAMETER OF PAN
I	YELLOW	44.960 ~ 44.966mm (1.7700 ~ 1.7703in.)
II	NONE	44.955 ~ 44.960mm (1.7698 ~ 1.7700in.)
III	WHITE	44.948 ~ 44.955mm (1.7696 ~ 1.7698in.)

Place of identification mark (Connecting rod bearing)



Discrimination of connecting rod bearing

CLASS	MARK	THICKNESS OF BEARING
-------	------	----------------------

AA	BLUE	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
A	BLACK	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
B	NONE	1.508 ~ 1.511mm (0.0594 ~ 0.0595in.)
C	GREEN	0.505 ~ 0.508mm (0.593 ~ 0.594in.)
D	YELLOW	0.502 ~ 0.505mm (0.0591 ~ 0.0593in)

(11) Selection

CRANKSHAFT IDENTIFICATION MARK	CONNECTING ROD IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	a (WHITE)	D (YELLOW)
	b (NONE)	C (GREEN)
	c (YELLOW)	B (NONE)
II (NONE)	a (WHITE)	C (GREEN)
	b (NONE)	B (NONE)
	c (YELLOW)	A (BLACK)
III (WHITE)	a (WHITE)	B (NONE)
	b (NONE)	A (BLACK)
	c (YELLOW)	AA (BLUE)

3. Check the crankshaft bearing oil clearance.

- (1) To check main bearing-to-journal oil clearance, remove the main caps and bearing halves.
- (2) Clean each main journal and bearing half with a clean shop towel.
- (3) Place one strip of plastigage across each main journal.
- (4) Reinstall the bearings and caps, then torque the bolts.

Tightening torque

30Nm (300kgf.cm, 22lb.ft) + 60° ~ 65°

NOTE
Do not turn the crankshaft.

- (5) Remove the cap and bearing again, and measure the widest part of the plastigage.

Standard oil clearance

0.028 ~ 0.046mm (0.0011 ~ 0.0018in.)

- (6) If the plastigage measures too wide or too narrow, remove the upper half of the bearing, install a new, complete bearing with the same color mark (select the color as shown in the next column), and recheck the clearance.

CAUTION

Do not file, shim, or scrape the bearings or the caps to adjust clearance.

- (7) If the plastigage shows the clearance is still incorrect, try the next larger or smaller bearing (the color listed above or below that one), and check clearance again.

NOTE

If the proper clearance cannot be obtained by using the appropriate larger or smaller bearings, replace the crankshaft and start over.

CAUTION

If the marks are indecipherable because of an accumulation of dirt and dust, do not scrub them with a wire brush or scraper. Clean them only with solvent or detergent.

Connecting rods

1. When reinstalling, make sure that cylinder numbers put on the connecting rod and cap at disassembly match. When a new connecting rod is installed, make sure that the notches for holding the bearing in place are on the same side.
2. Replace the connecting rod if it is damaged on the thrust faces at either end. Also if step wear or a severely rough surface of the inside diameter of the small end is apparent, the rod must be replaced as well.
3. Using a connecting rod aligning tool, check the rod for bend and twist. If the measured value is close to the repair limit, correct the rod by a press. Any connecting rod that has been severely bent or distorted should be replaced.

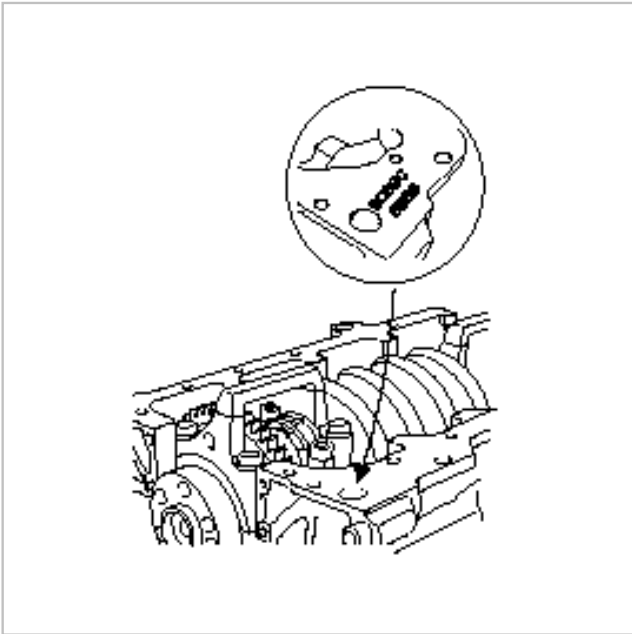
Allowable bend of connecting rod :

0.05mm / 100mm (0.0020 in./3.94 in.) or less

Allowable twist of connecting rod :

0.1mm / 100mm (0.0039 in./3.94 in.) or less

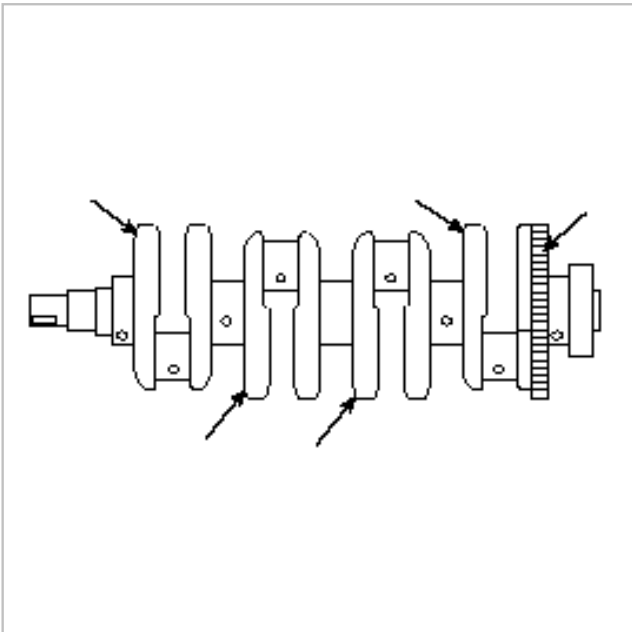
Letters have been stamped on the end of the block as a mark for the size of each of the 5 main journal bores.



Discrimination of cylinder block

CALSS	MARK	INSIDE DIAMETER
a	A	59.000 ~ 59.006mm (2.3228 ~ 2.3230in.)
b	B	59.006 ~ 59.012mm (2.3230 ~ 2.3233in.)
c	C	59.012 ~ 59.018mm (2.3233 ~ 2.3235in.)

Crankshaft journal mark location

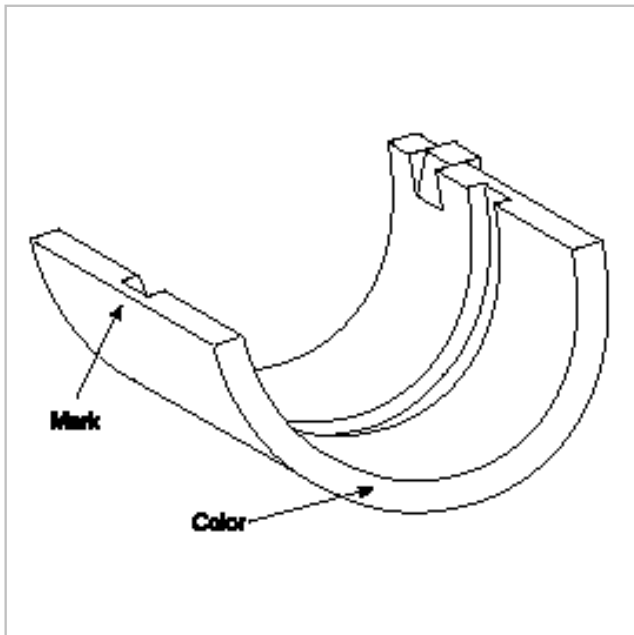


Discrimination of crankshaft

CLASS	MARK	OUTSIDE DIAMETER OF JOURNAL
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I	YELLOW	54.956 ~ 54.962mm (2.1636 ~ 2.1638in.)
II	NONE	54.950 ~ 54.956mm (2.1633 ~ 2.1636in.)
III	WHITE	54.944 ~ 54.950mm (2.1631 ~ 2.1633in.)

Place of identification mark (Crankshaft bearing)



Discrimination of crankshaft bearing

CLASS	MARK	THICKNESS OF BEARING
AA	BLUE	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)
A	BLACK	2.011 ~ 2.014mm (0.0791 ~ 0.0793in.)
B	NONE	2.008 ~ 2.011mm (0.0789 ~ 0.0790in.)
C	GREEN	2.005 ~ 2.008mm (0.0789 ~ 0.790in.)
D	YELLOW	2.002 ~ 5.005mm (0.0788 ~ 0.0789in.)

Selection

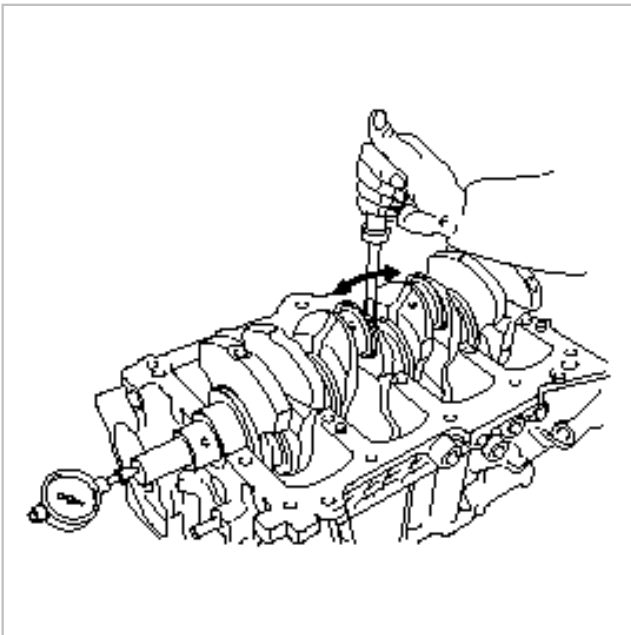
CRANKSHAFT IDENTIFICATION MARK	CRANKSHAFT BORE IDENTIFICATION MARK	ASSEMBLING CLASSIFICATION OF BEARING
I (YELLOW)	a (A)	D (YELLOW)
	b (B)	C (GREEN)
	c (C)	B (NONE)
II (NONE)	a (A)	C (GREEN)
	b (B)	B (NONE)
	c (C)	A (BLACK)
III (WHITE)	a (A)	B (NONE)
	b (B)	A (BLACK)
	c (C)	AA (BLUE)

4. Check crankshaft end play.

Using a dial indicator, measure the thrust clearance while prying the crankshaft back and forth with a screwdriver.

: 0.06 ~ 0.26mm (0.0023 ~ 0.010in.)

Limit : 0.30mm (0.0118in.)



If the end play is greater than maximum, replace the thrust bearings as a set.

Thrust bearing thickness

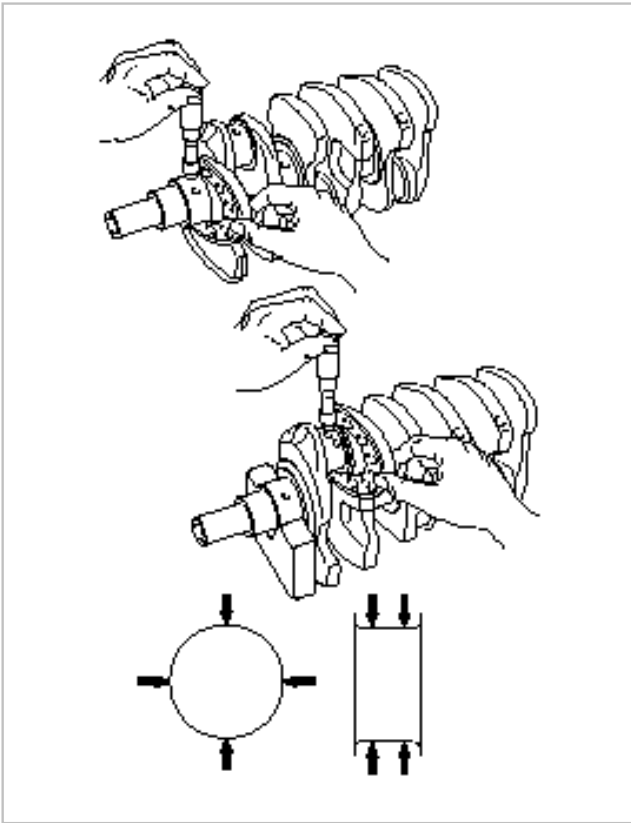
2.44 ~ 2.47mm(0.096 ~ 0.097in.)

5. Inspect main journals and crank pins

Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter : 57mm (2.244in.)

Crank pin diameter : 45mm (1.77in.)



CYLINDER BLOCK

1. Remove gasket material.

Using a gasket scraper, remove all the gasket material from the top surface of the cylinder block.

2. Clean cylinder block

Using a soft brush and solvent, thoroughly clean the cylinder block.

3. Inspect top surface of cylinder block for flatness.

Using a precision straight edge and feeler gauge, measure the surface contacting the cylinder head gasket for warpage.

Flatness of cylinder block gasket surface

Standard : Less than 0.03mm(0.0012 in.)

Limit : 0.05 mm (0.0020 in.)

4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

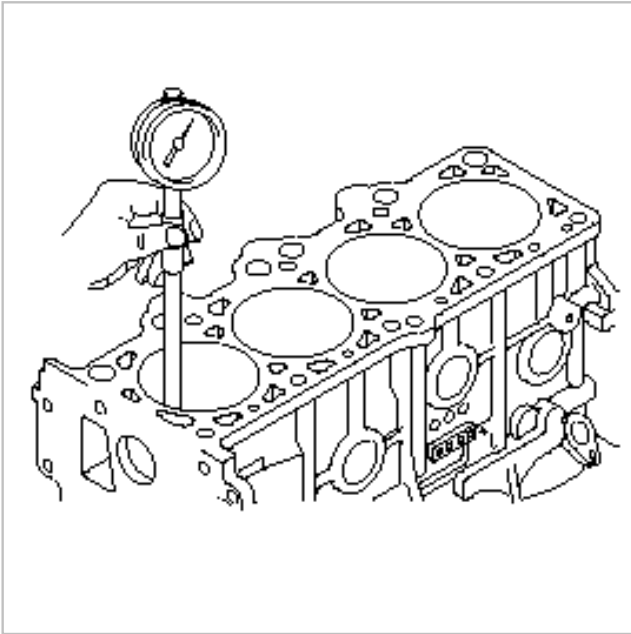
If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

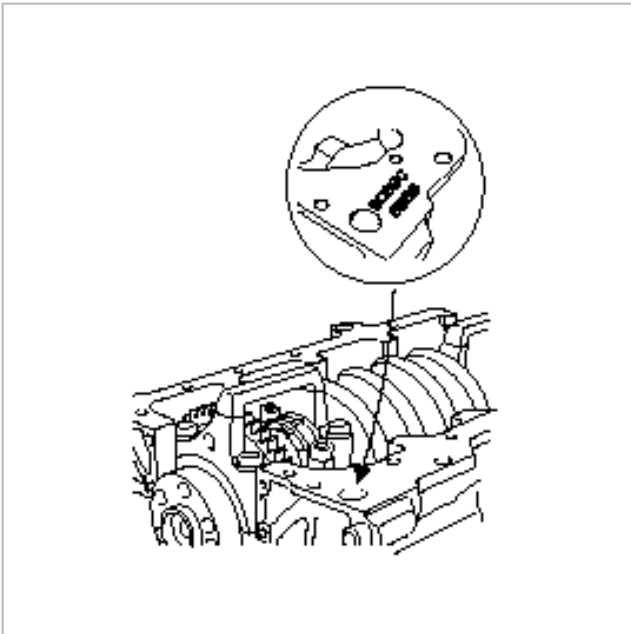
Using a cylinder bore gauge, measure the cylinder bore diameter at position A, B and C in the thrust and axial directions.

Standard diameter

82.00 ~ 82.03mm (3.2283 ~ 3.2295in.)

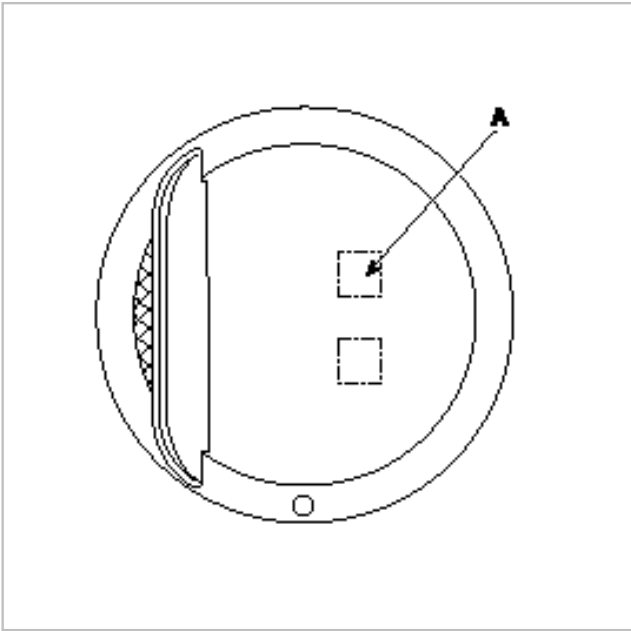


6. Check the cylinder bore size code (A) on the cylinder block bottom face.



Class	Cylinder bore inner diameter	Size code
A	82.00 ~ 82.01mm (3.2283~ 3.2287in.)	A
B	82.01 ~ 82.02mm (3.2287~ 3.2291in.)	None
C	82.02 ~ 82.03mm (3.2291~ 3.2295in.)	C

7. Check the piston size code on the piston top face.



NOTE

Stamp the grade mark of basic diameter with rubber stamp.

Class	Piston outer diameter	Size code
A	81.97 ~ 81.98mm (3.2271 ~ 3.2275in.)	A
B	81.98 ~ 81.99mm (3.2275 ~ 3.2279in.)	None
C	81.99 ~ 82.00mm (3.2279 ~ 3.2283in.)	C

8. Select the piston related to cylinder borre class.

Clearance

0.02 ~ 0.04mm (0.00078 ~ 0.00157in.)

Boring Cylinder

1. Oversize pistons should be selected according to the largest bore cylinder.

Identification Mark	Size
0.25	0.25mm (0.010in.)
0.50	0.50mm (0.0250in.)

NOTE

The size of piston is stamped on top of the piston.

2. Measure the outside diameter of the piston to be used.

3. According to the measured O.D., calculate the new bore size.

New bore size = Piston O.D + 0.02 to 0.04 mm
(0.0008 to 0.0016 in.) (clearance between piston and
cylinder) - 0.01 mm (0.0004 in.) (honing margin.)

4. Bore each of the cylinders to the calculated size.

CAUTION

To prevent distortion that may result from temperature rise during honing, bore the cylinder holes in the firing order.

- 5.hone the cylinders, finishing them to the proper dimension (piston outside diameter + gap with cylinder).
6. Check the clearance between the piston and cylinder.

Standard : 0.02 ~ 0.04 mm (0.0008 ~ 0.0016 in.)

NOTE

When boring the cylinders, finish all of the cylinders to the same oversize. Do not bore only one cylinder to the oversize.

PISTON AND RINGS

1. Clean piston
 - (1) Using a gasket scraper, remove the carbon from the piston top.
 - (2) Using a groove cleaning tool or broken ring, clean the piston ring grooves.
 - (3) Using solvent and a brush, thoroughly clean the piston.

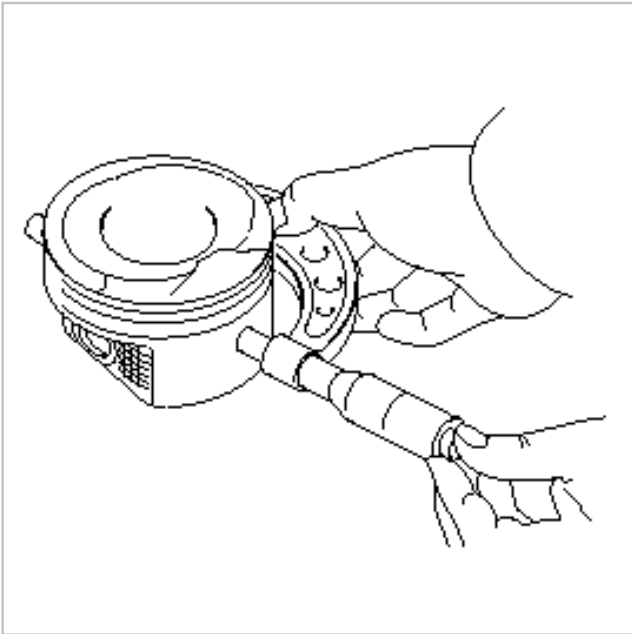
NOTE

Do not use a wire brush.

2. The standard measurement of the piston outside diameter is taken 47 mm (1.85 in.) from the top land of the piston.

Standard diameter

81.97 ~ 82.00mm(3.2272 ~ 3.2283in.)



3. Calculate the difference between the cylinder bore diameter and the piston diameter.

Piston-to-cylinder clearance

0.02 ~ 0.04mm(0.0008 ~ 0.0016in.)

4. Inspect the piston ring side clearance.

Using a feeler gauge, measure the clearance between new piston ring and the wall of the ring groove.

Piston ring side clearance

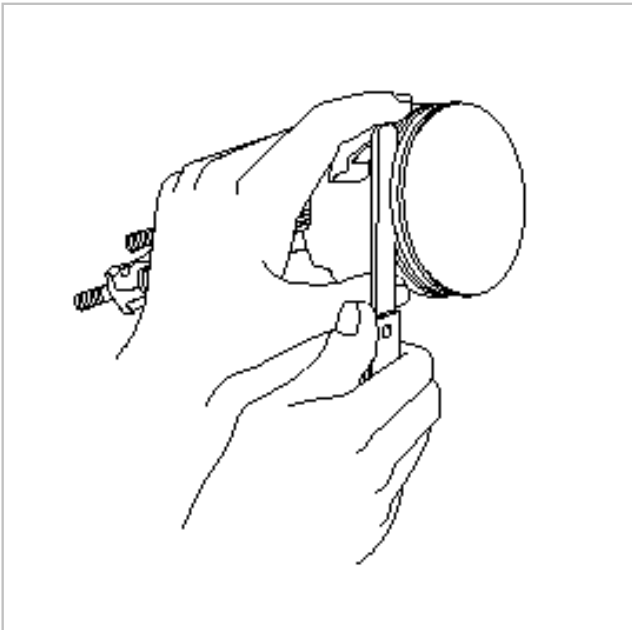
No. 1 : 0.04 ~ 0.08 mm (0.0016 ~ 0.0031 in.)

No. 2 : 0.03 ~ 0.07 mm (0.0012 ~ 0.0028 in.)

Limit

No. 1 : 0.1mm (0.004in.)

No. 2 : 0.1mm (0.004in.)



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

5. Inspect piston ring end gap.

To measure the piston ring end gap, insert a piston ring into the cylinder bore. Position the ring at right angles to the cylinder wall by gently pressing it down with a piston. Measure the gap with a feeler gauge. If the gap exceeds the service limit, replace the piston ring. If the gap is too large, recheck the cylinder bore diameter against the wear limits on page- , If the bore is over the service limit, the cylinder block must be rebored.(see page-).

Piston ring end gap

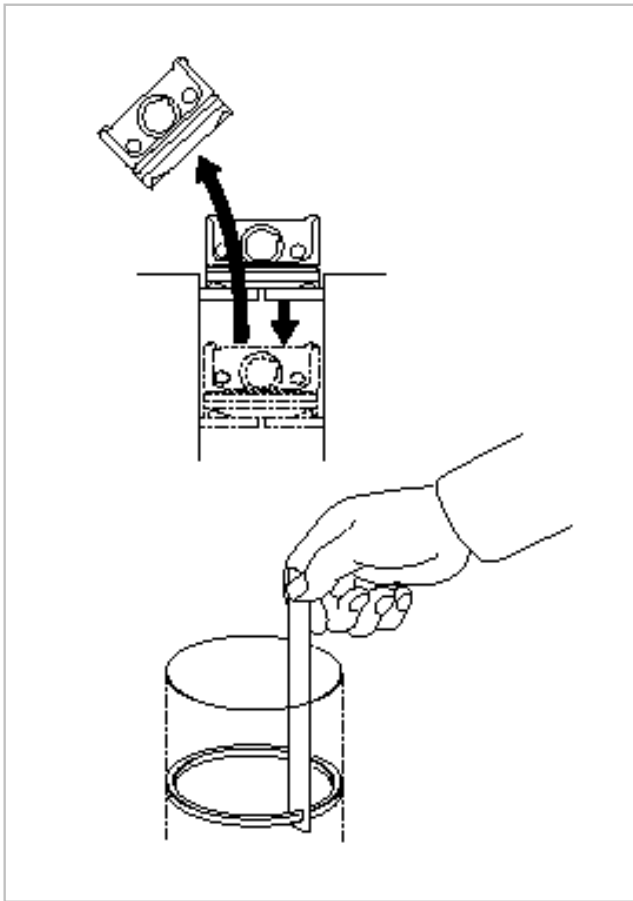
Standard

No. 1 : 0.23 ~ 0.38mm (0.0091 ~ 0.0150in.)

No. 2 : 0.33 ~ 0.48mm (0.0130 ~ 0.0189in.)

Limit

No. 1, 2, oil ring : 1.0mm (0.039in.)

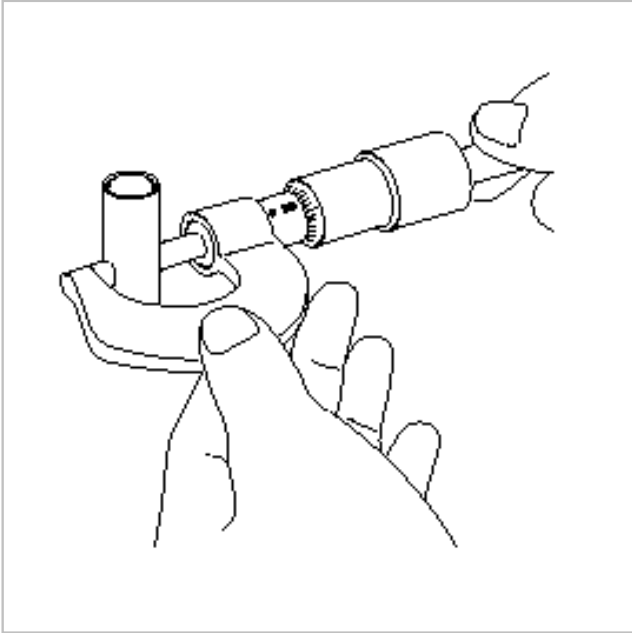


PISTON PINS

1. Measure the diameter of the piston pin.

Piston pin diameter

20.001 ~ 20.006mm (0.7874 ~ 0.7876in.)



2. Measure the piston pin-to-piston clearance.

Piston pin-to-piston clearance

0.01 ~ 0.02mm (0.0004 ~ 0.0008in.)

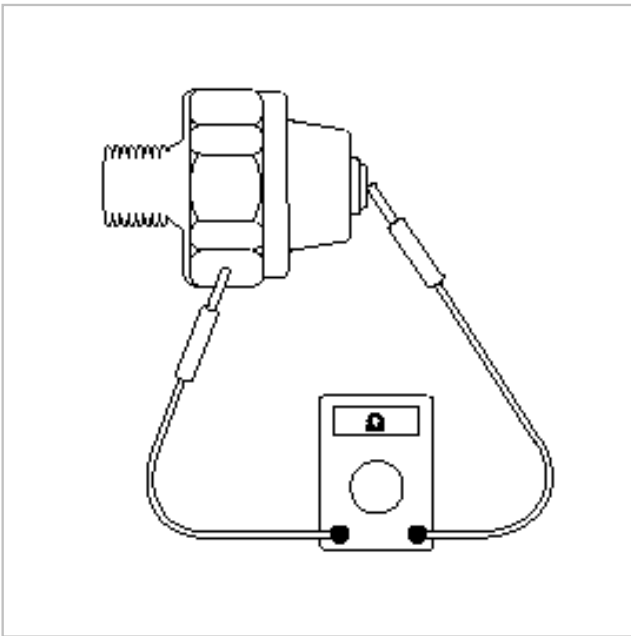
3. Check the difference between the piston pin diameter and the connecting rod small end diameter.

Piston pin-to-connecting rod interference

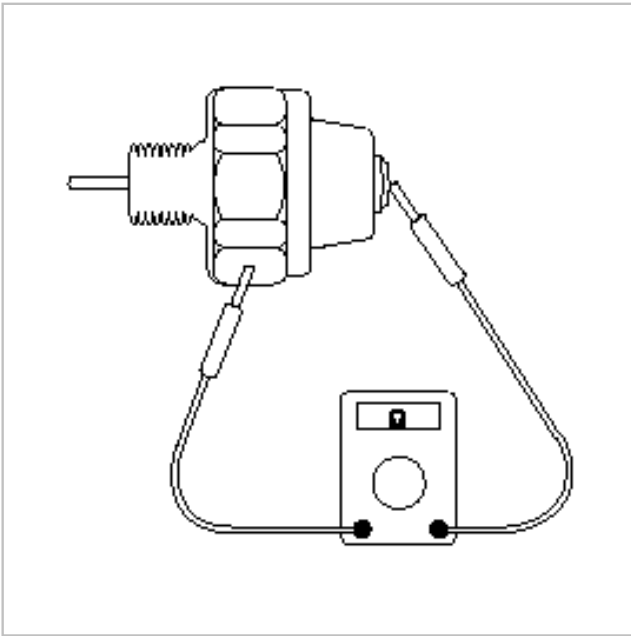
0.016 ~ 0.032mm (0.00063 ~ 0.00126in.)

OIP PRESSURE SWITCH

1. Check the continuity between the terminal and the body with an ohmmeter.
If there is no continuity, replace the oil pressure switch.



2. Check the continuity between the terminal and the body when the fine wire is pushed. If there is continuity even when the fine wire is pushed, replace the switch.
3. If there is no continuity when a 50kpa (7psi) vacuum is applied through the oil hole, the switch is operating properly.
Check for air leakage. If air leaks, the diahragm is broken. Replace it.



REASSEMBLY

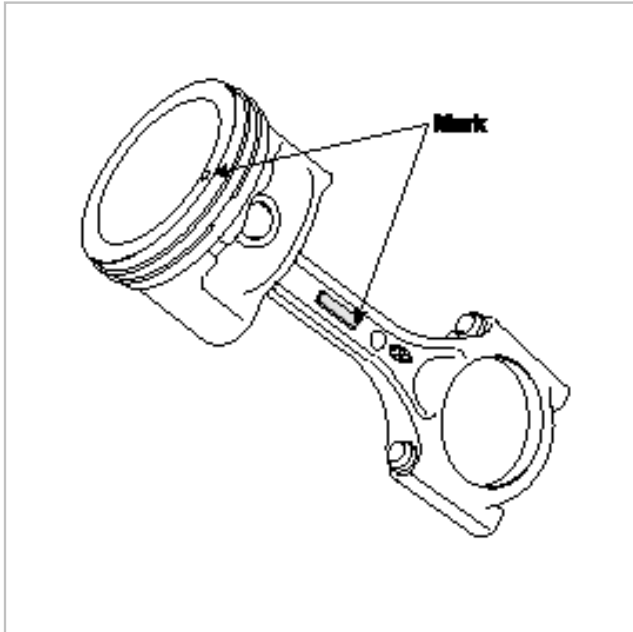
NOTE

- Thoroughly clean all parts to assembled.
- Before installing the parts, apply fresh engine oil to all sliding and rotating surfaces.
- Replace all gaskets, O-rings and oil seals with new parts.

1. Assemble piston and connecting rod.

(1) Use a hydraulic press for installation.

(2) The piston front mark and the connecting rod front mark must face the timing belt side of the engine.

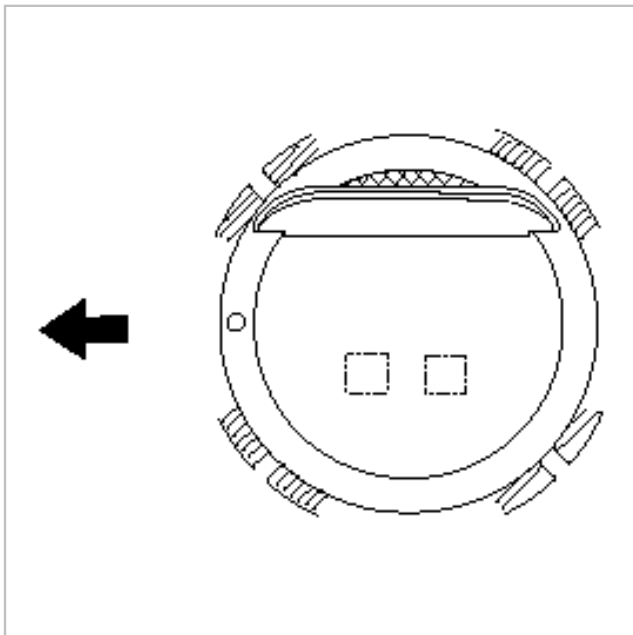


2. Install piston rings.

(1) Install the oil ring expander and 2 side rails by hand.

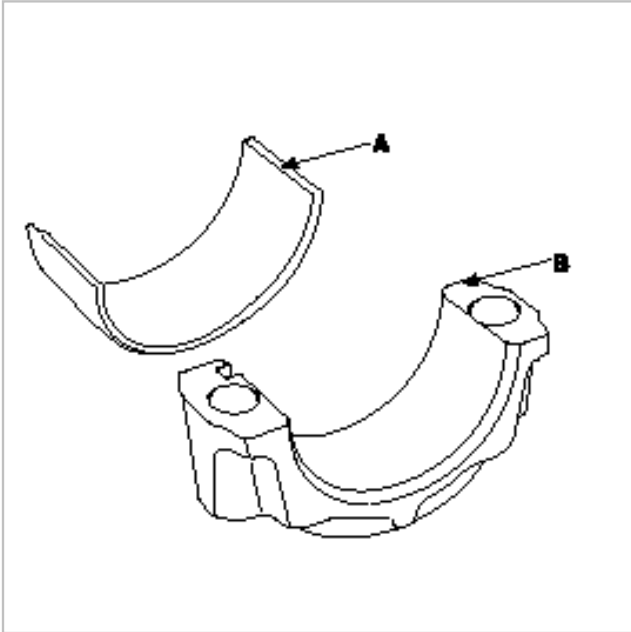
(2) Using a piston ring expander, install the 2 compression rings with the code mark facing upward.

(3) Position the piston rings so that the ring ends are as shown.



3. Install connecting rod bearings.

- (1) Align the bearing claw with the groove of the connecting rod or connecting rod cap.
- (2) Install the bearings in the connecting rod and connecting rod cap.



4. Install main bearings.

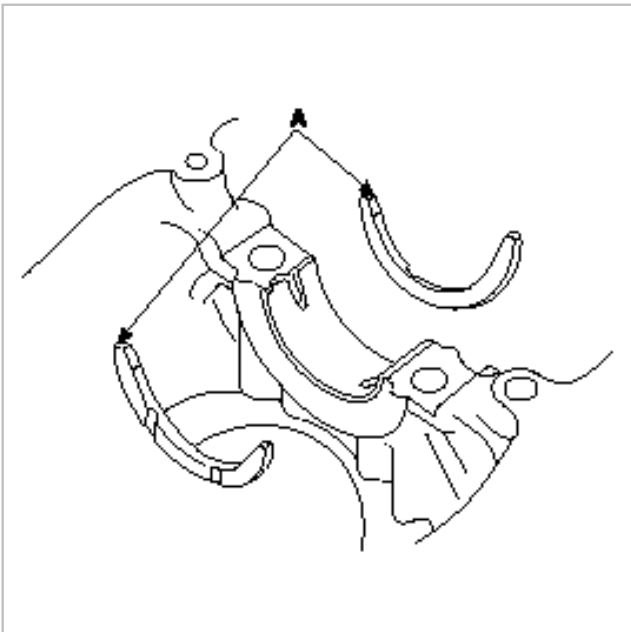
NOTE

Upper 1,2,4,5 bearings have an oil groove of oil holes; Lower bearings do not.

- (1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings.
- (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install thrust bearings.

Install the 2 thrust bearings (A) under the No.3 journal position of the cylinder block with the oil grooves facing outward.



6. Place crankshaft on the cylinder block.

7. Place main bearing caps on cylinder block.

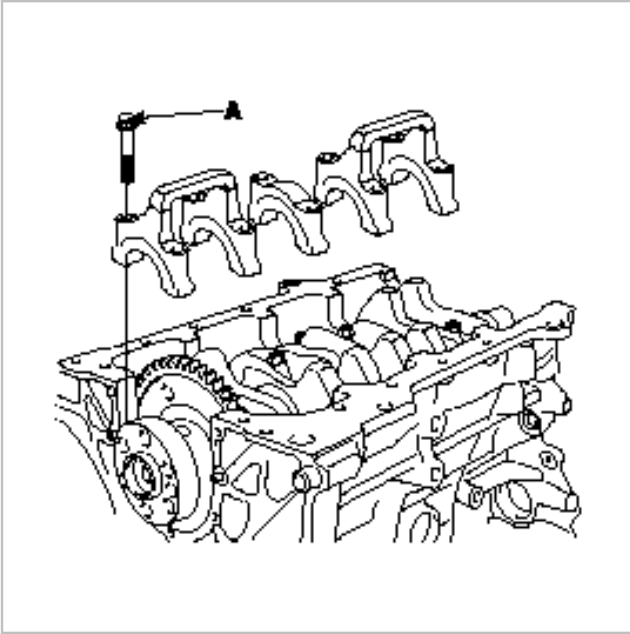
8. Install main bearing cap bolts.

NOTE

- The main bearing cap bolts are tightened in 2 progressive steps.
- If any of the bearing cap bolts is broken or deformed, replace it.

- (1) Apply a light coat of engine oil on the threads and under the bearing cap bolts.
- (2) Install and uniformly tighten the 10 bearing cap bolts, in several passes, in the sequence shown.

Tightening torque : 30Nm (300kgf.cm, 22lbf.ft)



- (3) Retighten the bearing cap bolts by 60°~65° in the numerical order shown.

Tightening torque

Main bearing cap bolt :

30Nm (300kgf.cm, 22lbf.ft) + 60° ~ 65°

- (4) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.(see page-)

10. Install piston and connecting rod assemblies.

NOTE

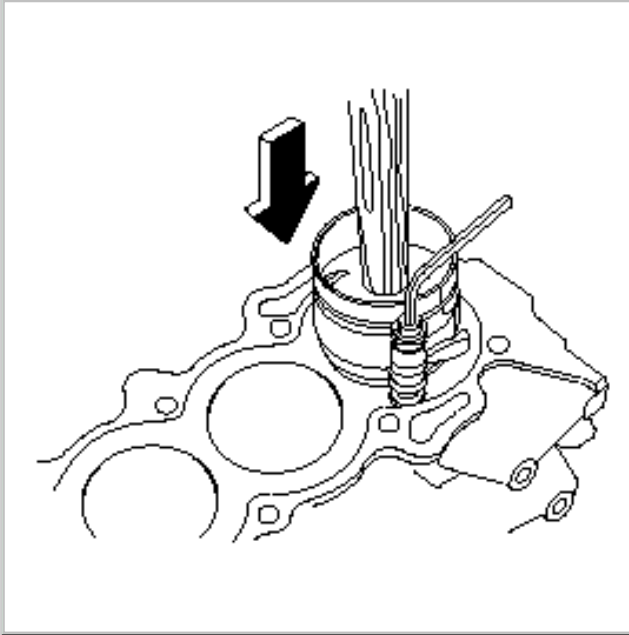
Before installing the pistons, apply a coat of engine oil to the ring grooves and cylinder bores.

- (1) Remove the connecting rod caps, and slip short sections of rubber hose over the threaded ends of the connecting rod bolts.
- (2) Install the ring compressor, check that the bearing is securely in place, then position the piston in the cylinder, and tap it in using the wooden handle of a hammer.
- (3) Stop after the ring compressor pops free, and check the connecting rod-to-check journal alignment before pushing the piston into place.

- (4) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the nuts : 50 ~ 53Nm (500 ~ 530kgf.cm, 36.9 ~ 39lb.ft)

NOTE

Maintain downward force on the ring compressor to prevent the rings from expanding before entering the cylinder bore.



11. Install a new gasket and rear oil seal case with 5 bolts.

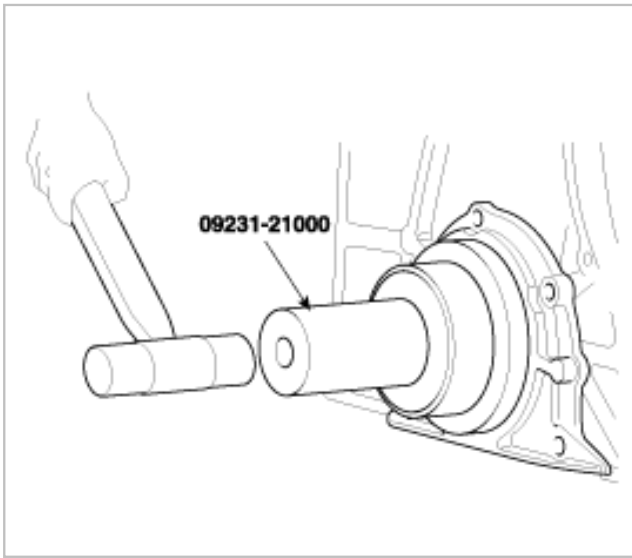
Tightening torque

10 ~ 12Nm (100 ~ 120kgf.cm, 7.3 ~ 8.8lb.ft)

NOTE

Check that the mating surfaces are clean and dry.

12. Install rear oil seal.
 - (1) Apply engine oil to a new oil seal lip.
 - (2) Using SST(09231-21000) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.



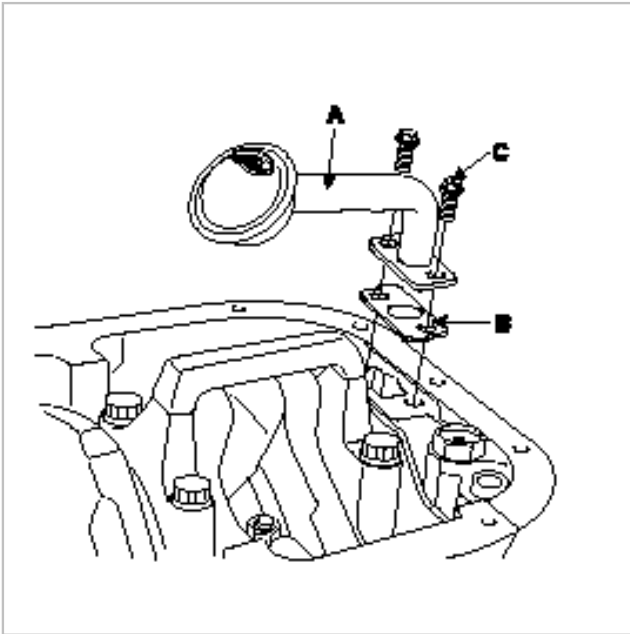
13. Install front case.(see page-)

14. Install oil screen.

Install a new gasket (B) and oil screen (A)with 2 bolts.

Tightening torque

15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lb.ft)



15. Install oil pan.

- (1) Using a razor blade and gasket scraper, remove all the old packing material from the gasket surfaces.

NOTE

Check that the mating surfaces are clean and dry before applying liquid gasket.

- (2) Apply liquid gasket as an even bead, centered between the edges of the mating surface.
Use liquid gasket MS 721-40A or equivalent.

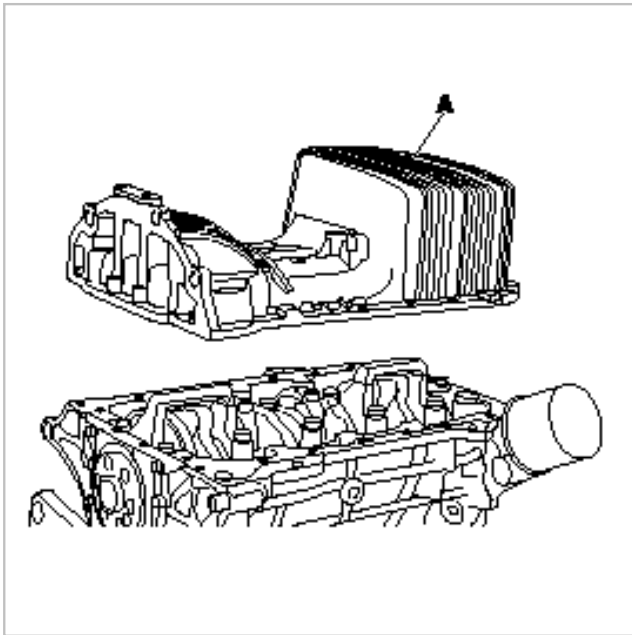
NOTE

- To prevent leakage of oil, apply liquid gasket to the inner threads of the bolt holes.
- Do not install the parts if five minutes or more have elapsed since applying the liquid gasket. Instead, reapply liquid gasket after removing the residue.
- After assembly, wait at least 30 minutes before filling the engine with oil.

- (3) with the 19 bolts.
Uniformly tighten the bolts in several passes.

Tightening torque

10 ~ 12Nm (100 ~ 120kgf.cm, 7.3 ~ 8.8lb.ft)



16. Install water pump. (see page EM-104)

17. Install oil pressure sensor (A).

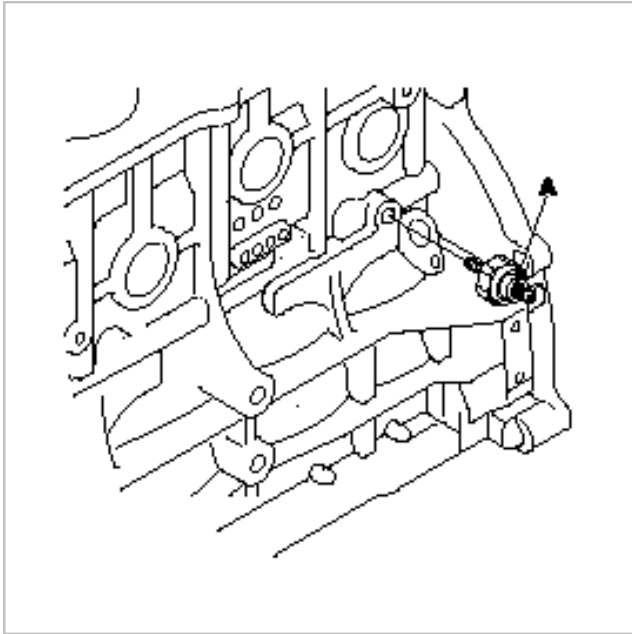
(1) Apply adhesive to 2 or 3 threads.

Adhesive : MS 721-39(B) or equivalent.

(2) Install the oil pressure sensor.

Tightening torque

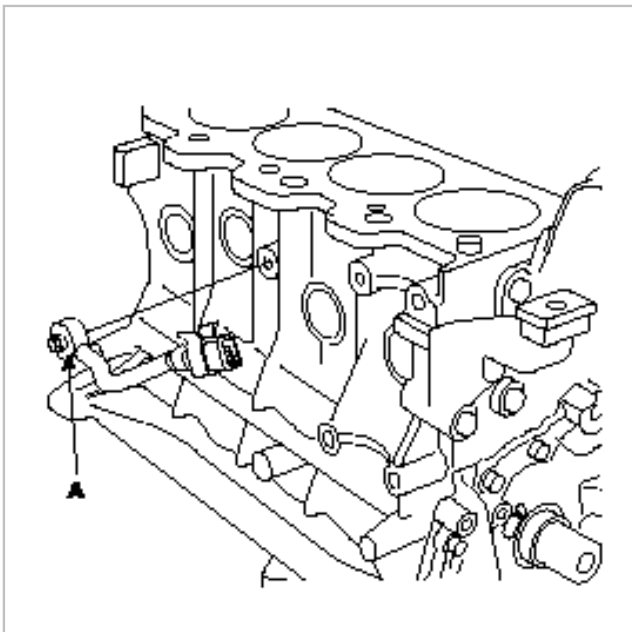
15 ~ 22Nm (150 ~ 220kgf.cm, 11 ~ 16lb.ft)



18. Install knock sensor (A).

Tightening torque

17 ~ 27Nm (170 ~ 270kgf.cm, 12.5 ~ 20lb.ft)

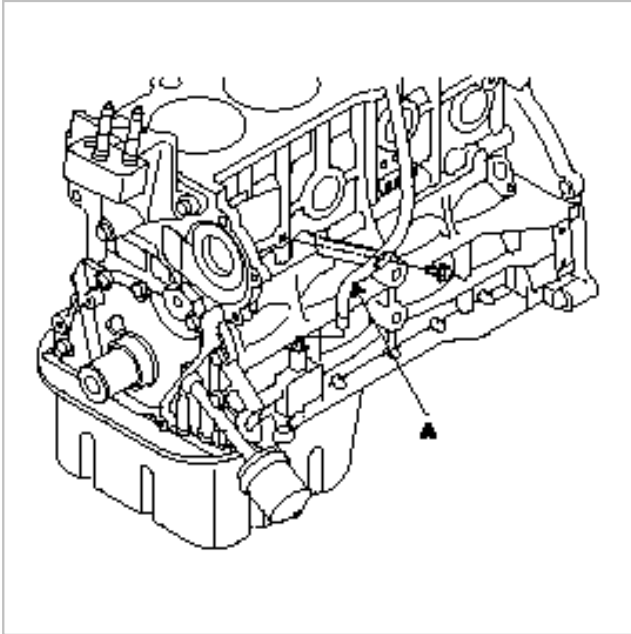


19. Install oil level gauge assembly.

- (1) Install a new O-ring on the oil level gauge.
- (2) Apply engine oil on the O-ring.
- (3) Install the oil level gauge assembly (A) with the bolt.

Tightening torque

12 ~ 15Nm (120 ~ 150kgf.cm, 9 ~ 11lbf.ft)



20. Install cylinder head. (see page EM-54)

21. Install timing belt. (see page EM-31)

22. Remove engine stand.

23. A/T : Install drive plate.

Tightening torque

120 ~ 130Nm (1200 ~ 1300kgf.cm, 89 ~ 96lbf.ft)

24. M/T : Install flywheel.

Tightening torque

120 ~ 130Nm(1200 ~ 1300kgf.cm, 89 ~ 96lbf.ft)
