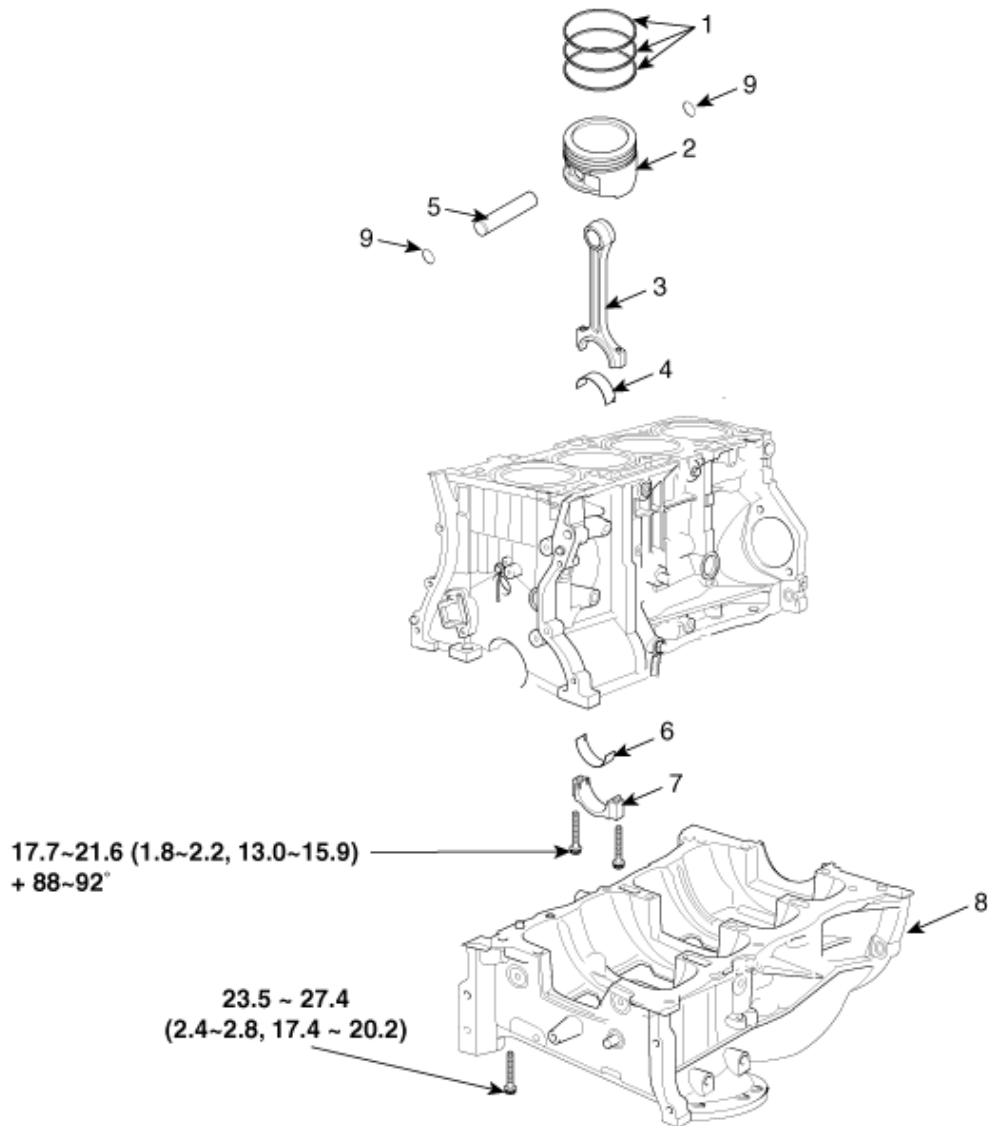


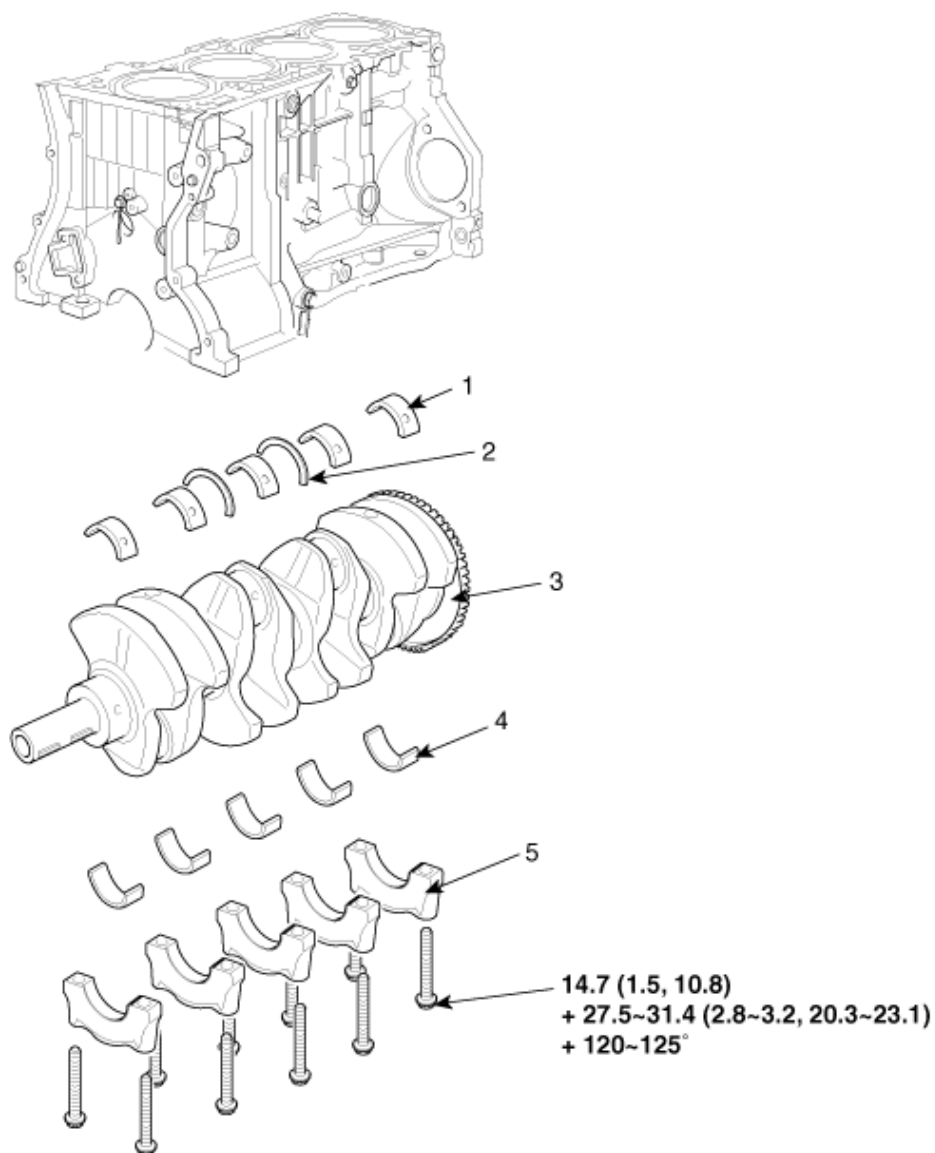
Components



Torque : N.m (kgf.m, lb-ft)

1. Piston ring
2. Piston
3. Connecting rod
4. Connecting rod upper bearing

5. Piston pin
6. Connecting rod lower bearing
7. Connecting rod bearing cap
8. Ladder frame
9. Snap ring



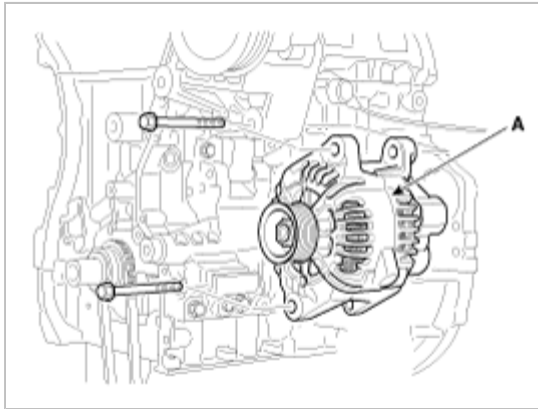
Torque : N.m (kgf.m, lb-ft)

1. Crankshaft upper bearing
2. Thrust bearing
3. Crankshaft

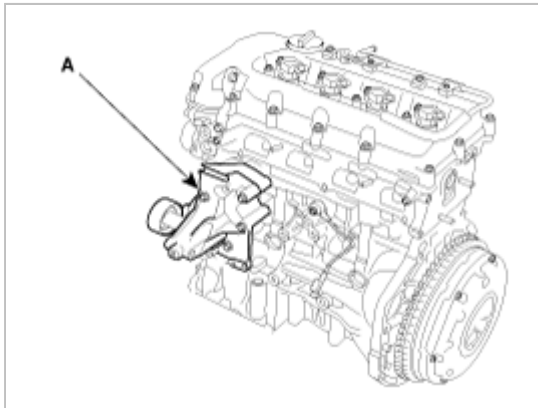
4. Crankshaft lower bearing
5. Main bearing cap

Disassembly

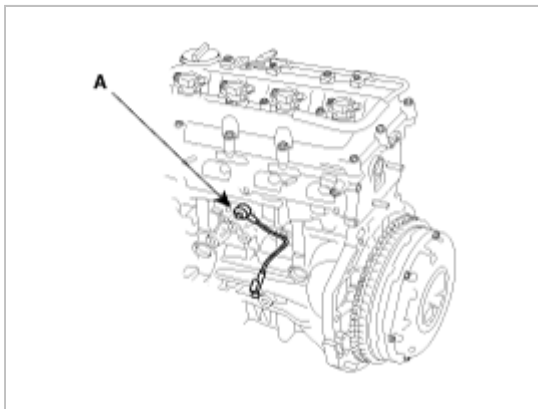
1. M/T : remove the flywheel.
2. A/T : remove the drive plate.
3. Install the engine to the engine stand for disassembly.
4. Remove the timing chain. (Refer to Timing system in this group)
5. Remove the cylinder head. (Refer to Cylinder block in this group)
6. Remove the alternator(A) from engine.



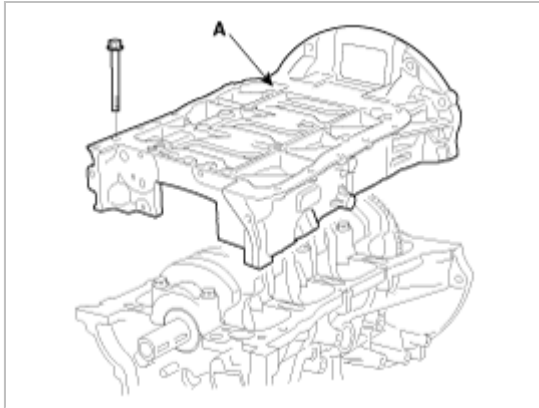
7. Remove the tensioner assembly integrated bracket(A).



8. Remove the knock sensor(A).



9. Remove the water pump.
10. Remove the oil pump.
11. Remove the ladder frame(A).



12. Check the connecting rod end play.
13. Remove the connecting rod caps and check oil clearance.
14. Remove the piston and the 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.

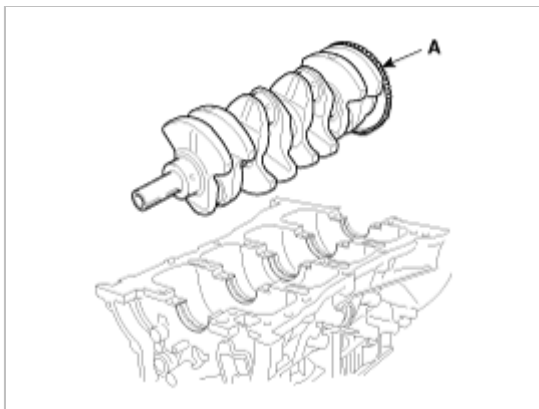
NOTE

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

15. Remove the crankshaft bearing cap and check oil clearance.
16. Check the crankshaft end play.
17. Lift the crankshaft(A) out of the engine, being careful not to damage journals.

NOTE

Arrange the main bearings and thrust bearings in the correct order.



18. 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.
19. Remove the piston rings.
 - (1) Using a piston ring expander, remove the 2 compression rings.
 - (2) Remove 2 side rails and the spacer by hand.

NOTE

Arrange the piston rings in the correct order only.

20. Disconnect the connecting rod from piston.

Inspection

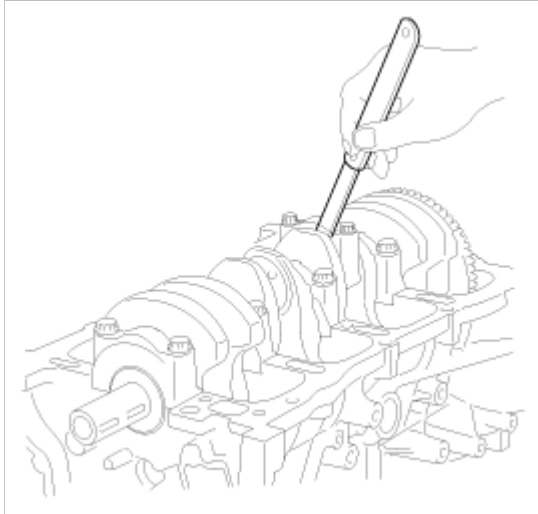
Connecting Rod And Crankshaft

1. Check the connecting rod end play.

Using a feeler gauge, 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 : 0.35mm(0.0138in.)



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 2 connecting rod cap bolts.

(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 bolts.

Tightening torque

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

NOTE

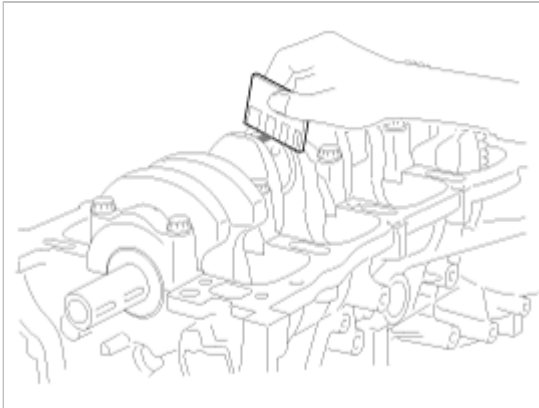
Do not turn the crankshaft.

(7) Remove 2 bolts, connecting rod cap and bearing half.

(8) Measure the plastigage at its widest point.

Standard oil clearance

0.025 ~ 0.043mm(0.0009 ~ 0.0016in.)



- (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	A	51.000 ~ 51.006mm (2.0079 ~ 2.0081in.)
B	B	51.006 ~ 51.012mm (2.0081 ~ 2.0083in.)
C	C	51.012 ~ 51.018mm (2.0083 ~ 2.0085in.)

Crankshaft Pin Mark Location Discrimination Of Crankshaft



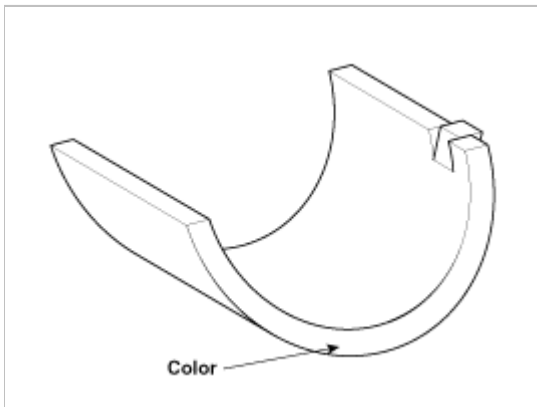
NOTE

Conform to read stamping order as shown arrow direction from #1.

Discrimination Of Crankshaft

Class	Mark	Outside Diameter Of Pin
I	1	47.966 ~ 47.972mm (1.8884 ~ 1.8886in.)
II	2	47.960 ~ 47.966mm (1.8881 ~ 1.8884in.)
III	3	47.954 ~ 47.960mm (1.8879 ~ 1.8881in.)

Place Of Identification Mark (Connecting Rod Bearing) Discrimination Of Connecting Rod Bearing



Discrimination Of Connecting Rod Bearing

Class	Mark	Thickness Of Bearing
AA	Blue	1.517 ~ 1.520mm (0.0597 ~ 0.0598in.)
A	Black	1.514 ~ 1.517mm (0.0596 ~ 0.0597in.)
B	None	1.511 ~ 1.514mm (0.0595 ~ 0.0596in.)
		1.508 ~ 1.511mm

C	Green	(0.0594 ~ 0.0595in.)
D	Yellow	1.505 ~ 1.508mm (0.0593 ~ 0.0594in.)

(11) Selection

Crankshaft Identification Mark	Connecting Rod Identification Mark	Assembling Classification Of Bearing
I (1)	a (A)	D (Yellow)
	b (B)	C (Green)
	c (C)	B (None)
II (2)	a (A)	C (Green)
	b (B)	B (None)
	c (C)	A (Black)
III (3)	a (A)	B (None)
	b (B)	A (Black)
	c (C)	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

14.7Nm (1.5kgf.m, 10.8lb-ft) + 27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1lb-ft) + 120~125°

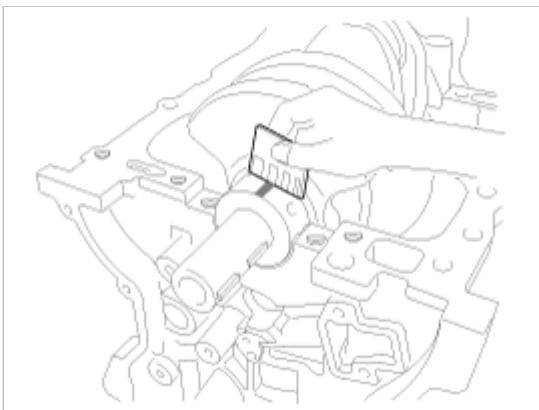
NOTE

Do not turn the crankshaft.

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

Standard oil clearance

0.020 ~ 0.038mm (0.0008 ~ 0.0015in.)



- (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

- 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.
- 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.
- 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

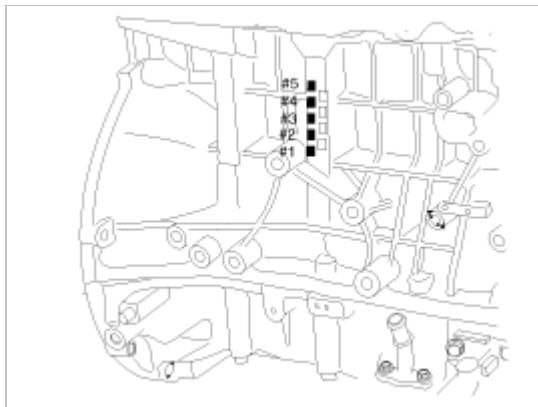
Allowable twist of connecting rod :

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

Crankshaft bore mark location

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

Use them, and the numbers or bar stamped on the crank (marks for main journal size), to choose the correct bearings.

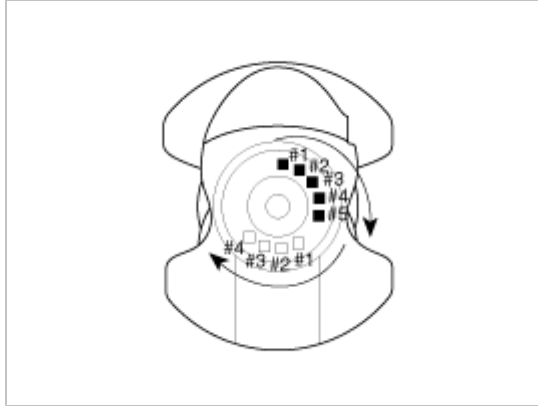


Discrimination Of Cylinder Block

Calss	Mark	Inside Diameter
a	A	56.000 ~ 56.006mm

		(2.2047 ~ 2.2049in.)
b	B	56.006 ~ 56.012mm (2.2049 ~ 2.2052in.)
c	C	56.012 ~ 56.018mm (2.2052 ~ 2.2054in.)

Crankshaft Journal Mark Location Discrimination Of Crankshaft



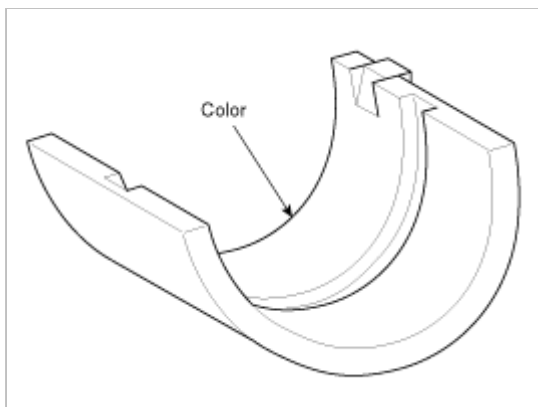
NOTE

Conform to read stamping order as shown arrow direction from #1.

Discrimination Of Crankshaft

Class	Mark	Outside Diameter Of Journal
I	1	51.954 ~ 51.960mm (2.0454 ~ 2.0456in.)
II	2	51.948 ~ 51.954mm (2.0452 ~ 2.0454.)
III	3	51.942 ~ 51.948mm (2.0449 ~ 2.0452in.)

Place Of Identification Mark (Crankshaft Bearing) Discrimination Of Crankshaft Bearing



Discrimination Of Crankshaft Bearing

Class	Mark	Thickness Of Bearing
AA	Blue	2.026 ~ 2.029mm (0.0797 ~ 0.0798in.)

A	Black	2.023 ~ 2.026mm (0.0796 ~ 0.0797in.)
B	None	2.020 ~ 2.023mm (0.0795 ~ 0.0796in.)
C	Green	2.017 ~ 2.020mm (0.0794 ~ 0.795in.)
D	Yellow	2.014 ~ 2.017mm (0.0793 ~ 0.0794in.)

Selection

Crankshaft Identification Mark	Crankshaft Bore Identification Mark	Assembling Classification Of Bearing
I (1)	a (A)	D (Yellow)
	b (B)	C (Green)
	c (C)	B (None)
II (2)	a (A)	C (Green)
	b (B)	B (None)
	c (C)	A (Black)
III (3)	a (A)	B (None)
	b (B)	A (Black)
	c (C)	AA (Blue)

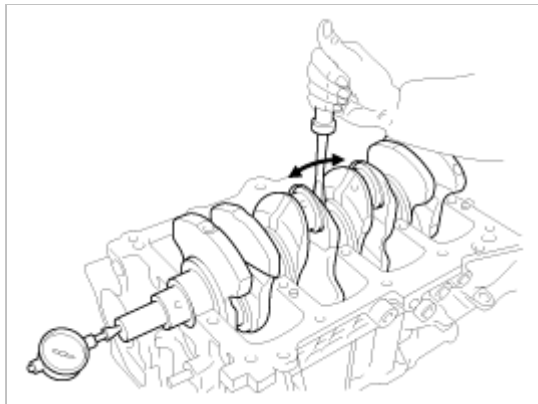
4. Check crankshaft end play.

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

Standard end play

0.07 ~ 0.25mm (0.0027 ~ 0.0098in.)

Limit : 0.30mm (0.0118in.)



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

Thrust bearing thickness

1.925 ~ 1.965mm(0.0758 ~ 0.0773in.)

5. Inspect main journals and crank pins

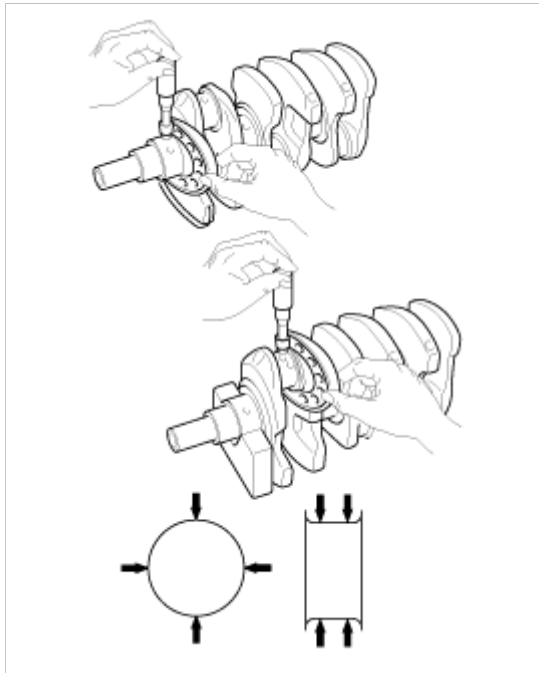
Using a micrometer, measure the diameter of each main journal and crank pin.

Main journal diameter :

51.942 ~ 51.960mm (2.0449 ~ 2.0456in.)

Crank pin diameter :

47.954 ~ 47.972mm (1.8879 ~ 1.8886in.)

**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

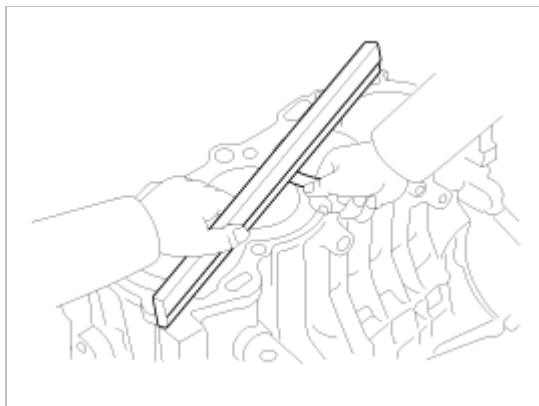
Using a soft brush and solvent, thoroughly clean the cylinder block.

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 0.05mm(0.0020 in.)



4. Inspect cylinder bore diameter

Visually check the cylinder for vertical scratches.

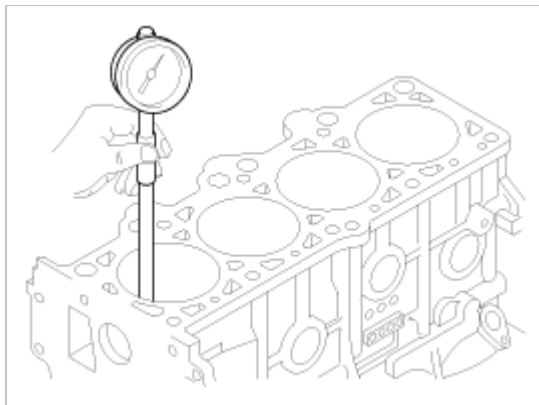
If deep scratches are present, replace the cylinder block.

5. Inspect cylinder bore diameter

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

Standard diameter

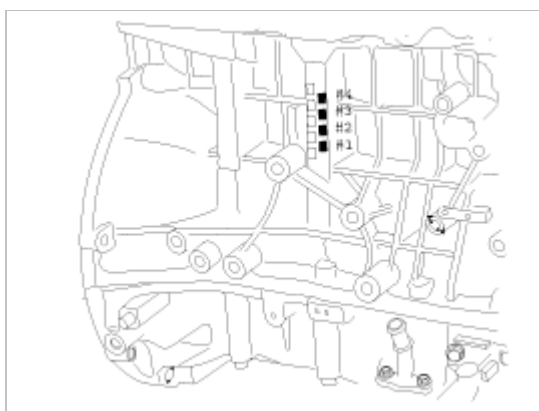
86.00 ~ 86.03mm (3.3858 ~ 3.3870in.)



NOTE

Measure position(from the bottom of the cylinder block)
: 110.7mm(4.3582in.) / 160mm (6.2992in.) / 210mm (8.2677in.)

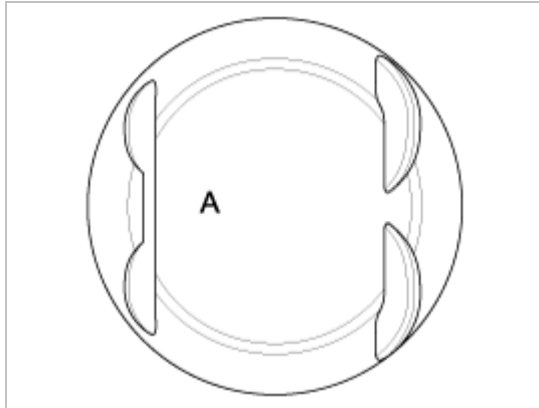
6. Check the cylinder bore size code on the cylinder block.



Cylinder Bore Inner Diameter

Size Code	Inner Diameter
A	86.00 ~ 86.01mm (3.3853 ~ 3.3862in.)
B	86.01 ~ 86.02mm (3.3862 ~ 3.3866in.)
C	86.02 ~ 86.03mm (3.3866 ~ 3.3870in.)

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



NOTE

Stamp the grade mark of basic diameter with rubber stamp.

Piston Outer Diameter

Size Code	Outer Diameter
A	85.975 ~ 85.985mm (3.3848 ~ 3.3852in.)
B	85.985 ~ 85.995mm (3.3852 ~ 3.3856in.)
C	85.995 ~ 86.005mm (3.3856 ~ 3.3860in.)

8. Select the piston related to cylinder bore class.

Clearance : 0.015 ~ 0.035mm (0.00059 ~ 0.00137in.)

Piston And Rings

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

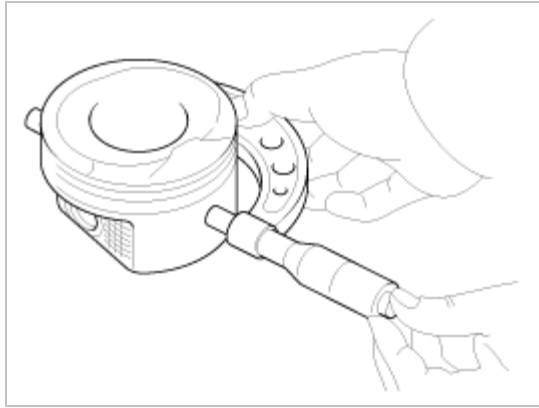
NOTE

Do not use a wire brush.

- The standard measurement of the piston outside diameter is taken 14 mm (0.55 in.) from the top land of the piston.

Standard diameter

85.975 ~ 86.005mm (3.3848 ~ 3.3860in.)



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

Piston-to-cylinder clearance

0.015 ~ 0.035mm (0.00059 ~ 0.00137in.)

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

Standard

No.1 : 0.05 ~ 0.08mm (0.0019 ~ 0.0031in.)

No.2 : 0.04 ~ 0.08mm (0.0015 ~ 0.0031in.)

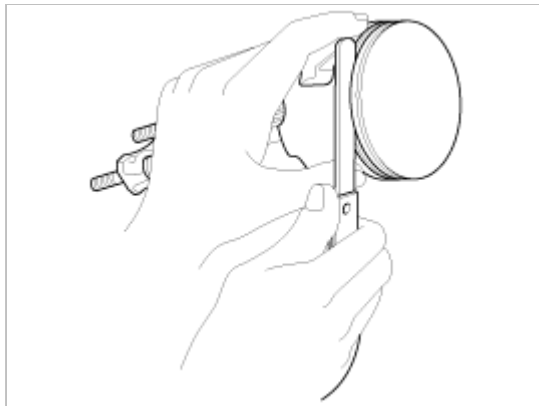
Oil ring : 0.06 ~ 0.15mm (0.0023 ~ 0.0059in.)

Limit

No.1 : 0.1mm (0.004in.)

No.2 : 0.1mm (0.004in.)

Oil ring : 0.2mm (0.008in.)



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. If the bore is over the service limit, the cylinder block must be rebored.

Piston ring end gap

Standard

No.1 : 0.15 ~ 0.30mm (0.0059 ~ 0.0118in.)

No.2 : 0.37 ~ 0.52mm (0.0145 ~ 0.0204in.)

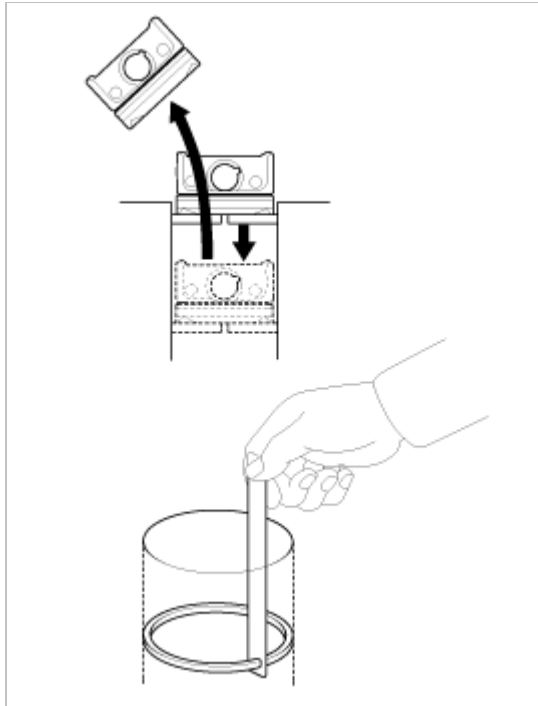
Oil ring : 0.20 ~ 0.70mm (0.0079 ~ 0.0275in.)

Limit

No.1 : 0.6mm (0.0236in.)

No.2 : 0.7mm (0.0275in.)

Oil ring : 0.8mm (0.0315in.)

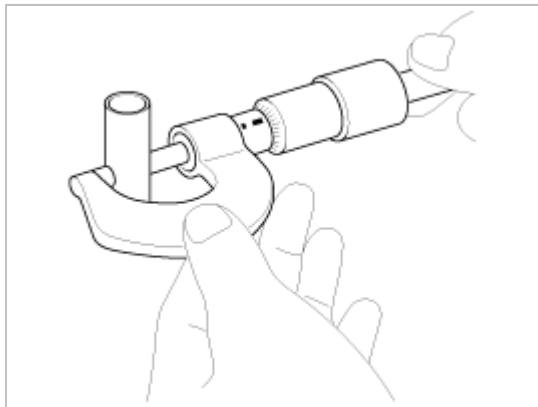


Piston Pins

1. Measure the diameter of the piston pin.
-

Piston pin diameter

21.997 ~ 22.000mm (0.8660 ~ 0.8661in.)



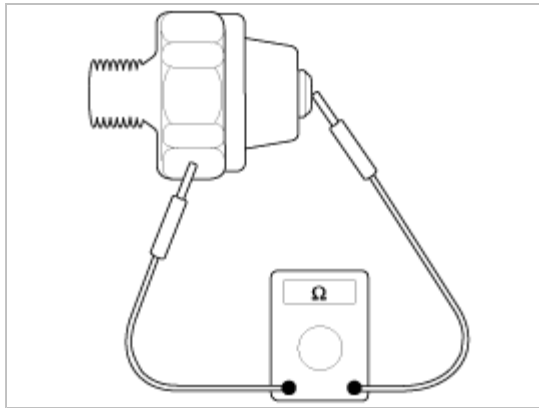
2. Measure the piston pin-to-piston clearance.
-

Piston pin-to-piston clearance

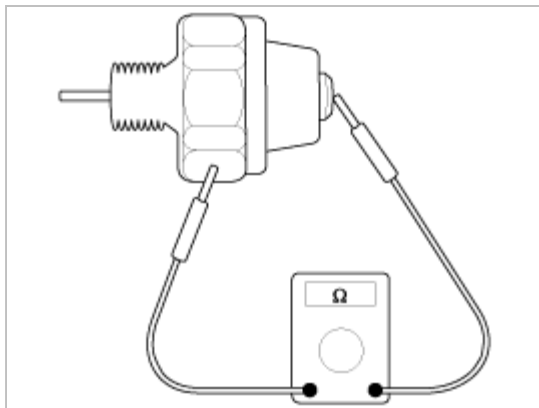
0.003 ~ 0.010mm (0.00011 ~ 0.00039in.)

Oil 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.



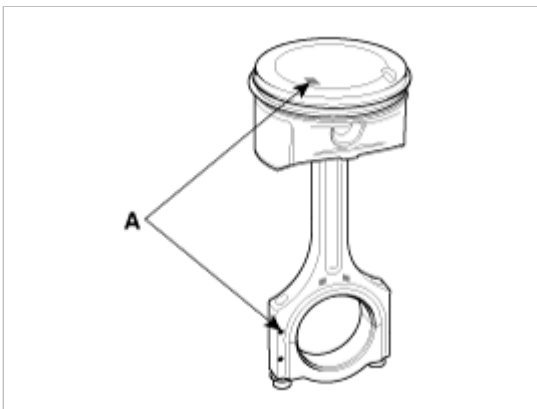
3. If there is no continuity when a 50kpa (7psi) is applied through the oil hole, the switch is operating properly. Check for air leakage. If air leaks, the diaphragm is broken. Replace it.

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



- (2) Before pressing the piston pin, apply a coat of lubricant oil to the piston pin outer and connecting rod.

CAUTION

- Apply heat to the piston (70°C) and then install the piston pin.
- Take care that piston pin is not to be damaged during pressing process.
- When replace the piston pin, check the piston pin outer diameter and connecting rod small end inner diameter as below.

Piston pin outer DIA. :

21.997mm ~ 22.000mm (0.8660 ~ 0.8661 in)

Connecting rod S/END inner DIA. :

22.005mm ~ 22.011mm (0.8663 ~ 0.8665 in)

- Take care that piston is not to be damaged during installing process. When replace the piston pin, check the gap as below.

Connecting rod bushing gap :

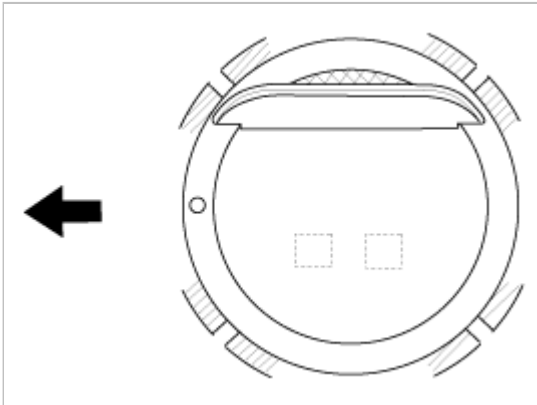
0.005mm ~ 0.014mm (0.00019 ~ 0.00055 in)

Piston pin BOSS gap :

0.003mm ~ 0.010mm (0.00012 ~ 0.00039 in) - Heat to 70°C

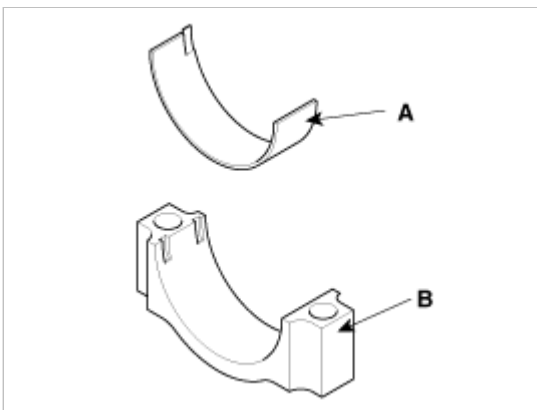
2. Install the piston rings.

- (1) Install the oil ring spacer 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 the connecting rod bearings.

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

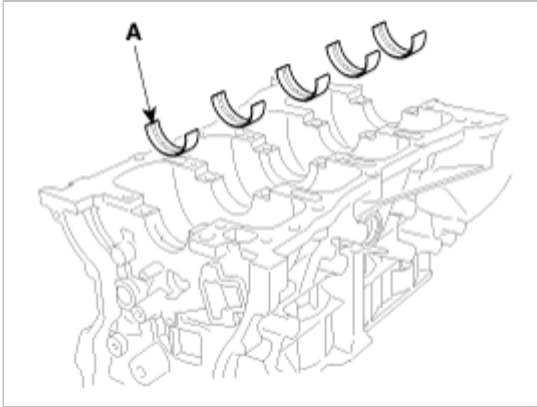


4. Install the main bearings.

NOTE

Upper bearings have an oil groove of oil holes; Lower bearings do not.

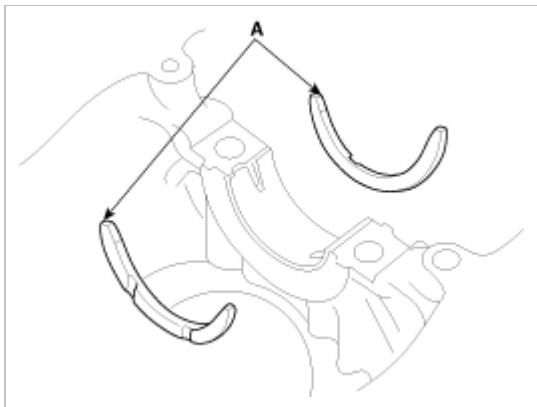
- (1) Align the bearing claw with the claw groove of the cylinder block, push in the 5 upper bearings(A).



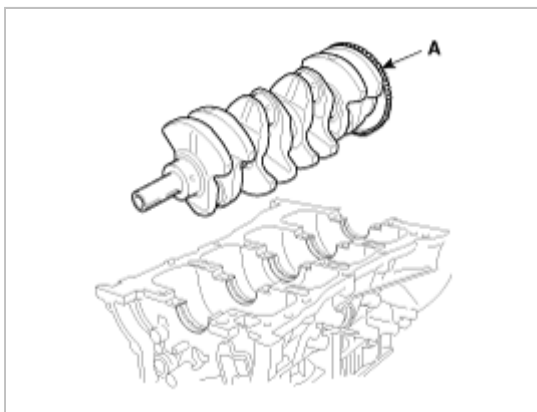
- (2) Align the bearing claw with the claw groove of the main bearing cap, and push in the 5 lower bearings.

5. Install the 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 the crankshaft(A) on the cylinder block.



7. Place the main bearing caps on cylinder block.

8. Install the main bearing cap bolts.

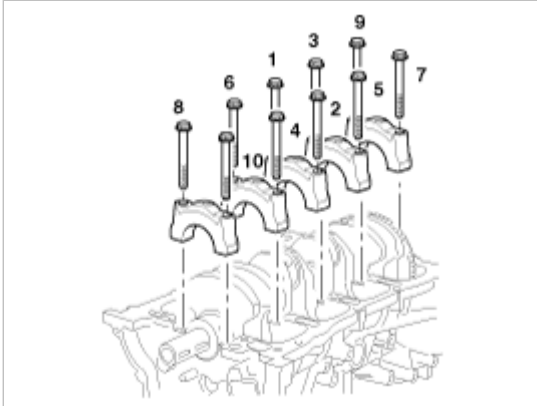
Tightening torque

14.7Nm (1.5kgf.m, 10.8lb-ft) + 27.5~31.4Nm (2.8~3.2kgf.m, 20.3~23.1lb-ft) + 120~125°

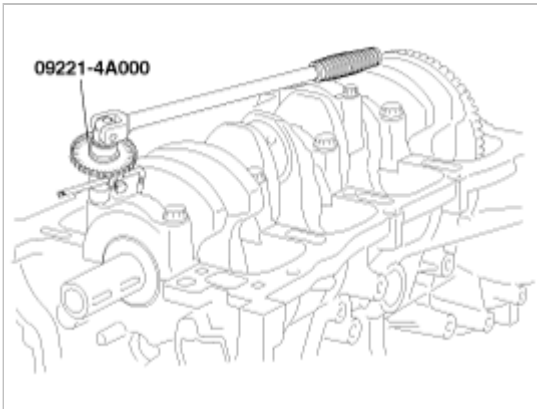
NOTE

- 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(A), in several passes, in the sequence shown.



- (3) Retighten the bearing cap bolts by 120° in the numerical order shown. (Using the SST (09221-4A000))



- (4) Check that the crankshaft turns smoothly.

9. Check crankshaft end play.
10. Install the piston and connecting rod assemblies.

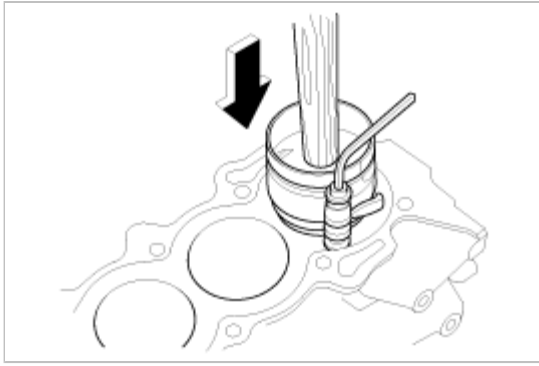
NOTE

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.

NOTE

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



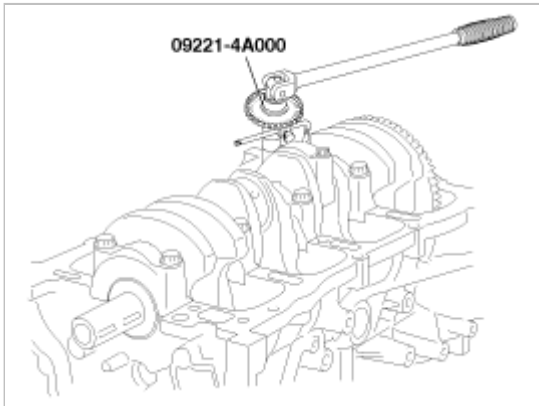
(4) Apply engine oil to the bolt threads. Install the rod caps with bearings, and torque the bolts.

Tightening torque

17.7~21.6Nm (1.8~2.2kgf.m, 13.0~15.9lb-ft) + 88~92°

NOTE

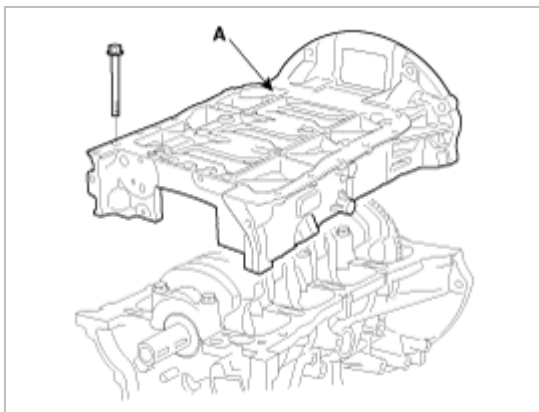
Always use new connecting rod bolt.



11. Install the ladder frame (A).

Tightening torque :

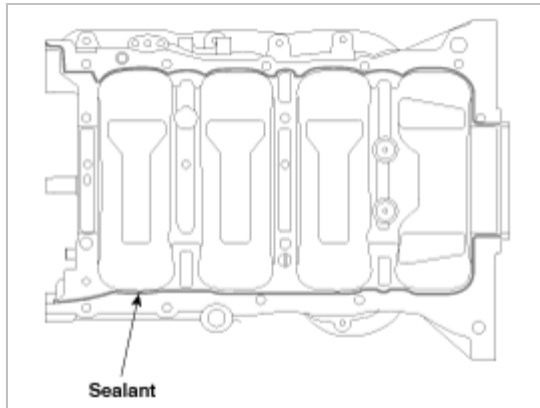
23.5 ~ 27.5N.m(2.4 ~ 2.8kgf.m, 17.4 ~ 20.2lb-ft)



NOTE

- Before assembling ladder frame, the liquid sealant Loctite 5900H or THREEBOND 1217H should be applied ladder frame.

- The part must be assembled within 5 minutes after sealant was applied.
- Apply sealant to the inner threads of the bolt holes.



12. Install the rear oil seal.

(1) Apply engine oil to a new oil seal lip.

(2) Using SST (09231-H1100, 09214-3K100) and a hammer, tap in the oil seal until its surface is flush with the rear oil seal retainer edge.

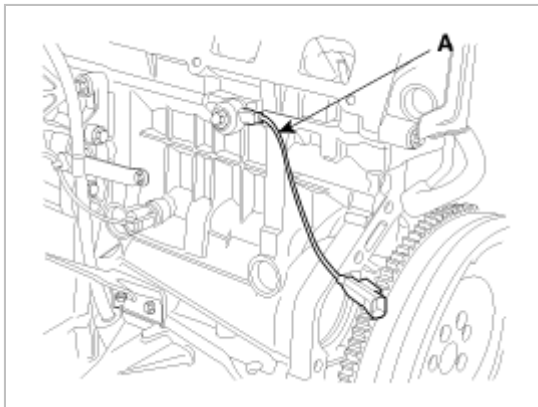
13. Install the oil pump.

14. Install the water pump.

15. Install the knock sensor(A).

Tightening torque

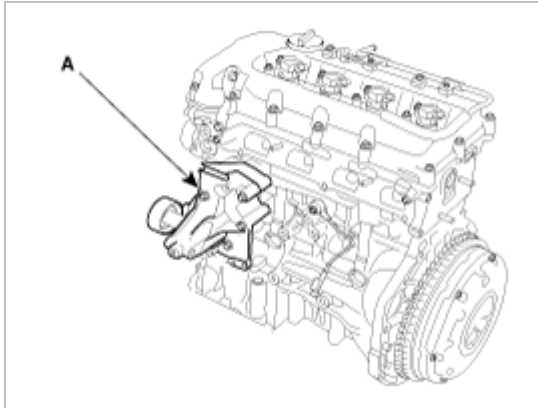
16.7 ~ 25.5N.m (1.7 ~ 2.6kgf.m, 12.3 ~ 18.8lb-ft)



16. Install the tensioner assembly integrated bracket(A).

Tightening torque

39.2 ~ 44.1N.m (4.0 ~ 4.5kgf.m, 28.9 ~ 32.5lb-ft)

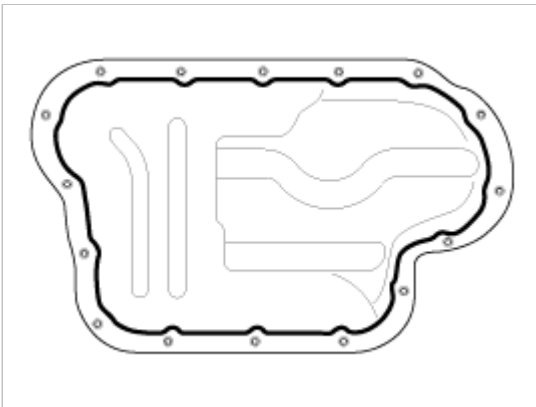


17. Install the power steering pump bracket and power steering pump.
18. Install the alternator.
19. Install the A/C compressor.
20. Install the cylinder head.
21. Install the timing chain.
22. Install the oil pan.
 - (1) Using a razor blade and gasket scraper, remove all the old gasket material from 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 LOCTITE5900H or THREEBOND 1217H equivalent (MS721-40).



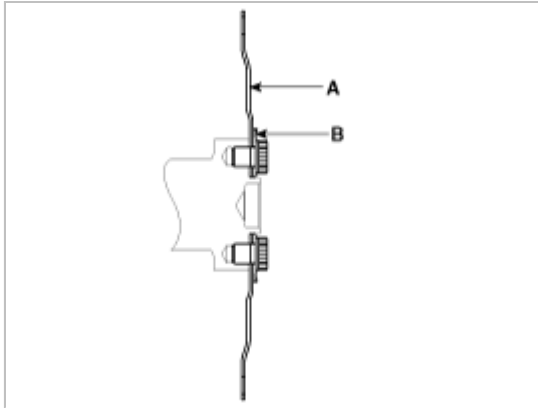
NOTE

- 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.

23. Remove the engine stand.
24. A/T : Install the drive plate (A) with washer (B).

Tightening torque

117.7 ~ 127.5N.m (12 ~ 13kgf.m, 86.8 ~ 94.0lb-ft)



25. M/T : Install the flywheel.

Tightening torque

117.7 ~ 127.5N.m (12 ~ 13kgf.m, 86.8 ~ 94.0lb-ft)

NOTE

- Always use new flywheel(drive plate) bolts.